

PAN AMERICAN SILVER CORP
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Washington, D.C. 20549

FORM 6-K

Report of Foreign Private Issuer
Pursuant to Rule 13a-16 or 15d-16 of
the Securities Exchange Act of 1934

For the month of, February
Commission File Number 000-13727

2010

Pan American Silver Corp
(Translation of registrant's name into English)

1500-625 Howe Street, Vancouver BC Canada V6C 2T6
(Address of principal executive offices)

Indicate by check mark whether the registrant files or will file annual reports under cover of Form 20-F or Form 40F:

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20-F	40-F	

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Yes	No	X
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If "Yes" is marked, indicate below the file number assigned to the registrant in connection with Rule 12g3-2(b): 82-_____

DOCUMENTS INCLUDED AS PART OF THIS REPORT

Document

- 1 Technical report entitled "Pan American Silver Corp: Navidad Project, Chubut Province, Argentina", dated February 4, 2010.
-

Pan American Silver Corp: Navidad Project, Chubut Province, Argentina

February 2010

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This report was prepared as a National Instrument 43-101 Technical Report, in accordance with Form 43-101F1, for Pan American Silver Corp. by Snowden. The quality of information, conclusions, and estimates contained herein is consistent with the level of effort involved in Snowden's services, based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions, and qualifications set forth in this report. This report is intended to be used by Pan American Silver Corp., subject to the terms and conditions of its contract with Snowden. That contract permits Pan American Silver Corp. to file this report as a Technical Report with Canadian Securities Regulatory Authorities pursuant to provincial securities legislation. Except for the purposes legislated under provincial securities law, any other use of this report by any third party is at that party's sole risk.

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Pan American Silver Corp:

1	Summary	11
2	Introduction	19
3	Reliance on other experts	21
4	Property description and location	22
4.1	Land tenure	22
4.2	Agreements and encumbrances	27
4.3	Environmental liabilities	27
4.4	Permits	28
5	Accessibility, climate, local resources, infrastructure, and physiography	29
5.1	Accessibility	29
5.2	Climate	29
5.3	Infrastructure and local resources	29
5.4	Land access	30
5.5	Physiography	31
6	History	32
7	Geological setting	34
7.1	Regional geology	34
7.2	Local geology	35
7.2.1	Lonco Trapial and Garamilla formations	38
7.2.2	Cañadón Asfalto Formation	38
7.2.3	Depositional setting	38
7.2.4	Structure and control of mineralisation	39
7.3	Property geology	39
7.3.1	Lithology	39
7.3.2	Structure and control of mineralisation	43
8	Deposit types	45
9	Mineralisation	48
9.1	Calcite NW	49
9.2	Calcite Hill	50
9.3	Navidad Hill	52

9.4	Connector Zone	54
9.5	Galena Hill	57
9.6	Barite Hill	60
9.7	Loma de La Plata	61
9.8	Valle Esperanza	65

February 2010

Pan American Silver Corp:

9.9	Additional prospects	68
	9.9.1	Navidad Trend 68
	9.9.2	Argenta Trend 68
10	Exploration	70
10.1	Exploration by Normandy Mining in 2002	70
10.2	Exploration by IMA from December 2002 to July 2006	70
	10.2.1	Geological mapping and topographical surveys 70
	10.2.2	Geophysical exploration 70
	10.2.3	Geochemical exploration 70
	10.2.4	Diamond drilling 71
	10.2.5	Other work 71
	10.2.6	Mineral Resource estimates 71
10.3	Exploration by Aquiline from October 2006 to June 2009	71
	10.3.1	Diamond drilling 72
	10.3.2	Geophysical exploration 73
	10.3.3	Geochemical exploration 75
	10.3.4	Geological mapping 75
	10.3.5	Mineral Resource estimates 75
	10.3.6	Future exploration work 75
11	Drilling	77
11.1	Diamond drilling methods	77
11.2	Drillhole collar surveys	77
11.3	Downhole surveys	77
11.4	Drill intercepts	78
	11.4.1	Southern Argenta Trend (Yanquetru) 78
	11.4.2	Marcasite Hill 78
	11.4.3	Bajo del Plomo and Filo del Plomo 79
	11.4.4	Tailings Dam 79
	11.4.5	Sector Z and Valle La Plata 79
12	Sampling method and approach	80

12.1	Core logging	80
12.2	Sampling	80
12.3	Density determinations	81
12.4	Independent statement on sampling methods	81
12.5	Recommendations	81
13	Sample preparation, analyses, and security	82
13.1	Sample preparation, analyses, and security	82
	13.1.1 Laboratory	82

February 2010

4 of 249

Pan American Silver Corp:

	13.1.2	Sample preparation	82
	13.1.3	Sample analyses	82
	13.1.4	Sample security and chain of custody	83
	13.1.5	Independent statement on sample preparation, analyses, and security	83
13.2	Quality control measures		83
	13.2.1	Certified standard samples	83
	13.2.2	Blank samples	89
	13.2.3	Duplicate drill core samples (field duplicates)	90
	13.2.4	Independent statement of Navidad quality control samples	97
14	Data verification		98
	14.1	Field and laboratory quality control data reviews	98
	14.2	Snowden independent site visits	99
	14.2.1	Independent review and sampling of mineralised intersections	99
	14.2.2	Independent review of drillhole collar locations	105
	14.2.3	Independent review of original assay certificates	108
15	Adjacent properties		111
	15.1	Patagonia Gold	111
	15.2	Mina Angela	111
	15.3	Flamingo Prospect	112
16	Mineral processing and metallurgical testing		113
	16.1	Mineral processing and metallurgical testing by IMA from 2005 to 2006	113
	16.1.1	Flotation test work	113
	16.1.2	Mineralogy overview	117
	16.1.3	Modal analyses	119
	16.1.4	Sample grindability	119
	16.2	Mineral processing and metallurgical test work by Aquiline in 2007	120
	16.2.1	Navidad Hill	120
	16.2.2	Barite Hill	122

	16.2.3	Loma de La Plata	122
	16.2.4	Galena Hill	122
	16.2.5	Discussion of G&T results	123
	16.2.6	Discussion of XPS results	124
16.3		Mineral processing and metallurgical test work by Aquiline in 2008	125
	16.3.1	XPS Phase 1 test work on Loma de La Plata samples	129
	16.3.2	XPS Phase 2 test work on Loma de La Plata samples	130
	16.3.3	G&T test work on Loma de La Plata samples	133
	16.3.4	G&T test work on Barite Hill samples	136
	16.3.5	G&T test work on Valle Esperanza samples	138

February 2010

5 of 249

Pan American Silver Corp:

	16.3.6	Conclusions and recommendations	140
17	Mineral Resource and Mineral Reserve estimates		141
	17.1	Disclosure	141
	17.1.1	Known issues that materially affect the Mineral Resources	141
	17.2	Assumptions, methods and parameters – 2009 Mineral Resource estimates	142
	17.3	Supplied data, data preparation, data transformations, and data validation	142
	17.3.1	Supplied data	142
	17.3.2	Data preparation	142
	17.3.3	Data transformations	144
	17.3.4	Data validation	144
	17.4	Geological interpretation, modelling, and domaining	144
	17.4.1	Geological interpretation and modelling	144
	17.4.2	Definition of grade estimation domains	145
	17.5	Sample statistics	145
	17.5.1	Sample compositing	145
	17.5.2	Extreme value treatment	145
	17.5.3	Data declustering	146
	17.5.4	Input sample statistics	147
	17.6	Variography	148
	17.6.1	Continuity analysis	148
	17.6.2	Variogram modelling	148
	17.7	Estimation parameters	151
	17.7.1	Kriging parameters	151
	17.7.2	Block size selection	151
	17.7.3	Sample search parameters	151
	17.7.4	Block model set up	151
	17.7.5	Grade interpolation and boundary conditions	152
	17.8	Specific gravity	152
	17.9	Estimation validation	154
	17.9.1	Domain statistics and visual validation	154

	17.9.2	Slice validation plots	155
	17.9.3	Comparison with previous estimates	155
17.10		Mineral Resource classification	158
	17.10.1	Geological continuity and understanding	158
	17.10.2	Data density and orientation	158
	17.10.3	Data accuracy and precision	158
	17.10.4	Spatial grade continuity	158
	17.10.5	Estimation quality	159
	17.10.6	Classification process	159

February 2010

6 of 249

Pan American Silver Corp:

17.11	Mineral Resource reporting	159
18	Other relevant data and information	163
19	Interpretation and conclusions	164
20	Recommendations	167
21	References	170
22	Date and signatures	173
23	Certificates	174

Tables

Table 1.1	Navidad April 2009 Mineral Resources reported above a cut-off grade of 50 g/t AgEQ	14
Table 2.1	Responsibilities of each co-author	20
Table 4.1	Tenement details in Chubut Province operated as Minera Argenta S.A.	22
Table 4.2	Tenement details in Chubut Province held in the name of Minera Aquiline Argentina S.A.	24
Table 10.1	Diamond drillholes completed by IMA from 2003 to 2006	71
Table 10.2	Diamond drillholes completed by Aquiline from 2006 to March 2009	72
Table 11.1	Downhole survey methods at the Navidad Project	78
Table 13.1	Certified values of standards	84
Table 13.2	Blank sample results	90
Table 14.1	Key Aquiline personnel involved in data verification discussions	99
Table 14.2	Snowden mineralised drill core intersection review	100
Table 14.3	Snowden independent samples	102
Table 14.4	Snowden verification of drill collar coordinates	106
Table 14.5	Snowden review of original assay certificates	108
Table 16.1	Head grades of composite drillhole samples used for metallurgical test work	114
Table 16.2	Summary of flotation tests	115
Table 16.3	Mineral composition of composite samples	117
Table 16.4	Summary of fragmentation characteristics	119
Table 16.5	Bond ball mill work indices values	120
Table 16.6	Loma de La Plata geo-metallurgical units	129

Table 16.7	Grades of sample composites used for variability testing	129
Table 16.8	Cleaner concentrate grades	130

February 2010

7 of 249

Pan American Silver Corp:

Table 16.9	Grades of sample composites used for optimisation test work	131
Table 16.10	Grades and specific gravity of the sample composites used for variability testing	133
Table 16.11	Locked cycle test conditions	133
Table 16.12	Summary of locked cycle test results	134
Table 16.13	Assay grades of Test 23 locked cycle concentrate	134
Table 16.14	Gravity and cyanidation test data results	135
Table 16.15	Grades of Barite Hill sample composites	136
Table 16.16	Locked cycle test conditions	136
Table 16.17	Summary of locked cycle test results	137
Table 16.18	Barite Hill, Valle Esperanza, and Loma de La Plata concentrate grades	138
Table 16.19	Grades of Valle Esperanza sample composites	138
Table 16.20	Locked cycle test conditions	139
Table 16.21	Summary of locked cycle test results	139
Table 17.1	Number of drillholes used in the Navidad 2009 Mineral Resource estimates	143
Table 17.2	Loma de La Plata estimation domains	145
Table 17.3	Declustered composite sample input statistics for Ag at Loma de La Plata	147
Table 17.4	Declustered composite sample input statistics for Pb at Loma de La Plata	147
Table 17.5	Declustered composite sample input statistics for Cu at Loma de La Plata	147
Table 17.6	95th decile variogram model parameters for Ag	149
Table 17.7	95th decile variogram model parameters for Pb	149
Table 17.8	95th decile variogram model parameters for Cu	150
Table 17.9	Navidad block model parameters	151
Table 17.10	Navidad block model densities	153
Table 17.11	Comparison of estimated and input data Ag grades by domain	155
Table 17.12	Comparison of estimated and input data Pb grades by domain	155
Table 17.13	Comparison of estimated and input data Cu grades by domain	155
Table 17.14	Additional drilling information since the November 2007 Mineral Resource estimates	156
Table 17.15		157

Superseded November 2007 Mineral Resource estimates reported
above a 50 g/t Ag equivalent cut-off ($\text{AgEQ} = \text{Ag} + (\text{Pb} \times 10,000 / 365)$)

Table 17.16	Navidad April 2009 Mineral Resources reported above a cut-off grade of 50 g/t AgEQ	161
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February 2010

8 of 249

Pan American Silver Corp:

Figures

Figure 4.1	Plan of tenements held by Pan American in the province of Chubut	26
Figure 5.1	Navidad surface landholders with status of negotiations or agreements	31
Figure 7.1	Regional geology plan	35
Figure 7.2	Local geology plan from Andolino (1999)	37
Figure 7.3	Property geology plan	40
Figure 7.4	Simplified Navidad Project stratigraphic column	41
Figure 8.1	Schematic reconstruction of Galena Hill from Sillitoe (2007)	47
Figure 8.2	Schematic reconstruction of Loma de La Plata from Sillitoe (2007)	47
Figure 9.1	Plan of Calcite NW	50
Figure 9.2	Plan of Calcite Hill	52
Figure 9.3	Plan of Navidad Hill	54
Figure 9.4	Plan and cross section of Connector Zone	56
Figure 9.5	Plan and cross section of Galena Hill	59
Figure 9.6	Plan of Barite Hill	61
Figure 9.7	Plan and oblique cross section of Loma de La Plata	64
Figure 9.8	Plan and cross section of Valle Esperanza	67
Figure 10.1	Plan of drillholes completed at the Navidad Project	73
Figure 13.1	Low grade standard GMB01 results	85
Figure 13.2	Low grade standard LGH results	86
Figure 13.3	Medium grade standard MGH results	87
Figure 13.4	High grade standard NHBG01 results	88
Figure 13.5	Ag field duplicate samples analysed by FA-GRAV from 2003 until 2009	91
Figure 13.6	Pb field duplicate samples analysed by ICP-OES from 2003 until 2009	93
Figure 13.7	Cu field duplicate samples analysed by ICP-OES from 2003 until 2009	95
Figure 16.1	Location plan of Navidad Hill and Connector Zone drill collars of samples selected for metallurgical studies	121
Figure 16.2	Location plan of Calcite Hill and Calcite NW drill collars of samples selected for metallurgical studies	123
Figure 16.3	Location plan of Loma de La Plata drill collars of samples selected for metallurgical studies	126
Figure 16.4	Location plan of Barite Hill drill collars of samples selected for metallurgical studies	127

Pan American Silver Corp:

Figure 16.5	Location plan of Valle Esperanza drill collars of samples selected for metallurgical studies	128
Figure 17.1	Location map of drillholes available in the April 2009 Navidad database	143
Figure 17.2	Log histogram of Loma de La Plata undeclustered sample composites in Domain 736	146

Appendices

A	Collar locations of drillholes available in the Navidad 2009 Mineral Resource estimates
B	Navidad estimation domains
C	Log histograms of input sample composites (undeclustered)
D	Declustered composite sample input statistics for Ag
E	Declustered composite sample input statistics for Pb
F	Comparison of estimated and input data Ag grades by domain
G	Comparison of estimated and input data Pb grades by domain
H	Navidad 2009 Mineral Resource estimates above a 50 g/t AgEQ cut-off using a \$10 per oz Ag and \$0.70 per lb Pb price
I	Navidad 2009 Mineral Resource estimates above a 1 oz Ag cut-off
J	Navidad 2009 Mineral Resource estimates above a 50 g/t Ag cut-off
K	Grade tonnage curves for the Navidad April 2009 Mineral Resource estimates above a range of Ag equivalent cut-off grades

Pan American Silver Corp:

1

Summary

This Technical Report refers to the Navidad Project, an advanced stage silver-lead mineral exploration project located in Chubut Province, Argentina, owned by Pan American Silver Corp. (Pan American) through its subsidiary Aquiline Resources Inc. (Aquiline), who in turn conduct business in Argentina through its subsidiaries Minera Aquiline Argentina S.A. (Minera Aquiline), and Minera Argenta S. A.. Pan American is a silver mining company based in Canada and listed on the Toronto Stock Exchange (TSX:PAA) and on NASDAQ (PAAS).

The Supreme Court of British Columbia awarded ownership of the Navidad Project to Minera Aquiline on 14 July 2006 following a court case with IMA Exploration Inc. (IMA) where IMA was found to have breached a Confidentiality Agreement with Minera Normandy Argentina S.A. (Minera Normandy), then a subsidiary of Newmont Mining Corporation. Minera Normandy was subsequently acquired by Aquiline and its name was changed to Minera Aquiline. IMA appealed the trial court decision to the Appeal Court of British Columbia which denied the appeal in reasons for judgment dated 7 June 2007. In September 2007 IMA submitted an Application for Leave to Appeal to the Supreme Court of Canada. Sole ownership rights were granted to Aquiline by the Supreme Court of Canada on 20 December 2007, subject to Aquiline making payment to IMA which would reimburse the latter for its accrued exploration expenditures up to the July 2006 court decision. Aquiline's final payment to IMA was made on 8 February 2008 giving Aquiline full ownership of the Project.

On 14 October 2009, Pan American announced a friendly offer to acquire all of the issued and outstanding securities of Aquiline. On 7 December 2009, Pan American acquired approximately 85% of the issued and outstanding shares of Aquiline and extended its bid to 22 December 2009, and on that latter date, Pan American took up an additional approximately 7% of the issued and outstanding shares in the capital of Aquiline. Since the offer to acquire the Aquiline shares was accepted by holders of more than 90% of the Aquiline shares, on 23 December 2009, Pan American provided notice to the remaining shareholders of its intention to exercise its right to acquire the remaining issued and outstanding Aquiline shares pursuant to the compulsory acquisition provisions of the Business Corporation Act (Ontario). Pan American was deemed to have acquired the balance of the Aquiline shares not already owned by it pursuant to the compulsory acquisition on or about 22 January 2010.

As a result of its acquisition of Aquiline, Pan American is required to file a technical report on the Navidad Project pursuant to NI 43-101. This Technical Report is prepared to fulfil this requirement and is based on information disclosed in the Technical Report filed on SEDAR by Aquiline on 2 June 2009, and dated May 2009, amended June 2009 (Snowden, 2009). There are no other material changes to the Navidad Project to report aside from the acquisition of Aquiline by Pan American.

The June 2009 Technical Report (Snowden, 2009) disclosed recently updated Mineral Resources at the Calcite NW, Calcite Hill, Navidad Hill, Connector Zone, Galena Hill, Barite Hill, and Loma de La Plata, and disclosed the first Mineral Resource for Valle Esperanza at the Navidad Project. The amended report dated June 2009 included the assay results of independent samples selected by Snowden in April 2009, which were not available at the time of the original filing on SEDAR in May, 2009.

Mineral Resource estimates were reported at the Navidad Property (Table 1.1) effective April 2009. Tonnes and grades were reported above a cut-off grade of 50 g/t silver

February 2010

11 of 249

Pan American Silver Corp:

equivalent. To date, no analysis has been made to determine the economic cut-off grade that will ultimately be applied to the whole Navidad Project. Silver equivalence was calculated using three year rolling average prices for silver (\$12.52 per oz) and an approximate ten year rolling average price for lead (\$0.50 per lb). The following formula, which does not include any other factors such as variable metal recoveries, was applied to reach the silver equivalent value: $AgEQ(g/t) = Ag(g/t) + (Pb(\%) \times 10,000/365)$.

The deposit areas at Navidad occur within a sedimentary package known as the Cañadón Asfalto Formation hosting an intermediate volcanic rock identified as trachyandesite, referred to locally as latite. Lithologies described as the Cañadón Asfalto may occur both above and below intercalated bodies of latite. The entire sequence is interpreted to have been deposited within a lacustrine basin environment.

A group of eight individual deposits and six prospects have been identified at the project and seven of these have been the subject of previous Mineral Resource estimates (Snowden 2006a, Snowden 2006b, and Snowden, 2007). All of these deposits are either hosted in the latite unit itself or in the sedimentary sequence proximal to the latite. Base metals, principally lead and to a lesser extent copper, are typically present but are largely not significant in quantity except at Galena Hill. There has been virtually no gold detected to date.

Since the filing of the November 2007 Technical Report, additional geochemical and geophysical surveys plus 367 diamond drillholes totalling 92,540 m have been done on the Project. The geophysical surveys over the core area of the property have included gravity, deep-array pole-dipole IP, CSAMT, and a high definition ground magnetometer survey. At Navidad only the latter technique has shown some continued promise as an exploration guide through the interpretation of the detailed structural setting in the district.

The drilling programme continued to yield significant results during the past 18 months, and of particular significance is the discovery of the Valle Esperanza deposit which in this estimate contains in the Indicated category 12.2 Mt at a grade of 172 g/t Ag, above a cut-off grade of 50 g/t AgEQ. In the Inferred category, the deposit contains 10.8 Mt at a grade of 123 g/t Ag above the same cut-off grade. The grade, geometry, and depth of this deposit are such that underground mining is a potential option.

Early metallurgical testing of Galena Hill has proved that differential flotation was effective in producing a lead concentrate and silver-rich concentrate, although it was recommended significant work was required to increase overall silver recovery and improve the quality of the concentrate for sale. Subsequent analysis of the pyrite concentrate mineralogy (XPS, 2007) identified the potential to upgrade the concentrate by inserting cleaning and entrainment controls into the circuit such as froth washing and column flotation, that improve concentrate grades by a factor of 2.5.

Initial metallurgical testing of Loma de La Plata proved highly successful especially as recovery of silver exceeded 80% and the concentrate was high in silver (around 50 kg/t Ag), but low in lead with a combined base metal (copper plus lead) content of 15% to 25%. Subsequent efforts were directed at testing the variability of the deposit in support of a Preliminary Economic Assessment of Loma de La Plata only. The test work at both G&T and XPS concluded that Loma de La Plata ore responds well to flotation, with high recoveries and concentrate grades. A simple crushing, grinding, and single product

flotation concentrator was proposed for the PEA, and the concentrate sold to an offshore copper smelter with minor penalties for lead.

February 2010

12 of 249

Pan American Silver Corp:

With the discovery of Valle Esperanza and its similarity in mineralisation style to Loma de La Plata, metallurgical testing was expanded to incorporate deposits likely to produce a high-value silver concentrate with low lead content. Testing of Valle Esperanza and Barite Hill samples yielded satisfactory results, and as with Loma de La Plata, silver recoveries of 80% or better appear likely. The concentrate grades from Valle Esperanza are particularly high (over 50 kg/t Ag to 60 kg/t Ag), while those from Barite Hill are also satisfactory containing 20 kg/t Ag to 25 kg/t Ag. However, the individual concentrates contain high levels of penalty elements such as arsenic and antimony. Mr. Wells believes that Loma de La Plata, Barite Hill, and Valle Esperanza can all be treated in the same, simple, one-product concentrator.

The testing of Loma de La Plata is likely to be sufficient to support a Feasibility Study. A large quantity of core has been kept in sealed bags and is sufficient for a pilot plant test should this be considered necessary.

The Preliminary Economic Assessment of Loma de La Plata (Snowden, 2008), concluded the development of Loma de La Plata would deliver a pre-tax NPV at 7.5% of US\$135.6 million, and internal rate of return (IRR) of 22%, and a 25 month payback period.

February 2010

13 of 249

Pan American Silver Corp:

Table 1.1 Navidad April 2009 Mineral Resources reported above a cut-off grade of 50 g/t AgEQ

Deposit	Classification	Tonnes (Mt)	AgEQ g/t	Ag g/t	Pb%	Cu%	Contained Ag (Moz)	Contained Pb (Mlb)	Contained Cu (Mlb)
Calcite Hill NW	Measured	-	-	-	-	-	-	-	-
	Indicated	14.8	94	78	0.59	-	37	194	-
	Meas. + Ind.	14.8	94	78	0.59	-	37	194	-
	Inferred	14.6	74	52	0.82	-	24	265	-
Calcite Hill	Measured	-	-	-	-	-	-	-	-
	Indicated	17.5	115	100	0.55	-	56	212	-
	Meas. + Ind.	17.5	115	100	0.55	-	56	212	-
	Inferred	4.9	106	96	0.36	-	15	39	-
Navidad Hill	Measured	8.4	122	109	0.46	-	29	85	-
	Indicated	5.6	96	90	0.24	-	16	29	-
	Meas. + Ind.	14	112	101	0.37	-	45	114	-
	Inferred	1.8	81	70	0.41	-	4	16	-
Connector Zone	Measured	-	-	-	-	-	-	-	-
	Indicated	8.2	102	91	0.41	-	24	74	-
	Meas. + Ind.	8.2	102	91	0.41	-	24	74	-
	Inferred	9.9	88	74	0.49	-	24	107	-
Galena Hill	Measured	7	242	170	2.62	-	38	404	-
	Indicated	44.7	166	117	1.78	-	168	1,754	-
	Meas. + Ind.	51.7	176	124	1.89	-	206	2,158	-
	Inferred	1.7	116	80	1.35	-	4	50	-

February 2010

14 of 249

Pan American Silver Corp:

Deposit	Classification	Tonnes (Mt)	AgEQ g/t	Ag g/t	Pb%	Cu%	Contained Ag (Moz)	Contained Pb (Mlb)	Contained Cu (Mlb)
Barite Hill	Measured	-	-	-	-	-	-	-	-
	Indicated	7.7	161	153	0.28	-	38	48	-
	Meas. + Ind.	7.7	161	153	0.28	-	38	48	-
	Inferred	0.9	100	81	0.69	-	2	13	-
Loma de La Plata	Measured	-	-	-	-	-	-	-	-
	Indicated	29.1	172	169	0.09	0.05	158	58	33
	Meas. + Ind.	29.1	172	169	0.09	0.05	158	58	33
	Inferred	1.3	82	76	0.21	0.05	3	6	1
Valle Esperanza	Measured	-	-	-	-	-	-	-	-
	Indicated	12.2	178	172	0.21	-	68	56	-
	Meas. + Ind.	12.2	178	172	0.21	-	68	56	-
	Inferred	10.8	133	123	0.35	-	43	84	-
Total	Measured	15.4	177	137	1.44	0	67	489	0
	Indicated	139.8	147	126	0.79	0.05	565	2,425	33
	Meas. + Ind.	155.2	150	127	0.85	0.05	632	2,914	33
	Inferred	45.9	97	81	0.57	0.05	119	580	1

Notes:

The most likely cut-off grade for these deposits is not known at this time and must be confirmed by the appropriate economic studies.

Silver equivalent grade values are calculated without consideration of variable metal recoveries for silver and lead. A silver price of US\$12.52/oz and lead price of US\$0.50/lb was used to derive an equivalence formula of $\text{AgEQ g/t} = \text{Ag g/t} + (\text{Pb\%} \times 10,000 / 365)$. Silver prices are based on a three-year rolling average and lead prices are based on an approximate ten-year rolling average.

The estimated metal content does not include any consideration of mining, mineral processing, or metallurgical recoveries.

Tonnes, ounces, and pounds have been rounded and this may have resulted in minor discrepancies in the totals.

Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability. No Mineral Reserves have been estimated.

The estimate of Mineral Resources may be materially affected by environmental, permitting, legal, title, taxation, socio-political, marketing, or other relevant issues.

February 2010

15 of 249

Pan American Silver Corp:

Measured and Indicated Mineral Resources silver ounces have increased by 40% since the November 2007 Mineral Resource estimate. This increase is mainly contributed by the upgrade of Inferred resources to Indicated resources, defined during infill drilling at Loma de La Plata. Valle Esperanza is now estimated to contain the largest Inferred resource of the Project. With additional infill drilling on 50 m sections at Valle Esperanza, the conversion rate of Inferred resources to Indicated resources is anticipated to be as high as that experienced at the other deposits at the Project.

No Mineral Reserves have been estimated at this time. Additional studies will be required to determine technical, economic, legal, environmental, socio-economic, and governmental factors. These modifying factors are normally included in a mining feasibility study and are a pre-requisite for conversion of Mineral Resources to, and reporting of, Mineral Reserves. The CIM Standards (CIM, 2005) describe completion of a Preliminary Feasibility Study as the minimum prerequisite for the conversion of Mineral Resources to Mineral Reserves.

The following recommendations are made for the further advancement of the Project:

- Continue metallurgical definition of the deposits with particular emphasis on Galena Hill, which hosts 30% of the Indicated Resource silver ounces as well as 2,158 Mlb of lead in the Measured and Indicated categories.
- Using the Loma de La Plata Preliminary Economic Assessment study as a model, develop an expanded model to include Valle Esperanza and Barite Hill as sources of high-grade silver concentrates with relatively low base metal content.
- Develop a global Preliminary Economic Assessment that takes all deposits into consideration with emphasis on an optimum extended mine life.
- Continue selective exploration of the best targets in the core project area that have Loma de La Plata or Valle Esperanza type potential. The continued exploration in the extended Valle Esperanza Valley is one of the highest priority areas.
- Continue to evaluate and prioritise the various mining concessions that Pan American controls along the Gastre Fault structural trend.
- Continue to advance the Navidad environmental base line studies in anticipation of an eventual filing of the appropriate environmental impact statement (EIS). In the short term Pan American plans to engage an international-level consultant to conduct a baseline review and plan the outstanding baseline work to complete the environmental impact assessment (EIA) for the proposed mine. This consultant would conduct an independent evaluation and consult with the Chubut Provincial authorities. The consultant would then assist with baseline studies and ultimately be responsible for preparation of the mine EIA.
- Pan American should continue and increase efforts to explain and present the Navidad Project to the authorities in the Chubut Provincial government, especially stressing the benefits in

employment, infrastructure, and tax revenue that would accrue to the community if the authorities were to rescind legislation that currently prohibits open pit mining.

Pan American should continue to implement their proposed continuous improvement practices on diamond drilling, QAQC, sampling, density determinations, and resource modelling aspects at the Project, including:

February 2010

16 of 249

Pan American Silver Corp:

- Survey all drillholes regardless of their orientation, with the first measurement taken at the collar of the drillhole, to ensure that the spatial location of mineralisation is well defined.
- Continue to refine the effectiveness of the QAQC database through more accurate documentation of the QAQC sample type and the analytical method, and by following the recommendations made by Smee (2008); these recommendations are being implemented.
- Determine the density of drill core prior to splitting with a diamond saw to reduce the error in the calculation introduced by a small sample size. Samples should be coated with a material such as wax or varnish to prevent water retention in the sample from influencing the calculated specific gravity value. Samples should be selected according to a representative suite of lithologies, mineralisation, and alteration types, through spatially representative locations throughout the area covered by drilling. The representativity can be confirmed by consulting the number of density determinations tabulated by grade estimation domain for each deposit in Table 17.10, and increasing the number of density samples in domains with low sample numbers relative to the number of sample assays in the domain. Spatial representativity can be confirmed by plotting the location of specific gravity samples on the drillhole trace in plan and in section.
- Further refine the geological interpretation to incorporate all available geological information, including surface mapping (including the position of outcropping mineralisation), geophysical information, structural information, and core logging detail in digital, three dimensional format.
- Continue the modelling of fault interpretations for use in future resource estimations.
- Undertake a study of the differences between the oxide and sulphide zones for modelling in future resource estimations.

Snowden further recommends that Pan American undertake a drillhole spacing study at Loma de La Plata using conditional simulation to quantify the optimal drillhole spacing required to achieve a range of estimation qualities. Some close-spaced drilling should be performed in a representative mineralised domain to characterise the short-range behaviour of the mineralisation. Aquiline has already drilled 23 holes at Loma de La Plata in anticipation of such a drillhole spacing study. The outcome of this approach would be an understanding of the degree of grade estimation error associated with particular volumes of mineralisation for a range of drillhole spacing patterns. The grade estimation error and other important aspects of the project data, described in Section 17.10, are considered while assigning Mineral Resource confidence categories.

Pan American plans to proceed to an expanded Preliminary Economic Assessment (PEA) of the Navidad Project, using the Loma de La Plata PEA study published in October 2008 as a basis (Snowden, 2008), focussing on deposits that are likely to produce a high-value silver concentrate with low lead content and maximise the operational mine life. The study will utilise the updated resource models produced as part of this report, in addition to the metallurgical testing of Valle Esperanza and Barite Hill. A more detailed evaluation of the market for silver/copper concentrates is also required. In addition to examining open pit mining methods, those deposits with likely

February 2010

17 of 249

Pan American Silver Corp:

high strip ratio cutbacks such as Valle Esperanza, Loma de La Plata, and Barite Hill will be evaluated for extraction by underground methods.

More test work with fresh core samples is essential to take Barite Hill and Valle Esperanza to Feasibility Study level to enable Bond Mill work indices to be determined, further tailings settling tests and potential penalty elements including arsenic and antimony.

Further studies of Galena Hill will focus on developing a programme to test the metallurgical variability of the deposit including initial modelling of the geo-metallurgical domains and designing the drill programme for fresh samples. The design of the metallurgical test programme should incorporate opportunities for improving concentrate quality already identified.

Continued exploration in the company's land package in the Navidad district will be directed towards additional Jurassic-age basins in the Gastre structural corridor with Cañadón Asfalto lithologies. Geochemical sampling techniques should be effective tools to efficiently explore these basins. The distribution of associated potassic-style alteration such as adularia within the regional basins may be detected through the interpretation of the 2008 airborne radiometric survey.

Approximately US\$500,000 was expended per month in Argentina on the exploration programme and related activities for the Navidad Property in 2009. Pan American will continue exploration drilling on several open or new targets along the mineralised trends. Infill drilling is planned for Loma de la Plata, Valle Esperanza, Barite Hill, and Galena Hill during 2010. These drillholes will also provide new samples for metallurgical analysis. Additional condemnation and geotechnical drilling is planned for potential future infrastructure sites.

February 2010

18 of 249

Pan American Silver Corp:

2

Introduction

This Technical Report has been prepared by Snowden Mining Industry Consultants Inc. (Snowden) for Pan American Silver Corp. (Pan American), in compliance with the disclosure requirements of Canadian National Instrument 43-101 (NI 43-101), to disclose relevant information about the Navidad Project. This information has resulted from the acquisition of Aquiline Resources Inc. (Aquiline) by Pan American. On 14 October 2009, Pan American announced a friendly offer to acquire all of the issued and outstanding securities of Aquiline. On 7 December 2009, Pan American acquired approximately 85% of the issued and outstanding shares of Aquiline and extended its bid to 22 December 2009, and on that latter date, Pan American took up an additional approximately 7% of the issued and outstanding shares in the capital of Aquiline. Since the offer to acquire the Aquiline shares was accepted by holders of more than 90% of the Aquiline shares, on 23 December 2009, Pan American provided notice to the remaining shareholders of its intention to exercise its right to acquire the remaining issued and outstanding Aquiline shares pursuant to the compulsory acquisition provisions of the Business Corporation Act (Ontario). Pursuant to the compulsory acquisition, Pan American has been deemed to have acquired the balance of the Aquiline shares not already owned by it on or about 22 January 2010.

As a result of its acquisition of Aquiline, Pan American is required to file a technical report on the Navidad Project pursuant to NI 43-101. This Technical Report is prepared to fulfil this requirement and is based on information disclosed in the Technical Report filed on SEDAR by Aquiline on 2 June 2009, and dated May 2009, amended June 2009 (Snowden, 2009). There are no other material changes to the Navidad Project to report aside from the acquisition of Aquiline by Pan American.

The June 2009 Technical Report (Snowden, 2009) was prepared to disclose information from additional Mineral Resource delineation drilling, Mineral Resource estimations, exploration drilling, and metallurgical test work completed since the previous Technical Reports (Snowden 2006a, Snowden 2006b, and Snowden, 2007). The June 2009 Technical Report was intended to disclose recently updated Mineral Resources at the Calcite NW, Calcite Hill, Navidad Hill, Connector Zone, Galena Hill, Barite Hill, Loma de La Plata, and Valle Esperanza deposits at the Navidad Project. The amended report dated June 2009 included the assay results of independent samples selected by Snowden in April 2009, which were not available at the time of the original filing on SEDAR in May, 2009.

The Supreme Court of British Columbia awarded ownership of the Navidad Project to Minera Aquiline on 14 July 2006 following a court case with IMA Exploration Inc. (IMA) where IMA was found to have breached a Confidentiality Agreement with Minera Normandy Argentina S.A. (Minera Normandy), then a subsidiary of Newmont Mining Corporation. Minera Normandy was subsequently acquired by Aquiline and its name was changed to Minera Aquiline. IMA appealed the trial court decision to the Appeal Court of British Columbia which denied the appeal in reasons for judgment dated 7 June 2007. In September 2007 IMA submitted an Application for Leave to Appeal to the Supreme Court of Canada. Sole ownership rights were granted to Aquiline by the Supreme Court of Canada on 20 December 2007, subject to Aquiline making payment to IMA which would reimburse the latter for its accrued exploration expenditures up to the July 2006 court decision. Aquiline's final payment to IMA was made on 8 February 2008 giving Aquiline full ownership of the Project.

February 2010

19 of 249

Pan American Silver Corp:

Pan American is a silver mining company based in Canada and listed on the Toronto Stock Exchange (TSX:PAA) and NASDAQ (PAAS).

Unless otherwise stated, information and data contained in this report or used in its preparation has been provided by Aquiline and Pan American. This Technical Report has been compiled from sources cited in the text by Ms. Pamela De Mark, P. Geo., Senior Consultant at Snowden, and under the supervision of Snowden by Mr. John J. Chulick, formerly Vice President of Exploration at Aquiline, Mr. Dean K. Williams, formerly Chief Geologist at Aquiline, Mr. Damian Spring, Chief Mining Engineer at Aquiline, and by John A. Wells, consultant metallurgist. Ms. De Mark, Mr. Chulick, Mr. Williams, Mr. Spring, and Mr. Wells are Qualified Persons as defined by NI 43-101. Ms. De Mark visited the Navidad Project site in September 2007 and in April 2009. The responsibilities of each author are provided in Table 2.1.

This report is intended to be used by Pan American subject to the terms and conditions of its contract with Snowden. That contract permits filing this report as a Technical Report with Canadian Securities Regulatory Authorities pursuant to provincial securities legislation. Except for the purposes legislated under provincial securities laws any other use of this report by any third party is at that party's sole risk.

Reliance on the report may only be assessed and placed after due consideration of Snowden's scope of work, as described herein. This report is intended to be read as a whole, and sections or parts thereof should therefore not be read or relied upon out of context. Any results or findings presented in this study, whether in full or excerpted, may not be reproduced or distributed in any form without Snowden's written authorisation.

Table 2.1 Responsibilities of each co-author

Author	Responsible for section/s
Dean K. Williams	7: Geological setting; 8: Deposit types
John J. Chulick	4: Property description and location; 6: History; 9: Mineralisation; 10: Exploration; 11: Drilling; 12: Sampling method and approach; 13: Sample preparation, analyses, and security; 15: Adjacent properties
John A. Wells	16: Mineral processing and metallurgical testing
Damian Spring	18: Other relevant data and information
Pamela De Mark	All other sections

Unless otherwise stated, all currencies are expressed in US dollars (\$). Coordinates for the Navidad Project grid, including drill coordinates referred to in this Technical Report are in the Gauss Kruger projection, Zone 2, relative to the Campo Inchauspe datum. Mining claims are registered using the Gauss Kruger projection, Zone 2, relative to the WGS 84 datum.

February 2010

20 of 249

Pan American Silver Corp:

3

Reliance on other experts

There has been no reliance on experts who are not Qualified Persons in the preparation of this report except for information cited in Section 15 regarding Adjacent Properties, where unverified information has been obtained from the company website of Patagonia Gold Plc. at www.patagoniagold.com.

February 2010

21 of 249

Pan American Silver Corp:

4

Property description and location

Information in this section has been sourced from Snowden (2009).

The Navidad Project is located in Gastre Department in the Province of Chubut, southern Argentina, at approximately 42°24' 54" S and 68°49' 12" W.

4.1 Land tenure

The Navidad Property is divided into four property claims (registration numbers 14340/04, 14341/04, 14902/06, and 14903/06), each of which is 2,500 ha in area. Additional Aquiline Property claims held or applied for in the name of Minera Argenta S. A. and Minera Aquiline Argentina S.A. in Chubut Province are shown in Table 4.1 and Table 4.2. A plan of the tenements held by Pan American in Chubut Province is shown in Figure 4.1.

In Argentina, exploration concessions are not physically surveyed or staked in the field, but are electronically filed using the Gauss Kruger coordinate system, zone (faja) 2, relative to the WGS 84 datum. There are three levels of mineral rights (which do not include surface rights):

- Cateo – an exploration permit granting any mineral discoveries on the cateo to the applicant. Cateos are measured in units of 500 ha, with a minimum of one unit (500 ha) and a maximum of 20 units (10,000 ha) granted to any holder. Cateo units must be reduced over time relative to the number of units held; the maximum duration for any granted cateo is three years. The holder may conduct prospecting, mapping, sampling, and geophysical surveys, and drilling and trenching after notifying the mining office of the exploration plan.
- Manifestacion de Descubrimiento (MD) – once mineralisation is discovered on a cateo, the cateo lease expires and the permit is upgraded to a manifestacion. The maximum area of a manifestacion is 7,000 ha. A basic environmental impact assessment, a physical survey, and boundary markers are required at this stage.
- Pertenencia – a lease allowing mining. A physical survey and boundary markers are required.

Snowden has not reviewed the land tenure situation and has not independently verified the legal status or ownership of the properties or any agreements that pertain to the Navidad Project. Land tenure aspects have been provided by Aquiline; Snowden has reviewed the information and believes it is reliable.

Table 4.1 Tenement details in Chubut Province operated as Minera Argenta S.A.

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Registration number	Property name	Area(ha)	Tenement type*	Property status*
14340/04	Navidad Este	2,500	MD	GMD; LL & MC IP
14341/04	Navidad Oeste	2,500	MD	GMD; LL & MC IP
14352/04	Pampa 1	2,975	MD	GMD; LL & MC IP

February 2010

22 of 249

Pan American Silver Corp:

Registration number	Property name	Area(ha)	Tenement type*	Property status*
14367/04	Colonia Este	1,596	MD	GMD; LL & MC IP
14368/04	Colonia Oeste	2,990	MD	GMD; LL & MC IP
14369/04	Sierra	3,469	MD	IP
14370/04	Sierra 1	2,856	MD	GMD
14446/05	Pampa III	2,500	MD	GMD; LL & MC IP
14731/05	Sierra Cacique II	3,025	MD	GMD; LL & MC IP
14732/05	Sierra Cacique I	3,025	MD	GMD; LL & MC IP
14742/05	Carlota 1	3,481	MD	IP
14830/06	Sierra Cacique III	3,484	MD	IP
14831/06	Sierra Oeste	3,105	MD	IP
14832/06	Colonia Este 1	1,622	MD	GMD
14833/06	Colonia Este 2	1,596	MD	IP
14834/06	Sierra Sur 1	2,840	MD	IP
14902/06	Navidad Este 1	2,500	MD	GMD; LL & MC IP
14903/06	Navidad Oeste 1	2,500	MD	GMD; LL & MC IP
15302/07	Trucha A	2,926	MD	IP
15303/07	Alamo A	2,990	MD	IP
15304/07	Mara A	2,486	MD	IP
15305/07	Mara B	2,486	MD	IP
15306/07	Condor C	2,024	MD	IP
15307/07	Condor D	1,957	MD	IP
15323/07	Trucha B	3,001	MD	IP
15426/08	Alamo B	4,752	MD	IP
15439/08	Mara C	2,486	MD	IP
15455/08	Puente 1	2,499	MD	IP
15456/08	Puente 2	2,499	MD	IP
15488/08	Carlota 3	3,448	MD	IP
15493/08	Nina 3	3,448	MD	IP
15525/08	Noelita	9,405	MD	IP

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15528/08	Julie	3,577	MD	IP
15529/08	Navidad 3	2,968	MD	IP
15530/08	Navidad II Oeste	2,748	MD	IP
15531/08	Navidad II Este	2,365	MD	IP
15532/08	Puente 3	6,624	MD	IP

February 2010

23 of 249

Pan American Silver Corp:

Registration number	Property name	Area(ha)	Tenement type*	Property status*
15545/09	Navidad 4	7,000	MD	IP
15550/09	Nuevo Condor	4,800	MD	GMD
15555/09	Los Loros	8,470	CA	IP

*Tenement type codes:

CA = Cateo, exploration permit

MD = Discovery claim (Manifestacion de Descubrimiento), advanced exploration permit

*Property status codes:

IP = In progress. Application submitted

LL = Labour legal, the legal declaration of work that proves existence of mineralisation. Initial process prior to sub-division into mining claims

GMD = Granted discovery claim (Manifestacion de Descubrimiento)

MC = Mining claims (Pertenencias)

JV = Joint venture

Table 4.2 Tenement details in Chubut Province held in the name of Minera Aquiline Argentina S.A.

Registration number	Property name	Area(ha)	Tenement type*	Property status*
14170/03	Calquitas 1	5,165	MD	GMD; LL & MC IP
14171/03	Calquitas 2	5,150	MD	GMD; LL & MC IP
14728/05	Calquitas 3	6,472	MD	GMD
14729/05	Calquitas 4	4,111	MD	IP
15527/08	Flamingo	5,635	MD	IP
14195/04	Regalo II	10,000	CA	JV
14399/04	Regalo III	7,670	CA	JV
14616/05	Regalito 1	2,500	MD	JV
14617/05	Regalito 2	2,500	MD	JV
14642/05	Regalo IV	2,350	CA	JV
14643/05	Regalo V	4,000	CA	JV
14644/05	Regalo VI	4,200	CA	JV
15053/06	Regalito 3	2,500	MD	JV
15054/06	Regalito 4	2,500	MD	JV

*Tenement Type codes:

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CA = Cateo, exploration permit

MD = Discovery claim (Manifestacion de Descubrimiento), advanced exploration permit

*Property status codes:

IP = In progress. Application submitted

LL = Labor legal, the legal declaration of work that proves existence of mineralisation. Initial process prior to sub-division into mining claims

GMD = Granted discovery claim (Manifestacion de Descubrimiento)

February 2010

24 of 249

Pan American Silver Corp:

Registration number	Property name	Area(ha)	Tenement type*	Property status*
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MC = Mining claims (Pertenencias)

JV = Joint venture

February 2010

25 of 249

Pan American Silver Corp:

Figure 4.1 Plan of tenements held by Pan American in the province of Chubut

February 2010

26 of 249

Pan American Silver Corp:

4.2 Agreements and encumbrances

Silverstone Resources has rights to 12.5% of the eventual silver produced at Loma de La Plata under a “silver stream” agreement. Pan American has represented that Navidad is not subject to any other royalties, back-in rights, payments, agreements, or encumbrances.

In 2006 the government of Chubut Province decreed a three year moratorium on all mining activities, including exploration, in the western part of the Province. This moratorium is due to expire on 29 June 2009, and the government of Chubut has publicly declared that it intends to extend the moratorium for another three years. The government asserts this is to enable the completion of a province-wide map of the mineral potential. The Navidad Property lies outside of and to the east of these “no-mining” zones. The government of Chubut Province has also decreed a Province-wide ban on the use of cyanide for mining purposes and the development of open pit mines. The law states that the government of Chubut Province will accept and review mining proposals, including open pit and cyanide based mining operations, on a case by case basis and determine at that point whether permits may be issued.

4.3 Environmental liabilities

The Province holds the Property administrator responsible for any potential environmental damage liabilities that may arise.

Navidad is flanked by the communities of Gastre to the northwest, Gan Gan to the east and Blancuntre and Lagunita Salada to the southwest. Blancuntre is the closest recognised indigenous community to the Project, with approximately 50 indigenous families living within the town and surrounding area.

Pan American is in the process of completing environmental and social baseline studies for the Project. The bulk of baseline work done to date has been contracted to local Argentine consultants working under the supervision of international firms including Water Management Consultants (WMC)/Schlumberger Water Services, Ground Water International, On Common Ground Consultants Inc., and Klohn Crippen Berger Ltd. Pan American is currently selecting an international consultant that will finalise the baseline work and prepare the future Environmental Impact Assessment (EIA) for the Project.

Key studies underway or completed to date include:

- Climate and air quality
- Surface and groundwater
- Water resources
- Flora, fauna, limnology and ecosystem characterisation
- Archaeology and palaeontology
- Soils, geomorphology, and seismic
- Toxicology and ecotoxicology
- Noise
- Acid Rock Drainage

February 2010

27 of 249

Pan American Silver Corp:

4.4 Permits

Drilling at the Navidad Project requires a separate permit for each affected tenement valid for one year, subject to the approval of an Environmental Impact Statement (EIS). Pan American is required to submit an EIS which covers the impacts and mitigation/monitoring procedures for the exploration activities, in order to obtain environmental permits. The level of the exploration activity dictates the level of study required.

The Navidad Project is in an advanced exploration stage involving drilling and trenching activities. Aquiline submitted the most recent EIS update in 2008 which was approved in January 2010. Until this EIS update was approved the Project operated under the existing valid permit which was modified in 2008. As a result of the EIS approval, a new drilling permit was issued for a one year period and this new permit allows for the operation of up to eight drill rigs. Rehabilitation of the drilling platforms and impacted areas is carried out throughout the year.

Water rights are treated separately from environmental permits. Aquiline has permitted two extraction wells for use in exploration activities.

Depending on overall project timing, Pan American plans to finalise an Environmental and Social Impact Assessment report for the Project and present it to the provincial Chubut Government in 2010. While the Government has publicly indicated its support for the Navidad Project proceeding, the status of a 2003 provincial law banning open pit mining would need to be clarified before permits for mining can be obtained. Other than the legal/political matter raised above, Pan American does not identify any specific or unique environmental or social risks associated with the Navidad site or Project aspirations.

February 2010

28 of 249

Pan American Silver Corp:

5 Accessibility, climate, local resources, infrastructure, and physiography

Information in this section has been sourced from Snowden (2009).

5.1 Accessibility

The nearest towns to the Property are Gastre, with a population of about 500, 40 km to the northwest, and Gan Gan, with a population of about 600, about 40 km to the east. Both towns are located on Provincial Route 4, a gravel highway that passes just north of the Property. Aquiline established offices, accommodation, and facilities for core storage and logging in Gastre and to a lesser degree in Gan Gan. The Property is accessible year round except in very wet conditions.

Daily scheduled flights are available from the city of San Carlos de Bariloche, a tourism centre with a population of approximately 100,000, located about 355 km by road to the northwest. Daily flights are also available through Trelew, located about 390 km by road to the southeast near the coast, with a population of approximately 90,000. The nearest airport, which has regularly scheduled flights, is located in Esquel, about four hours drive to the southwest by gravel road. The provincial capital of Rawson, located 20 km east of Trelew, has a population of approximately 23,000. Aquiline established an office from which to advance the technical studies of the Project in Puerto Madryn, a city with a population of approximately 70,000, located 60 km north of Rawson. There are at least three scheduled flights per week between Puerto Madryn and Buenos Aires. Pan American also maintains offices in Buenos Aires and in the regional centre of Ingeniero Jacobacci, which has a population of approximately 8,000, located two hour's drive to the north of Gastre.

5.2 Climate

The climate is semi-arid with average annual temperatures ranging from 1°C to 20°C. High winds frequently occur from October through December, but may also occur throughout the year. Annual precipitation averages between 5 mm to 10 mm per month, but during the winter months from May to August, higher accumulations ranging from 15 mm to 20 mm may occur as either rain or snow. Field activities run

throughout the year and are not curtailed by weather conditions.

5.3 Infrastructure and local resources

Pan American's base of operation for the Navidad Project is in Gastre. Facilities include offices, modular living facilities, and core-storage warehouses. Communications are provided by land line telephone service, national mobile phone operator, and a satellite internet dish. The modular living facilities provide lodging and meals for up to 20 people. The warehouses include three drill core storage sheds, a logging and sampling shed, metal shop, vehicle workshop, and a regional exploration office. In the logging shed there are four diamond saws used to cut drill core.

In Gan Gan the company has built two core storage facilities as well as an office on land purchased on the western edge of town in 2007. The office serves as a base of operation for its social and community relations personnel, while the warehouses contain older drill core from the Navidad Property.

February 2010

29 of 249

Pan American Silver Corp:

On the Navidad Property a small camp facility has been installed with electrical power provided by several small generators. Communication is provided by a satellite internet uplink. Other infrastructure on site includes storage areas for drill supplies. There are two water bores authorised by the Chubut Province Hydrology Department to pump water for use with diamond drilling. Water pumping is accomplished by one of two company owned water pumps. To provide access for drilling a total of 26 km of access roads have been constructed on the Property.

During 2008, the drilling contractor, Boart Longyear, installed a transportable 60-person camp in the Yanquetru Valley, on company-owned land to the south of the Project. The company installed a water tank and sewerage facilities in support of the camp.

5.4 Land access

Access to land for drilling and other exploration activities is allowed through outright surface ownership as well as through a series of easement contracts with the remaining surface owners. Aquiline continued land acquisition to facilitate unimpeded land access to the Navidad Project through land swap deals and direct land purchases.

Pan American reports the current status of its land acquisition process as follows:

- Santana Sarmiento Property: Land swap completed
- Santana Horacio Property: Direct purchase of land completed
- Montenegro Succession: Direct purchase of land with agreements signed and title transfer to occur in July 2009
- Raileff Succession: Land swap agreements signed, titles to be transferred when the IAC (Colonisation Office) grants property to the Raileff family
- Llanquetru Eleuterio Property: In progress

Figure 5.1 shows a plan of the properties now owned by Pan American shaded in red, while agreed sales transactions or negotiations continue on the properties shaded in green. The blue outlines represent the previous cateos, now re-applied for as Manifestaciones de Descubrimientos (MD), while the dashed bold blue line represents the MDs covering the main area of the Project. The properties previously owned by Sarmiento and Horacio Santana contain the Loma de La Plata Project and the favoured sites for the associated waste dump, tailings dam, and concentrator (Snowden, 2008).

Pan American Silver Corp:

Figure 5.1 Navidad surface landholders with status of negotiations or agreements

5.5 Physiography

The Property is located in the Patagonian Plateau region with steppe vegetation characterised by low and compact bushes of grass and by stocky shrubs of less than a metre high. Elevation ranges from 1,060 m to 1,460 m with gentle topographic relief interrupted by local structurally controlled ridges.

February 2010

31 of 249

Pan American Silver Corp:

6 History

Information in this section has been sourced from Snowden (2009), which excerpted and updated from Cuburu (2007).

The first exploration programme that included the Navidad Project area consisted of a preliminary regional geochemical sampling programme conducted by Normandy Argentina (Normandy) in mid 2000 to locate additional deposits to supplement those known at its Calcatreu Property, a gold and silver deposit located approximately 80 km from Navidad. The programme consisted of 1,200 bulk leach extractable gold (BLEG) stream sediment samples taken from drainage systems overlying Jurassic volcanic rocks in Chubut Province in the general vicinity of Calcatreu, Mina Angela, Gastre, Lagunita Salada, Gan Gan, and other areas. This programme took place on what was then considered open exploration ground, and resulted in the identification by Normandy of various anomalies, including the Flamingo Prospect and Sacanana, which is today known as Navidad.

In January and February 2002, Newmont Mining (Newmont) purchased Normandy's worldwide mining interests, and in March 2002, Newmont decided to sell all of its interests in Argentina. In September 2002, IMA signed a confidentiality agreement (Confidentiality Agreement) in order to obtain a copy of the Information Brochure and technical data related to Newmont's Argentinean interests, which included the Calcatreu Project. In December 2002, IMA applied for an exploration concession (cateo) over the area formerly known as Sacanana and now known as Navidad, utilising and relying upon the Normandy BLEG data (known as BLEG A), and began undertaking a regional exploration programme over the Navidad area, including regional mapping and sampling. From December 2002 to July 2006, IMA conducted diamond drilling, geochemical sampling, geophysical exploration, and Mineral Resource estimates at Navidad.

In January 2003 Aquiline entered into an agreement with Newmont, which was completed in July 2003, to purchase all of the shares of Normandy and Newmont's 100% interest in Calcatreu, and acquired all of Newmont's assets including the BLEG A data. In May 2003 Aquiline reviewed the BLEG A data and found that the ground covered by the BLEG A data had already been claimed by IMA. After failure to receive a

credible response from IMA as to how they could otherwise have made a legitimate discovery at Navidad without having breached the terms of the Confidentiality Agreement, Aquiline went on to file suit in the Supreme Court of British Columbia in March 2004.

The Supreme Court of British Columbia awarded ownership of the Navidad Project to Aquiline on 14 July 2006 following a court case with IMA where IMA was found to have breached the Confidentiality Agreement. IMA subsequently appealed to the Court of Appeal for British Columbia, but lost the appeal by unanimous decision in June 2007. An Application for Leave to Appeal to the Supreme Court of Canada was filed by IMA in September 2007. Sole ownership rights were granted to Aquiline by the Supreme Court of Canada on 20 December 2007, subject to Aquiline making payment to IMA which would reimburse the latter for its accrued exploration expenditures up to the July 2006 court decision. Aquiline's final payment to IMA was made on 8 February 2008, giving Aquiline full ownership of the Project.

Since October 2006, Aquiline undertook diamond drilling, geophysical and geochemical exploration, metallurgical test work, resource estimates (Snowden, 2007), including the

Pan American Silver Corp:

2009 Mineral Resource estimate, and a Preliminary Economic Assessment for Loma de La Plata (Snowden, 2008).

On 14 October 2009, Pan American announced a friendly offer to acquire all of the issued and outstanding securities of Aquiline. On 7 December 2009, Pan American acquired approximately 85% of the issued and outstanding shares of Aquiline and extended its bid to 22 December 2009, and on that latter date, Pan American took up an additional approximately 7% of the issued and outstanding shares in the capital of Aquiline. Since the offer to acquire the Aquiline shares was accepted by holders of more than 90% of the Aquiline shares, on 23 December 2009, Pan American provided notice to the remaining shareholders of its intention to exercise its right to acquire the remaining issued and outstanding Aquiline shares pursuant to the compulsory acquisition provisions of the Business Corporation Act (Ontario). Pursuant to the compulsory acquisition, Pan American has been deemed to have acquired the balance of the Aquiline shares not already owned by it on or about 22 January 2010.

February 2010

33 of 249

Pan American Silver Corp:

7 Geological setting

Information in this section has been sourced from Snowden (2009).

7.1 Regional geology

The Navidad Project is located on the southwest edge of the Northern Patagonia Massif in southern Argentina. This boundary of the massif is coincident with the “Gastre Fault System”, which was originally interpreted as a large-scale dextral shear zone (Figure 7.1). This mega-structural feature is now believed to be the result of continental-scale northeast to southwest extension that produced through down-faulting a series of northwest to southeast trending half grabens and tectonic basins. (von Gosen et. al. 2004)

Granitoid rocks of the basement in northern Chubut Province belong to the Palaeozoic age Mamil Choique and Lipetren formations. Locally these rocks are exposed at surface in windows through the overlying Mesozoic age volcanic and sedimentary rocks. At Navidad the Mesozoic sequence consists of the Lonco Trapial Formation and overlying Cañadón Asfalto Formation. The latter of these formations hosts the Navidad mineralisation.

Chubut Province was tectonically active during the Jurassic with abundant evidence of syn-sedimentary faulting observed in the Cañadón Asfalto Formation. Continued post- sediment tectonic activity resulted in the faulting, tilting, and local folding of the Lonco Trapial and Cañadón Asfalto formation stratigraphies. This resulted in the formation of a series of northwest trending half and full horsts and grabens.

Overlying these tilted Jurassic age volcanics and sediments are the generally flat lying sediments and pyroclastic rocks of the Cretaceous age Chubut Group Formation. To the east and south these are covered by Tertiary age plateau basalts.

Pan American Silver Corp:

Figure 7.1 Regional geology plan

7.2 Local geology

The local geology as shown in Figure 7.2 consists of exposures of the Palaeozoic age Mamil Choique Formation along the western side of the map area. This unit is composed of red and grey granitoids and aplite dykes with quartz-rich pegmatites.

February 2010

35 of 249

Pan American Silver Corp:

These crystalline basement rocks are overlain by Jurassic age rocks of the Lonco Trapial and Cañadón Asfalto formations. These formations are unconformably overlain by the Cretaceous age Chubut Group of the Cerro Barcino Formation of continental sandstones, conglomerates and tuffs and by plateau basalts of the Miocene age Pire Mahuida Volcanic Complex.

The contact between the Mamil Choique Formation basement rocks and the volcanic rocks of the Lonco Trapial Formation is located 6.5 km southwest of the Navidad Trend.

February 2010

36 of 249

Pan American Silver Corp:

Figure 7.2 Local geology plan from Andolino (1999)

Units present in Navidad Project Area listed below:

- 39 Alluvial and colluvial deposits, fine to medium sands, silts and clays subordinate; disperse boulders
- 38 Deposits in lows and lakes. Silts and clays; salts
- 36 Deposits that cover undifferentiated layers. Sands, gravels and silts
- 35 Deposits that cover the second layer in the Gan Gan low. Sands, gravels and silts
- 34 Deposits that cover the first layer in the Gan Gan low. Sands, gravels and silts
- 30 Pire Mahuida Volcanic Complex. Basalts (flows), nepheline
- 16 Colhué Huapi Formation (continental). Tuffs, lapilli tuffs and sinters
- 13 Catán Lil Ignimbrites. Rhyolitic ignimbrites.
- 10 La Colonia Formation. (continental, lagunal, marine). Pelites; subordinate fine sandstones
- 7 Chubut Group – Cerro Barcino Formation (continental). Sandstones, conglomerates and tuffs
- 6 Cañadón Asfalto Formation (continental lacustrine). Fine sandstones, limestones and volcanics

February 2010

37 of 249

Pan American Silver Corp:

- 4 Lonco Trapial Formation. Ignimbrites, andesites, porphyritic andesites, andesite breccias
- 3 Garamilla Formation. Ignimbrites and rhyolite lavas and dacites
- 1 Mamil Choique Formation. Red and grey granites; sheared granites 1a: Aplite dykes and quartz
(translated from the original Spanish by Lhotka, 2003)

7.2.1 Lonco Trapial and Garamilla formations

The Lonco Trapial Formation is the oldest Jurassic age unit located in the vicinity of the Navidad Project area. It forms the northeast contact with the exposed batholithic rocks of the Mamil Choique Formation. The unit is characterised by lavas and volcanic breccias of intermediate composition. Locally it may become intercalated with the typically more felsic and pyroclastic rocks of the Garamilla Formation. This latter unit consists of multiple pyroclastic flow events and reworked volcanoclastics.

7.2.2 Cañadón Asfalto Formation

This unit stratigraphically overlies the Lonco Trapial and Garamilla formations. Within the portion of the government geologic map shown in Figure 7.2, the spatial distribution of this unit is restricted to the area immediately surrounding the Navidad Project and an area on strike to the southeast in the lower right hand corner of the map. The formation consists of lacustrine sedimentary rocks, which grade laterally and vertically from lower arkose basal conglomerates and sandstones to greywacke that give way to mudstones at higher stratigraphic levels. Interbedded with both the arkose, greywacke and shales are thin horizons of carbonaceous marls and limestone, some of which contain stromatolites.

Within the sedimentary sequence are three distinguishable volcanic lava flows. These appear conformable to the sedimentary stratigraphy and are believed to have been emplaced in sub-areal to sub-aqueous environments. Pyroclastic and phreatic-magmatic events precede the extrusion of the latter two lavas. Evidence of these events is preserved as pyroclastic horizons within the volcanic-sedimentary sequence and what is interpreted to be a maar – diatreme complex. The lavas consist of an intermediate composition rock referred to as andesite and two trachyandesite units referred to as the Lower and Upper latite units. The lower of these units is distinguishable from the upper by the ubiquitous presence of monolithic xenoliths in the former.

No obvious intrusive rocks are identified within the Project area with the exception of feeder dikes of the Lower Latite unit. The present

interpretation is that the latite units are the product of volcanic lava flows and flow breccias, though at Navidad Hill, the base of the latite has so far not been found by drilling, leaving open the possibility of a dome in this area.

7.2.3 Depositional setting

The rocks of the Lonco Trapial and Cañadón Asfalto formations were deposited into an actively subsiding tectonic basin. Sub-basins control the distribution of lacustrine sediments resulting in rapid facies changes. Source areas for the sediments appear to have changed over time. Early arkoses are believed to have been derived from highlands of the crystalline basement rocks to the southwest. The greywacke sediments of intermediate composition are believed to be sourced from the north. There is evidence the sedimentary cycles may have been interrupted by block faulting and tilting with erosion and re-sedimentation. The environment during the deposition of the volcanics of the Cañadón Asfalto Formation appears to have varied over time from

February 2010

38 of 249

Pan American Silver Corp:

place to place as exhibited by textures and characteristics for both sub-areal and submarine emplacement.

7.2.4 Structure and control of mineralisation

At the regional scale the main structural orientations within the Navidad District are northwest to southeast, east-northeast to west-southwest, and north-northwest to south-southeast. The depositional basin containing rocks of the Cañadón Asfalto Formation is approximately 55 km long and 10 km wide with the long axis trending northwest to southeast. Ground gravity surveys show a linear northwest to southeast boundary between high and low Bouguer anomalies, which are interpreted to represent structures affecting the crystalline basement rocks. The Navidad Project is located at the northwestern end of the basin. Mineralisation along the Navidad Trend from Marcasite Hill to Calcite NW exhibits a strongly linear northwest to southeast affinity. The Arco Iris Fault at Loma de La Plata is also orientated northwest to southeast.

The Navidad depositional basin is terminated to the northwest by an east-northeast to west-southwest trending structure that juxtaposes the volcanic-sedimentary sequences against rocks of the Lonco Trapial and Mamil Choique formations. To the southeast the Cañadón Asfalto facies are presumed buried beneath Quaternary cover in a large east-northeast to west-southwest trending depression.

The entire Navidad Project area is crossed by north-northwest to south-southeast structures that define the limits of many of the bedrock exposures and are believed to have offset stratigraphy with a dextral sense of relative movement. Observed displacements on these structures range from several metres to over a kilometre.

7.3 Property geology

7.3.1 Lithology

A simplified version of the Navidad Project geology is shown in Figure 7.3. The corresponding stratigraphic column for the Project area is shown in Figure 7.4. The oldest rocks are the crystalline basement rocks of the Mamil Choique Formation

located in the southwest corner of the map area. These basement rocks are overlain by a sequence of pyroclastics, volcanic agglomerates and lavas of the Lonco Trapial Formation. These rocks are exposed along a northwest to southeast trending strip in the southwest quadrant of the map area and in the valley northeast of the Sauzal Fault along the Navidad Trend. They are also exposed on the southeast projection of the Esperanza Trend at the Fold Zone.

February 2010

39 of 249

Pan American Silver Corp:

Figure 7.3 Property geology plan

February 2010

40 of 249

Pan American Silver Corp:

Figure 7.4 Simplified Navidad Project stratigraphic column

The welded pyroclastics of the Lonco Trapial Formation exposed to the southwest of the map area are also found directly north of Calcite Hill and in deep drilling along the Navidad Trend below the Sauzal Fault. Here they are interbedded with juvenile volcanoclastics derived from the same flows. A drill hole northeast of Navidad Hill crossed in excess of 500 m of this volcanoclastic/pyroclastic sequence without encountering the underlying agglomerates or basement rocks. This thick sequence of rock is generally oxidised as denoted by its characteristic red colour and in Section 8 of this report are likened to “Red Beds”.

February 2010

41 of 249

Pan American Silver Corp:

Stratigraphically above the Lonco Trapial volcanic sequence and forming the base of the Cañadón Asfalto Formation are coarse clastic sediments of arkosic composition. Basal conglomerates of the arkoses may contain boulders up to 2 m in diameter. They are composed almost exclusively of angular grains of quartz and feldspar derived from the Mamil Choique Formation. Locally the arkoses contain horizons of limestone, some with stromatolites. Coarser beds include pebble to cobble size clasts of granite and metamorphic rocks. These beds may locally exhibit cross-bedding sedimentary textures. These sediments extend from the valley floor southwest of the Argenta Trend to the Esperanza Trend. Intersections from drillholes southeast of Loma de La Plata and further south on the Argenta Trend indicate the arkoses are interbedded with thick sequences of argillaceous shales. At surface the coarser arkoses horizons are resistive and form extensive exposures. The shales are erosionally recessive and are rarely if ever exposed at surface.

At Loma de La Plata and between the Esperanza and Navidad trends there are no arkose sediments. In their place intercalated with the argillaceous black shales are mature greywackes of intermediate volcanic composition. These are deposited in rhythmic sequences consisting of pebble conglomerates that grade normally into coarse muddy sandstones. The greywackes locally contain thin carbonaceous horizons.

Above the greywackes from Loma de La Plata to Sector Z and between Esperanza and Navidad trends southeast of Calcite NW are argillaceous black shales. These sediments contain limestone horizons and zones with intercalations of coarser grained muddy sediments. They are rich in organic carbon and locally may contain thin coal seams. In the northwest to central portions of the Esperanza Valley the shales may also contain horizons of pyroclastics with varying degrees of re-working with thicknesses that range from 1 m up to 10 m. At Galena Hill the shales host massive sulphide replacement bodies at their lower contact with the latite lavas. At several of the Project deposits these shales contain Pb and Zn mineralisation distal to the higher grade silver zones.

Contemporaneous with the deposition of the sediments within the Project area, there were a minimum of three distinct extrusive lava and multiple pyroclastic volcanic events. The oldest of the lavas are fine-grained and of intermediate to mafic composition. These are referred to at the Project as andesite. These rocks are believed to been extruded sub-aerially as the auto-brecciated tops of the flows show the

effects of thermal oxidation. These lavas were either simultaneously deposited within two separate basins, one dominated by arkoses and the other by black argillaceous shales, or there were multiple andesite eruptive events. On the Argenta Trend the andesites are inter-bedded with arkoses and on the southern end of the Navidad Trend they are inter-bedded with black shales. At the northwestern end of the Navidad Trend and north of Provincial Route No. 4 they are overlain by pyroclastics and other latite lava flows with no intervening sediments. The andesite lavas are generally not mineralised; however, locally they can host Ag-Cu mineralisation. The best known mineralisation hosted in andesite is located at the southern limit of the Connector Zone. Here the tectonically brecciated and hydrothermally altered andesite return grades of up to 11 kg/t Ag in surface rock chip samples. There are also mineralised showings in andesites south of Loma de La Plata on the Argenta Trend and at the Fold Zone at the southeast end of the Esperanza Trend.

The next extrusive lava event produced what is referred to on the Project as the Lower Latite unit. It is actually a hybrid consisting of a trachyandesite contaminated by quartz, which appears as rounded 1 mm to 3 mm quartz phenocrysts with reaction rings in quantities ranging from 1% to 5%. The Lower Latite also contains cognate clasts 0.5 cm to 3 cm in size of fine-grained material of the same composition without quartz

Pan American Silver Corp:

phenocrysts. On the Project these are referred to as “xenoliths”. The Lower Latite was preceded by a pyroclastic eruption that produced pumice bearing ash tuff. At Navidad Hill and Galena Hill the exposed volcanic sequence is andesite, pumice tuff followed by the Lower Latite with no intercalated sediments. The Lower Latite lava is restricted in distribution to the northern end of the Argenta Trend and the northern half of the Esperanza and Navidad trends. These lavas host high grade mineralisation at Calcite Hill, where the Upper Latite lavas are believed to have been removed by erosion prior to the deposition of the black shales. The Lower Latites also host mineralisation together with the Upper Latites at Galena Hill.

The last extrusive volcanic event produced the Upper Latite lava flows. These rocks are macroscopically identical to the Lower Latite except they do not contain cognate clasts. Potentially these autoclasts were completely reabsorbed by the magma before their extrusion. It is believed the initial eruption of the Upper Latite encountered sufficient ground water to create a maar – diatreme complex located at Calcite NW. Evidence supporting this hypothesis is a 2 km wide zone of milled matrix breccia containing rounded clasts of the welded pyroclastic flows and Lower Latite lavas. Horizons of reworked pyroclastics observed within the sediment sequences at the northern end of the Navidad Trend may represent surge deposits. Continued eruption of the Upper Latite lavas led to its distribution over an area minimally 60 km² in size including the entire length of the Argenta, Esperanza and Navidad trends and north of the Provincial Route No. 4. At the southeast end of the trend the groundmass of the lava is glassy and has devitrified to form spherulites. At the northwest end of the Argenta Trend and on the Esperanza and Navidad trends the lava is interbedded with greywackes and shales. The Upper Latite lava hosts practically all of the Ag-Cu mineralisation at the Loma de La Plata and Esperanza Valley deposits and a larger portion of the mineralisation at the Navidad Hill and Galena Hill deposits

7.3.2 Structure and control of mineralisation

Collectively the individual mineralised deposits along the Navidad Trend exhibit a strong northwest to southeast lineation. A few observed small mineralised veins and breccia dikes located along the trend also exhibit northwest to southeast to north-northwest to south-southeast orientations. No large potential feeder structure common to all the deposits has yet been discovered. If such a structure exists, it is likely that post-mineral movement on the Sauzal Fault laterally displaced it from beneath the known mineralised bodies.

At the individual deposit scale the mineralisation is clearly controlled by zones of primary or secondary porosity. Examples of this are the upper latite lavas at Esperanza Valley and Loma de La Plata and volcanoclastic horizons at the Connector Zone and Calcite NW. These zones are often capped by impermeable horizons. These aquitards effectively capped the ascending hydrothermal fluids and forced lateral migration outward from the plumes. The result was the formation of mineralised bodies with strataform geometries.

Almost all the Project mineralised deposits are contained within structural blocks separated from each other by three major structures. These structures are believed to be pre-mineralisation in some cases and are definitely post-mineralisation in others as evidenced by these structures truncating mineralisation. The most influential of these post-mineral structures are the Sauzal, Esperanza and Arco Iris faults. The Sauzal Fault is located along the northeast side of the Navidad Trend and dips shallowly to the southwest. This structure truncates the mineralisation at depth on the Galena Hill, Connector Zone, Navidad Hill and Calcite Hill deposits. The Esperanza Fault located

February 2010

43 of 249

Pan American Silver Corp:

along the Esperanza Trend has resulted in the drag folding of the host lithologies of the Valle Esperanza deposit. The Arco Iris Fault is located in the northern end of the Argenta Trend. This steeply northeast dipping fault limits the Loma de La Plata mineralised deposit to the southwest where it juxtaposes it against unmineralised andesite. The Barite Hill deposit is also interpreted to be affected by post-mineral low angle faulting, potentially analogous to the interpreted movement on the nearby and similarly orientated Sauzal Fault.

February 2010

44 of 249

Pan American Silver Corp:

8 Deposit types

Information in this section has been sourced from Snowden (2009), which incorporated contributions from Sillitoe (2007).

Navidad mineralisation is clearly epithermal in nature as demonstrated by widely observed open space filling by crustiform and cockade textures of the carbonate, barite and sulphide mineral assemblages. The abundance of base metals combined with gangue mineralogy of carbonate and barite dominate over silica, indicates the deposit should most appropriately be categorised as an intermediate – rather than a low sulphidation epithermal deposit. The alteration and sulphide mineral assemblages are incongruent with high sulphidation epithermal style of mineralisation, although late-stage kaolinite and reported minor hydrothermal alunite could imply the late ingress of a hypogene acidic fluid.

The Navidad deposits formed post-deposition and lithification of the containing greywacke and shale sedimentary sequences of the Cañadón Asfalto Formation. Evidence supporting this is open fractures filled by calcite and barite within the sediments overlaying zones of mineralisation. The depth of formation is believed to be moderately shallow, potentially on the order of 400 m to 500 m below the paleosurface. This is consistent with findings from calcite fluid inclusion studies by Lang (2003) that indicated the hydrothermal fluid was vapour dominated with a temperature of homogenisation below 200°C. Despite being formed near the paleosurface, no concrete evidence has ever been observed to indicate an exhalative facies to the mineralisation. The semi-massive sulphides at Galena Hill are clearly replacement in origin. The finely laminated carbonates postulated to represent exhalative products are in fact stromatolitic limestone. Hence, Navidad is not analogous to shallow-water volcanogenic massive sulphide (VMS) deposits like Eskay Creek in British Columbia as has been suggested by previous investigators.

The ore deposit model presented in Figure 8.1 is a schematic reconstruction at the time of emplacement for either Galena Hill or Navidad Hill. Vein and veinlet stockworks grade upwards into hydrothermal breccias believed to have been created by over pressuring of the ascending hydrothermal fluids within the latites. Breccia textures range from crackle to rotated and commonly contain a high component of fine sediments in their

matrix. The breccias locally contain displaced banded carbonate and mineralised clasts indicating multiple inter-mineralisation brecciation events. The breccias are cemented by carbonate and barite gangue and sulphide minerals. At Galena Hill, the breccia clasts become progressively more intensely replaced upwards by the sulphide cement, resulting in irregular bodies of semi-massive sulphide. The breccia and related semi-massive sulphide bodies at Galena Hill terminate abruptly upwards against a finely laminated limestone bed of stromatolitic origin. The overlying carbonaceous mudstone contains Zn mineralisation and can be massively silicified for up to 5 m above the upper limit of the high grade Ag-Pb mineralisation.

Figure 8.2 is a schematic drawing of lateral-flow style mineralisation away from the main ascending plume centres based upon observation made at the Loma de La Plata deposit. Here relatively thin horizons of latite lavas are interbedded with sediments. The silver plus minor copper mineralisation is preferentially localised along the top of the upper latite flow unit in either flow-top auto breccias or in crackle breccias. These breccias are likely to have resulted from even minor tectonic deformation due to the sharp rheology contrast between the brittle latite and the overlying sediments. Disseminated Zn

Pan American Silver Corp:

mineralisation in the sediments forms halos both above and below the main Ag horizon of mineralisation.

The preferred hypothesis for the transport of the metals and their deposition is dependent upon the redox state of the underlying red bed and ignimbrite units and the reducing state of the overlying carbonaceous sediments. The transport mechanism further requires physical fluid-flow conditions of structural conduits and the primary or secondarily induced permeability of the breccias pipes and latite flow units. Ascending hydrothermal fluids passing through the underlying red beds would rapidly become buffered and oxidised, thus resulting in oxidation of sulphide sulphur in solution to sulphate. These fluids would be capable of precipitating carbonate, barite and specular hematite in the veins and veinlets within the red beds, but not Fe, Ag or base metal sulphides. The content of these metals could simply have been transported to higher levels within the hydrothermal system. Upon entry to the overlying relatively reduced rock package, the fluids became more reduced, allowing sulphide formation to commence, presumably as a result of admixture with sulphide-bearing groundwater from the organic carbon-rich, upper sedimentary unit. Interestingly, the Ag mineralisation in the basal grey sedimentary unit, immediately above the red beds, at Barite Hill is rich in native Ag, a mineral that could form after only relatively minor reduction of the ascendant fluids and without the need for reduced sulphur.

This model for Navidad, with mineralisation control by a district-wide redox interface, is reminiscent of red bed Cu and Ag deposits, where fluids ascending through thick red bed sequences leach Cu and/or Ag, along with other metals, and deposit them on contact with reduced horizons. The red bed silver deposits, such as Nacimiento in New Mexico in the United States, are also characterised by sulphur-poor mineral species, such as native Ag and acanthite. The difference is that at Navidad the mineralising fluid was epithermal in origin rather than being basinal brine as in the case of the red bed deposits.

The broadly strataform nature of the Navidad mineralisation is rather uncommon for an intermediate-sulphidation epithermal silver deposit, most of which tend to be of vein type (e.g. Fresnillo in Mexico, Arcata in Peru, Martha in Santa Cruz province, Argentina). Potential analogous deposits include the Jardin Cu-Ag deposit of northern Chile. Here strata-bound cupriferous sulphide mineralisation is associated with the upper brecciated and unwelded portion of a pyroclastic flow overlain by organic-rich tuffaceous lacustrine sedimentary rocks (Lortie, 1987). Another example of a broadly strataform deposit is San Cristóbal in Bolivia. Although the feeders for the San Cristóbal deposit are largely

confined to a dacite dome complex, the bulk of the silver-zinc-lead mineralisation is hosted by lacustrine sedimentary rocks rather than by lava as at Navidad.

February 2010

46 of 249

Pan American Silver Corp:

Figure 8.1 Schematic reconstruction of Galena Hill from Sillitoe (2007)

Figure 8.2 Schematic reconstruction of Loma de La Plata from Sillitoe (2007)

February 2010

47 of 249

Pan American Silver Corp:

9 Mineralisation

Information in this section has been sourced from Snowden (2009), which excerpted and updated from Kain (2007) and Allo, Paolini, and Williams (2009).

In all of the deposits and mineral showings the gangue minerals are principally calcite with or without barite and a much lower proportion of silica. Visibly recognisable ore minerals are native silver, grains and clots of black sulphides containing argentite, acanthite and discrete grains of sphalerite, galena, chalcopyrite, cuprite, bornite, native copper and copper carbonates. Distinct styles of mineralisation are reflected in the differences in ore minerals and proportion of gangue between the deposits. Various pulses of mineralisation are observed, principally at Galena Hill. With the exception of the latter, pyrite and sulphides in general are relatively scarce.

The principal mineral association of interest is Ag-Pb. Other associations of interest are Ag-Pb-Cu and Cu-Ag or more rarely Ag-Zn. Occasionally there is Ag only, or Cu-Pb-Zn or simply isolated occurrences of these base metals. This further suggests that deposition occurred through successive pulses of mineralisation. So far as it is known to date, gold is totally absent from the system.

Mineralisation is preferentially hosted in lavas with the upper latite containing the dominant proportion, followed by the lower latite and then rarely by the andesite. Deposits with the dominate portion of mineralisation within lavas include Loma de La Plata, Valle Esperanza, Calcite Hill, and Galena Hill. Sedimentary rocks and volcanoclastics can also contain significant mineralisation. Deposits where the mineralisation is dominantly hosted by these rock types include Calcite NW, Navidad Hill, Barite Hill, and the Connector Zone.

High grade mineralisation is nearly always correlative with either primary or induced secondary porosity of the host rocks. Examples of primary porosity include coarse volcanoclastic horizons and auto-brecciated lava flow tops. Secondary porosity occurs as crackle brecciation of the brittle lava flows, hydrothermal eruption breccias, and tectonic breccias. At both Valle Esperanza and Loma de La Plata the crackle brecciated upper latites are believed to have acted as aquifers bounded upward by what are interpreted as bedding plane faults with the

overlaying sediments. The capping lutitic sediments created effective aquitards that would have greatly promoted the lateral migration of the ascending hydrothermal fluids. Mixing of the reduced formation waters within the aquifers with the oxidised and metal-laden hydrothermal fluids is hypothesised to have been a principal triggering mechanism for the precipitation of ore minerals. Locally the argillaceous mudstones above the upper latite are fractured and infilled by calcite. This indicates that the host rocks were buried and the sedimentary rocks lithified prior to the mineralising event.

To date the general Navidad Project is comprised of eight individual mineral deposits in three separate mineralised trends referred to as the Navidad Trend, the Esperanza Trend, and the Argenta Trend. The six deposits in the Navidad Trend are essentially contiguous and include, in a 5.8 km alignment from northwest to southeast, Calcite NW, Calcite Hill, Navidad, Connector Zone, Galena Hill, and Barite Hill. The Valle Esperanza deposit occurs on the east flank of the Esperanza Trend and is found approximately 370 m to the south-southwest of Galena Hill. The Loma de La Plata deposit occurs along the northern portion of the Argenta Trend and lies approximately 2.2 km southwest from the centre of Calcite Hill.

Pan American Silver Corp:

9.1 Calcite NW

A plan of Calcite NW is shown in Figure 9.1. Calcite NW is located stratigraphically in the upper sedimentary package found directly above the latite unit. This package is comprised of mudstone, sandy volcanic tuffs, tuffaceous sandstones, lapilli tuffs, and volcanoclastic intervals. In general the layers with a significant tuffaceous component exhibit a strong argillic alteration.

Mineralisation occurs disseminated in the sediments where it is observed as galena with occasional scarce chalcopyrite. Facies with high permeability, such as the tuffaceous sandstones and volcanic tuffs, are preferentially mineralised. Towards the northwest the mineralisation is characterised by Pb with low Ag and is hosted mainly by tuffs and pyroclastic units. In the central to southwest area of Calcite NW, Ag and Pb mineralisation with low grade Cu and occasional Zn mineralisation are hosted by sandy mudstones and tuffaceous sandstones.

The main mass of mineralisation is located along the axis of the general Navidad Trend. There is a strong stratigraphic control. The wacke and tuffaceous units host the mineralisation within the inter-grain pore space. Mineralisation is interpreted to have been channelled through the migration of hydrothermal fluids between the nearly impermeable mudstone units.

There are two marker units within the deposit. One of these is a green lapilli tuff which is generally only weakly mineralised, and the second marker is generally taken as the base of mineralisation. The green lapilli tuff, between 5 m to 10 m thick, is found near the top of the deposit in a relatively lead-free zone. The second marker, known as the Galena Marker, is approximately 80 cm thick and is comprised of a type of massive dark mudstone with disseminated crystalline and irregular micro-veinlets of galena with high lead values and silver. Lead mineralisation with scarce to absent silver mineralisation is occasionally encountered up to 1 m below these units in a volcanoclastic layer or in a coarse detrital facies.

Mineralisation at Calcite NW takes the form of three long and tabular to slightly synformal bodies. The main body lies from the surface to a depth of 130 m below surface and has an average overburden thickness of approximately 60 m. It has a strike length of 1,825 m towards the northwest, a width between 350 m to 500 m, and a thickness between 10 m and 80 m. The mineralised body plunges gently to the northeast with a dip between 1° to 5°. The base of the main body is normally identified by the Galena Marker.

Towards the south-eastern end of the deposit, a smaller lens lies close to the surface parallel to the main body and about 80 m above it. It has a regular shape 275 m long, up to 250 m wide and between 20 m and 40 m thick.

Another elongated lens of mineralisation lies between 15 m to 50 m below and parallel to the northern end of the main body. The body is 1,000 m long, between 200 m and 350 m wide, and ranges between 10 m and 30 m in thickness.

February 2010

49 of 249

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Figure 9.1 Plan of Calcite NW

9.2 Calcite Hill

A plan of Calcite Hill is shown in Error! Reference source not found.. The mineralisation is hosted principally in the latite with xenoliths unit (lower latite) and occurs upwards for a few metres above the contact with the overlying upper sedimentary or pyroclastic package depending on the sequence. The style of mineralisation is typically banded epithermal vein filling and stockworks in breccias developed in the brittle massive portions of the flow. Where present in the upper sedimentary package, mineralisation occurs as disseminations infilling the primary porosity as well as micro-veinlets that are comprised of argentiferous Pb and Zn sulphides along with interstratified galena.

Gangue mineralisation is comprised of calcite, minor silica, and barite either white in colour or as a caramel-coloured variety that occurs almost exclusively at Calcite Hill although it has been occasionally identified on nearby Navidad Hill. High grade mineralisation is comprised of galena, black sulphides, native silver, and occasional chalcopyrite. The overlying geochemical signature is Ag-Pb with minor Cu.

A zonation of the mineralisation hosted in the latite unit is exhibited in the sequence of the three principal zones which in descending depth order are:

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- An upper zone with principally Pb mineralisation with minor Ag, and minor to absent Cu
- An intermediate zone with high grade Ag mineralisation and proportionally less Pb and moderate Cu
- A lower zone with primarily silica fracture filling, low in sulphides and Ag mineralisation

Similar to the Galena Hill deposit, the mineralisation at Calcite Hill terminates abruptly at the lower contact of the latite unit with the reddish basal sedimentary unit, which exhibits poor to no permeability. An interpretation is that the latite, being confined as well on the upper contact with the mudstones which frequently act as fluid barriers, served as a unit with secondary permeability (in this case due to fracturing) which favoured the migration of mineralising fluids.

On the north flank of Calcite Hill the mineralisation is hosted in volcanoclastic rocks and in the lower portion of the overlying calcareous mudstone unit, and in the contact between the same volcanoclastic unit with the lower latite with xenoliths. The entire sequence exhibits structural disturbance. This is attributed to a possible low-angle fault at the base of the sequence which has underlying it the reddish-coloured volcanoclastic basal unit.

The mineralisation occurs principally as veinlets and as matrix filling in the breccia, at times with silica and iron oxides, with minor galena, copper oxides, and scarce pyrite. The upper sedimentary units as well as the volcanic and volcanoclastic units host Ag, Pb, and scarce Cu and Zn mineralisation.

Mineralisation at Calcite Hill forms an irregular body with a narrow upper portion outcropping towards the western end of Calcite Hill, which merges with a larger mineralised lens. Mineralisation outcrops and extends to a depth of around 250 m below surface. It forms a relatively flat surface 600 m long, ranging from 270 m to 600 m in width. The lower portion of the body has an irregular shape resulting from two nearly separate lenses that merge into one lens having a variable thickness between 150 m to 20 m. The body plunges to the southwest with a -5° dip.

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Figure 9.2 Plan of Calcite Hill

9.3 Navidad Hill

A plan of Navidad Hill is shown in Figure 9.3. The Navidad Hill deposit exhibits two different types of mineralisation and control. The first of these outcrops along the crest of the hill where mineralisation related to structural control is most evidently displayed compared to elsewhere on the Project. Here outcropping vein structures exhibit breccias comprised of finely banded crystalline calcite gangue, barite, and finely crystalline to chalcedonic silica. Visually identifiable ore grade minerals include galena, black sulphides, copper and manganese oxides, and lesser quantities of pyrite, chalcopryrite, and rare native copper and silver.

The high grade brecciated vein structures occur in a belt approximately 100 m in width with discontinuous sub-vertical extensions, striking generally at an oblique angle to the main Navidad Trend in the range of 310° to 345°. Vein thicknesses are 1 m or less with Ag values in the 1,000 g/t to 10,000 g/t range. Vein development discontinuity is also evidenced by “rosario” outcrops along strike and by changes in mineralogical composition along strike as well as at depth. The latite wall rock adjacent to the breccia veins is also found mineralised with the development of veinlets, stockworks, and breccia zones. As indicated so far by drilling, the outcropping breccia veins do not

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extend to a depth exceeding 80 m where the vein integrity tends to break down into a zone of veinlets comprised principally of chalcedonic silica that increases at depth. To date the base of the latite has not been encountered by drilling at Navidad Hill which leaves open the possibility of a dome structure in this area.

The second main type of mineralisation at Navidad Hill is found emplaced on the southwest flank of the hill where it is hosted in and above the contact between the latite unit and an overlying volcanoclastic breccia. It has a well-developed stratigraphic control with a gentle southerly dip of some 20° to 30°. Moving away from the possible dome, the stratiform body changes its composition from a heterolithic latite breccia to a breccia with remobilised sedimentary clasts. This breccia exhibits gangue mineral matrix fillings of calcite, barite, and lesser silica, accompanied by black sulphides, minor galena, copper oxides, and relatively frequent native silver.

A third sub-set of mineralisation is found to the northwest of Navidad Hill where there is found a multi-phase heterolithic breccia with characteristics that indicate an explosive origin. The gangue is principally calcite and barite with ore minerals of galena, possible black sulphides, copper oxides, and contains moderate concentrations of Ag on the order of 100 g/t.

Mineralisation at Navidad Hill trends for 520 m towards the northwest and forms an irregular globular shape ranging from 270 m to 470 m wide and 10 m to 175 m thick. The mineralised zone has a shallow dip to the southwest and lies at the subsurface along the ridge crest to around 50 m depth along the southern flank.

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Figure 9.3 Plan of Navidad Hill

9.4 Connector Zone

A plan and cross section of the Connector Zone is shown in Figure 9.. The mineralisation occurs as disseminations and replacement of the matrix in the volcanoclastic rocks. Locally the volcanoclastic rock is crackle brecciated with a matrix of hydrothermal minerals, sulphides and rare native silver. The volcanoclastic rock can exhibit a wide range of textures ranging from conglomeratic horizons to thinly bedded strata. The volcanoclastic unit contains sub-rounded to very angular clasts of latite derived from the uplift and erosion of the latite lavas. Lesser, and generally lower grade mineralisation can also be hosted in the underlying greywacke and the overlying mudstones.

The Connector Zone is structurally complex. It shares some of the same structural trends found at Galena Hill located immediately to the southeast. At Connector the principal structural trends are:

— North-northeast to south-southwest trending steeply dipping structures that are responsible for radical changes in the stratigraphy across the generalised northwest trending strike of the mineralisation. It is interpreted that displacements along these structures are responsible for changes in thickness of the host volcanoclastic unit of up to 170 m in only 50 m along strike with

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similar changes in thickness in adjoining units. Synchronous erosion is a possible cause of the local removal of both the lower and upper latite lavas that allowed the volcanoclastic and mudstone units to be deposited directly on the lower andesites.

- Northwest to southeast to east-west oriented sub-vertical faulting is interpreted to have followed the deposition of the mudstones and produced a series of horst and graben structures by block faulting similar to those described at Galena Hill. Also similar to Galena Hill are the spatial coincidence of the higher grade values with these structures. It is believed movement on these northwest to southeast structures is synchronous to post-mineral in age.
- The post-mineral, northwest to southeast trending, southwest shallow dipping Sauzal Fault. This structure truncated the host lithologies and mineralisation at Connector Zone in a similar fashion as described at Galena Hill.
- Possible re-activated faulting on the north-northwest to south-southeast trend: Crossing the central portion of the Connector Zone there is some evidence to suggest the presence of a north-northwest to south-southeast trending structural corridor that may have cut and displaced the Sauzal Fault trace.

The mineralisation at Connector forms two intersecting, but distinct bodies, which combined, are 670 m in strike length, and between 240 m and 590 m wide. The mineralisation lies from the surface to a depth of 330 m. The deposits are hosted in a sedimentary sequence comprised of sandstones and fine conglomerates with minor mudstones, interbedded with volcanoclastic layers which are mostly formed by sub-rounded to angular latite fragments derived from the erosion of the latite lavas. Locally the host rocks exhibit micro-veinlets up to 1 cm thick and poorly developed stockwork texture. The intensity of the brecciation is weak to moderate and the gangue infilling is comprised of calcite and silica. Alteration is weak and is manifested by a moderate bleaching of the rock due to the presence of low-temperature illitic-smectitic clays.

Sulphide mineralisation occurs as galena, black and grey presumably Ag-bearing sulphides, as chalcopyrite and bornite disseminated in the sediments, in veinlets, and in replacements in the matrix of the volcanoclastic unit. Native silver is also present in trace amounts.

Of less importance and restricted to the east of the Connector Zone, the mineralisation is hosted by the brittle upper latite and andesite units. Disseminated sulphides occur in

hydrothermal crackle breccias with a matrix of calcite and barite with minor laumontite and silica.

In the upper portion of the volcanoclastic unit the geochemical signature is Ag-Pb with minor Cu, and in the lower portion of the sedimentary units Ag is present with practically no lead.

The geometry of the mineralisation suggests the north-northeast to south-southwest structures could be feeder zones for the ascending hydrothermal fluids. The fluids are postulated to have ascended the steep north-northeast structures, and then preceded up dip along the porous volcanoclastic unit where they are intersected by the west-northwest to east-southeast trending block faults.

February 2010

55 of 249

Pan American Silver Corp:

Figure 9.4 Plan and cross section of Connector Zone

February 2010

56 of 249

Pan American Silver Corp:

9.5 Galena Hill

A plan and cross section of Galena Hill is shown in Figure 9.. Mineralisation at Galena Hill is hosted in a variety of distinct fragmental rock types. These include hyaloclastites at the margins and ends of lava flows and crackle breccias within the massive cores of the flows. Also present are dikes and pipes of hydrothermal breccia. The predominant style of mineralisation is the selective replacement of breccia matrix, or as open space filling. Locally the mineralisation pervasively replaces the matrix of the host lithologies including the mudstones. Where the mudstones are mineralised, they can form massive sulphide-rich stratiform lenses containing galena and marcasite.

The lithology that hosts mineralisation varies within the different portions of the deposit. At the far northwest end of the deposit the mineralisation is primarily hosted within the lower latite with minor mineralisation in the overlaying mudstones and underlying volcanoclastics. Towards the southeast end of the deposit the mineralisation is hosted in both the lower latite unit and the upper latite unit and locally in the overlaying mudstones. To the far southeast end of the deposit all of the mineralisation is contained within the upper latite with only trace mineralisation contained in the overlaying mudstones.

At Galena Hill both the upper and lower latite lavas are believed to have been emplaced as submarine flows. Evidence supporting this interpretation is the lack of thermal

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oxidation, which is common in other zones such as Loma de La Plata, and the abundance of very angular fragmental portions of the latite interpreted to represent in situ the reworked hyaloclastite. These fragmental portions of the lava flows are often the preferred location of mineral deposition.

Galena Hill is structurally complex. It is believed to be located at the vertices of several intersecting structural trends. From the reconstruction of the geology it appears that the earliest faults were syn- to post-mineralisation northwest to southeast block faults. Movement on these structures resulted in the formation of a horst and graben geometry. This movement is post-sedimentation, potentially in part syn-mineralisation and definitely part post-mineralisation. The continued movement of these structures post-mineralisation resulted in the uplift and erosion of part of the mineralisation and the preservation of those parts that were down-dropped.

The northwest to southeast trending block faults are truncated by the shallow dipping, northwest to southeast trending Sauzal Fault. The trace of this fault is coincident with the break in slope along the lower northeast flank of the Navidad Trend. The fault juxtaposes all the upper lithologies and mineralisation against the lower “red bed” volcanoclastics. Movement on this structure is considered post-mineralisation. No evidence has been observed to indicate that this fault served in any way as a channel for the ascending hydrothermal fluids.

The last interpreted faulting at Galena Hill occurred along steeply dipping north-northwest to south-southeast trending structures. These structures form a structural corridor roughly 100 m to 150 m wide that crosses the central portion of the mineralisation. These structures are interpreted from surface mapping, ground magnetic and construction of drill sections. These structures are believed to have off-set the Sauzal Fault plane in places.

Alteration is variable from trace to locally strongly argillic. In general alteration is limited to bleaching of the host volcanic rock in close proximity to the mineralisation.

Sulphide minerals are galena, marcasite, lesser pyrite, scarce chalcopyrite, and occasional bornite. According to a preliminary report by Xstrata Process Support (2007), 85% of the Ag is contained in solid solution within a combination of marcasite and pyrite with 15% in acanthite (Ag₂S). The lead occurs as galena (PbS). The mineralisation appears to all occur as sulphides with little oxidation observed as evidenced by fresh galena occurrences found at surface. Gangue

mineralogy consists chiefly of calcite and barite with lesser silica.

The extent of mineralisation is long and wide with a strike length of roughly 900 m and a width of between 250 m and 700 m. In section views orientated at 030° to 210°, the mineralised body as defined by values approaching 50 g/t AgEQ forms a roughly strataform body with a slight dip to the southwest. This body resembles an inverted shield with a flat top and a thicker central portion that thins to the margins. On nearly every section the mineralisation is affected by post-mineralisation movement on the northwest to southeast trending block faults resulting in displacements of roughly 10 m to 50 m. Those portions of the mineralisation located above the horst are partly eroded whilst those portions to either side are preserved in their entirety. The mineralised zone ranges from a few metres thick at the extreme margins to over 200 m thick in the central portions of the deposit.

Mineralisation outcrops in several locations including the upper northwest flank and within the window through the mudstones in the area of the structural horst. The top

February 2010

58 of 249

Pan American Silver Corp:

of mineralisation ranges from surface to 200 m below surface with an average depth less than 40 m.

There are 12 drill holes in the Galena Hill sector of the Project that are being monitored on a regular basis for determining the level of the water table. Across the area the top of the water table is at approximately 1,137 m elevation, and is indicated on the cross section in Figure 9.. The majority of the Mineral Resource at Galena Hill lies beneath this level.

Figure 9.5 Plan and cross section of Galena Hill

February 2010

59 of 249

Pan American Silver Corp:

Galena Hill cross section on local coordinate 51000E view to 300°

9.6 Barite Hill

A plan of Barite Hill is shown in Figure 9.. At Barite Hill two styles of mineralisation are present in distinct stratigraphic units. The first occurrence from surface to depth is a relatively weak Ag-Pb mineralisation with minor Cu and Zn hosted in calcite and lesser barite gangue filling veinlets and breccia matrix within the upper latite unit.

The second style of mineralisation is found in two clastic units below the upper latite flow that is normally found mineralised at the Navidad Project. The units are a sedimentary unit comprised of sandstone and mudstone, and a volcaniclastic unit derived from latite. Mineralisation is interpreted to have been emplaced through the migration of hydrothermal fluids across zones of primary permeability in the sandstones or through zones of secondary permeability through fracturing. This lithology package is bounded on top by a greywacke unit and underneath by fine-grained clastic sediments (mudstones), both of which are interpreted to have relatively low permeability.

Observed mineralisation occurs as a matrix gangue filling of calcite, barite and clays that contains sparse chalcopryrite, black sulphides, and native silver. It is deposited in fine fractures, stockworks and breccias in the mudstones and volcaniclastic rocks, and occurs as disseminations of black sulphides in the sandstones. In areas reporting high Ag assay values, native silver is very common and occurs as pure veinlet fillings up to

February 2010

60 of 249

Pan American Silver Corp:

5 mm in thickness. The principal geochemical association is Ag with low Cu; in general Pb is scarce.

Mineralisation at Barite Hill forms three lenses. The northern lens is about 230 m long along strike, between 170 m and 430 m wide in the dip direction and between 5 m and 30 m thick. The southwest dip varies between 3° where the body outcrops in the north to 25° in the southwest where the body lies approximately 120 m below surface. The second lens is found towards the southern end of Barite Hill. Its dimensions are approximately 300 m long by 350 m wide with thicknesses ranging from 4 m to 32 m. It occurs at the subsurface on the crest of the ridge and plunges to the southwest.

The third mineralised body, characterised by high Ag values, forms an irregularly shaped mass around 350 m long, between 100 m and 400 m wide, and between 7 m to 100 m thick. It lies between 50 m and 200 m below the second lens in southern Barite Hill and has a dip of 30° to the west-southwest.

Figure 9.6 Plan of Barite Hill

9.7 Loma de La Plata

A plan and cross section for Loma de La Plata is shown in Figure 9.. At Loma de La Plata the stratigraphy consists of basal andesites overlain by greywackes and sandy

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conglomerates that change laterally to mudstones and arkoses. Autoclastic breccias lay between the lower sedimentary sequence and the volcanic flow units comprised by the two latite units, with and without xenoliths, which are separated by an interbedded sedimentary layer. The sequence is completed by mudstones and fine to very fine sandstones that vary to limestones laterally to the east.

In the west to southwest the sedimentary units are thin or missing due to erosion and the lithology is typically comprised by the latites with and without xenoliths that overlay the andesites. Towards the east the sequence is complete due to down-dropped blocks that are the product of normal faulting with an approximate north-south strike presumably resulting from northwest to southeast orientated compression.

The entire sequence has a 325° strike and dips -20° to -30° to the northeast; the dip tends to flatten somewhat along strike to the northwest.

Mineralisation is hosted primarily in the upper latite unit which outcrops in the southwest part of the deposit area and dips towards the northeast where it has been intercepted up to 300 m below the surface. Drilling in 2008 demonstrated that the mineralisation tends to be enriched in breccia zones associated with north-south normal faults that have a spacing on the order of 70 m to 90 m.

The style of mineralisation is characterised by hydrothermal veinlets up to 3 cm thick and tectonic and crackle breccias developed in the brittle massive portions of the lava flow. Gangue mineralisation is comprised of calcite, laumontite, barite and silica present as a white quartz and occasional amethyst. Textures are massive to crustiform and occasionally botryoidal; bladed calcite replacement textures have been observed.

Mineralisation is comprised of acanthite, native silver, argentite, stromeyerite, silver sulphosalts, galena, chalcopryrite and bornite disseminated in the matrix of the breccias and as rims in veinlets. Chalcopryrite is the only mineral that is also disseminated in the host rock. The acanthite and lesser stromeyerite are the principal silver-bearing sulphide minerals that contain approximately 80% of the reported silver. QEMSCAN analyses performed by Xstrata Process Support (2008) report an average Ag grain size in the range of 6 μm to 20 μm .

Geochemical data indicates a good correlation between Ag and Cu and a moderate correlation between Ag and Pb. Arsenic tends to be

concentrated in the upper portion of the main mineralised body in the upper latite as well as in the upper non-mineralised sedimentary package. Antimony is present as isolated occurrences in the upper part of the deposit where it exhibits a low correlation with Ag and Cu. For the most part Zn is concentrated in the sedimentary unit beneath the upper latite where it largely occurs in limestone lenses within the mudstone.

Up to three events of brecciation and veinlet formation have been detected during core logging. The brecciation intensity is moderate to strong in the high grade mineralised zone. Mineralisation is interpreted to have been emplaced by the migration of epithermal fluids through zones of previously formed tectonic and crackle breccias. Alteration is weak and is represented by low temperature clays in the proximity of the mineralisation areas. The alteration clay mineral assemblage indicates the presence of low temperature hydrothermal fluids, and the banded textures, bladed calcite, barite and quartz in-fill, along with the presence of abundant base metals, is characteristic of an intermediate low-sulphidation system.

Two distinct mineralised bodies are present at Loma de La Plata. The main deposit is 850 m long with a north-south strike, between 600 m to 1,200 m wide and 40 m to 50 m thick. It covers a surface area of 74 ha. The second body is considerably lower in

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grade and is located approximately 60 m beneath the main deposit. It has approximately the same surface area as the upper main body but with an average thickness of only 5 m.

The area with the highest grade mineralisation is located in the central and western side of the upper Loma de La Plata deposit; overburden thickness varies from 0 m to 50 m. The dimensions of the high grade zone are 500 m north-south by 170 m east-west.

The principal objectives of the 2008 drilling programme at Loma de La Plata were to upgrade the Inferred resources to Indicated and to define the limits of potential economic mineralisation. Concerning this latter objective, the deposit was defined in the western and southern sectors, where the outcropping andesite forms a footwall to the deposit, without appreciable change in the 2007 resource perimeter. Here the outcropping mineralised upper latite exhibits crackle breccias that are hydrothermally in-filled by calcite with the presence of malachite, azurite and iron oxides.

To the southeast of the deposit the latite lava flow continues towards the Bajo del Plomo area but with greatly diminished Ag and relatively high Pb values. To the east the deposit was expanded by some 400 m where the mineralised portion of the latite becomes progressively thinner with diminishing Ag values and higher lead. Towards the northeast drilling has confirmed that the deposit is cut off by the Esperanza Fault. Towards the north the 2007 perimeter was expanded 200 m where generally no further significant Ag mineralisation has been encountered despite the presence of the host unit.

In summary, the total mineralised footprint has been increased by 100% with respect to the area defined in 2007. The deposit still has limited potential to expand towards the northwest where the latite as well as the mineralisation continues to Valle La Plata sector, and there remain some restricted possibilities for expansion to the east-southeast.

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Figure 9.7 Plan and oblique cross section of Loma de La Plata

February 2010

64 of 249

Pan American Silver Corp:

Oblique southwest-northeast cross section of Loma de La Plata

9.8 Valle Esperanza

A plan and cross section of Valle Esperanza is shown in Figure 9.8. At Valle Esperanza the main mineralised deposit is emplaced in the upper latite volcanic unit without xenoliths immediately below the contact with the upper carbon-rich sedimentary package comprised of mudstone, sandstone, and greywacke. The latite varies from massive to autobrecciated in the flow top depending on the number of lava flows. The unit is brecciated with a matrix of calcite, with minor laumontite, barite and silica that are present as massive in-filling, sometimes as banded textures. In the brittle massive portions of the flows, the breccias occur as tectonic or crackle breccias that were hydrothermally in-filled. In the autobrecciated zones with abundant amygdaloids, the hydrothermal fluids used the primary porosity in the contacts between fragments to generate the breccia. The intensity of brecciation is moderate and at least two events of brecciation are recognised.

Of less importance, a lower grade mineralisation is hosted in the underlying lower latite with xenoliths that is below the upper latite and overlain by another sedimentary package comprised of mudstones, greywacke and volcaniclastic rocks.

Alteration is weak to locally strongly argillic in breccias. In general alteration is limited to a gentle bleaching of the host volcanic rock in close proximity to the mineralisation.

February 2010

65 of 249

Pan American Silver Corp:

The predominate style of mineralisation is the disseminated occurrence of black sulphides, native silver, chalcopyrite, malachite, pyrite and galena in the breccia matrix and in veinlets up to 1 cm thick. Locally the mineralisation of chalcopyrite and galena pervasively replaces both the matrix and the host lithologies. The silver shows a very good correlation with copper and low correlation with lead.

QEMSCAN analyses of the float concentrate performed by G&T (2009) determined that almost 90 percent of the silver occurs as acanthite/argentite and about 2% occurs as native silver and alloy.

The same volcanic rocks are exposed at surface along both the Esperanza and Navidad Trends. Valle Esperanza is located in a graben structure and the variation in elevation of the latite is the result of block faulting. The mineralisation has been preserved on the down-dropped blocks.

The graben adjoins the northwest-southeast trending Esperanza Fault that has been interpreted from ground magnetic, surface mapping and drill sections. At Valle Esperanza, there are no outcrops or surface evidence of mineralisation. No evidence has been observed to indicate that the Esperanza Fault served as a channel for the ascending hydrothermal fluids.

Drillhole intersections have traced the two mineralised zones from surface to approximately 400 m below surface. The upper body is about 1,100 m long and between 130 m and 700 m wide. The lower body lies approximately 50 m below the upper deposit, and is 800 m long and between 140 m and 500 m wide. Both bodies range in thickness between 5 m to 30 m.

The mineralised horizon strikes approximately to 290° with a variable northeast dip between -70° to -10°. The dip appears to flatten towards the northeast.

The Valle Esperanza deposit is not fully defined as yet and future work will include drilling along strike to the north-west and south-east and down dip to the north of the presently defined deposit.

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Figure 9.8 Plan and cross section of Valle Esperanza

February 2010

67 of 249

Pan American Silver Corp:

9.9 Additional prospects

9.9.1 Navidad Trend

Marcasite Hill

The Marcasite Hill prospect occurs along the southern extension of the Navidad Trend approximately 1 km southeast of Barite Hill; it was originally identified and drill tested during 2007 based on a strong induced polarisation (IP) and resistivity anomaly. The stratigraphic setting is similar to Barite Hill, but with a thickening of the pelitic sediments below the latite. Structural complexity and widespread fracturing is attributed to a northwest trending regional fault that passes to the east of the hill.

9.9.2 Argenta Trend

The Sector Z, Bajo del Plomo, Filo del Plomo, Ginger, and Yanquetru zones are located along the northwest trending contact between the latite and the overlying upper sedimentary package in the Argenta Trend. Mineralisation is characterised by veinlets and discontinuous breccias in the latite with open-space fillings of calcite, minor barite, and locally important quantities of galena with moderate accompanying Ag.

To date limited drilling has been done at Ginger and at Bajo del Plomo. In the latter area Pb values appear to diminish rapidly at depth below outcrop, suggesting the

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development of near-surface supergene enrichment. At Ginger, where only one drillhole has been completed, low values in Pb and Ag have been detected in brecciated portions of the latite which may occur only as a lens in this area. At Sector Z, which occurs approximately 2 km to the northwest of Loma de La Plata, copper oxides are observed with only minor Pb present in samples; the geochemical association suggests Ag-Cu. Greater structural complexity, as observed though faulting and folding, is indicated in the Sector Z area.

February 2010

69 of 249

Pan American Silver Corp:

10 Exploration

Information in this section has been sourced from Snowden (2009), which was excerpted and updated from Williams (2007).

10.1

Exploration by Normandy Mining in 2002

The first exploration programme on the Navidad Project area consisted of a preliminary regional geochemical sampling programme conducted by Normandy in mid 2000 to locate additional deposits to supplement those known at its Calcatreu Project, a gold and silver deposit located approximately 90 km from Navidad. The programme consisted of 1,200 BLEG stream sediment samples taken from drainage systems overlying Jurassic age volcanic rocks in Chubut Province in the general vicinity of Calcatreu, Mina Angela, Gastre, Lagunita Salada, Gan Gan, and other areas. This programme took place on what was then considered open exploration ground, and resulted in the identification of various anomalies, including the Flamingo Prospect and Sacanana, which is today known as Navidad.

10.2

Exploration by IMA from December 2002 to July 2006

10.2.1 Geological mapping and topographical surveys

IMA commenced the initial detailed outcrop mapping of the Navidad Project along the Navidad Trend in 2003 at both 1:500 and 1:5,000 map scales. During 2004 this mapping was expanded to cover a wider portion of the mineral tenement at 1:5,000 and 1:10,000 map scales.

In 2003 IMA produced a 2 m contour map over the central portion of the Navidad Project using a differential GPS. The coverage of this topography is 2.5 km by 4.5 km. Outside this core zone 10 m contour lines were produced from satellite radar data. In 2004 IMA commissioned high resolution air photo coverage of the Navidad Project area. These photos were used to produce an orthophoto of the Project area and to create 2 m contour lines covering an area of 14.4 km by 5.5 km.

10.2.2 Geophysical exploration

In 2003 IMA contracted Proingeo S.A. to conduct a limited ground gravimetric survey over Galena Hill, Connector Zone and the southeast part of Navidad Hill. The survey consisted of ten lines of roughly 2 km each at 200 m line spacing.

In 2005 IMA commissioned Quantec Geoscience Argentina S.A. (Quantec) to conduct pole-dipole and gradient array IP and ground magnetometer surveys over the Navidad Trend. These surveys covered roughly an area of 6.9 km by 4.6 km. A large open spaced survey of IP covered strike extensions of the main trend for a total coverage of 14.4 km by 5.5 km. The data from these surveys was reprocessed in 2007 by Aquiline. The results of these surveys were mixed, probably in great part due to the distinct physical characteristics of the various deposits and their varying degree of oxidation.

10.2.3 Geochemical exploration

Commencing in 2002 and continuing through 2006, IMA collected soil, rock chip and stream silt samples over the Navidad Project. A total of 1,852 rock, 6,411 soil and 63 stream sediment geochemical samples are listed in the IMA database spatially related to the Project area. This work led to the identification of nearly all mineralised bedrock exposures known on the Property. The best example of soil geochemistry leading to the

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identification of a mineralised zone is that of Loma de La Plata. Collectively the anomalous rock chip samples clearly delineate the Navidad, Esperanza and Argenta trends as does the soil geochemistry.

10.2.4 Diamond drilling

A list of the drillholes completed by IMA between November 2003 and July 2006 is shown in Table 10.1.

Table 10.1 Diamond drillholes completed by IMA from 2003 to 2006

Deposit	Number of drillholes	Metres drilled
Calcite NW	45	7,788
Calcite Hill	71	13,949
Navidad Hill	96	11,289
Connector Zone	37	4,712
Galena Hill	66	12,862
Barite Hill	8	1,315
Loma de La Plata	12	1,615
Exploration drillholes elsewhere on the Property	32	7,391
Total	367	60,921

10.2.5 Other work

Metallurgical samples were also collected during IMA's second field season running from November 2003 to March 2004, the results of this test work is summarised in Section 16.

In 2005 Peter Lewis, a consulting structural geologist, studied the Project area including the Esperanza and Navidad trends. He concluded the Esperanza Fault formed part of the larger Gastre Fault system and was active at the time of mineralisation. He postulated that there could be a splay to this fault that was as yet unrecognised coincident with the Navidad Trend and that mineralisation was related to dilatational zones formed by dextral strike-slip movement on these northwest-southeast structures. He further concluded that post mineral tectonic activity resulted in deformation of the host rock units. This manifested in the formation of folds and southwest dipping thrust faulting.

10.2.6 Mineral Resource estimates

In February 2006 and updated in May 2006, Snowden prepared Mineral Resource estimates for IMA on the Navidad Project deposits including Calcite NW, Calcite Hill, Navidad Hill, Connector Zone, and Galena Hill (Snowden, 2006a). In September 2006, Snowden prepared an updated Mineral Resource estimate and drill spacing study at Galena Hill for IMA (Snowden, 2006b).

10.3 Exploration by Aquiline from October 2006 to June 2009

The Qualified Person for exploration at the Navidad Project is Mr. John J. Chulick, who is a registered geologist in the State of California.

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Aquiline focussed exploration efforts on identifying new exploration targets with diamond drilling, with delineation and infill drilling at the Loma de La Plata deposit, and with minor infill drilling of other previously identified mineralised zones. Exploration for additional deposits through the use of fence drilling across prospective covered areas is feasible, since as is so far known, the occurrence of the latite unit hosting mineralisation is generally of relatively large areal extent that can be measured in units of tens of hectares. Mineralisation is frequently stratiform with relatively shallow dips, and most of the known deposits occur as large roughly tabular bodies.

Geophysical and geochemical methods have proved useful in mapping the distribution of the latite unit and potassic-style alteration, in detecting Galena Hill style sulphide-rich mineralisation, and in interpreting the Project-scale structural regime. The characteristics of the host rock and wall rock units are favourable for diamond drilling, and extensive areas can be rapidly explored by drilling at relatively low cost. As was demonstrated during the 2007 diamond drilling programme, additional Resources can be delineated by extension drilling laterally away from known deposit areas.

10.3.1 Diamond drilling

A list of the drillholes completed by Aquiline from November 2006 to March 2009 is shown in Table 10.2. A plan of the drillholes completed at the Navidad Project at the time of the April 2009 Mineral Resource estimate is shown in Figure 10.1.

Table 10.2 Diamond drillholes completed by Aquiline from 2006 to March 2009

Deposit	Number of drillholes	Metres drilled
Calcite NW	68	9,144
Calcite Hill	10	1,024
Navidad Hill	8	909
		110

Connector Zone	36	6,994
Galena Hill	26	4,359
Barite Hill	48	11,518
Loma de La Plata	226	46,867
Valle Esperanza	53	20,399
Bajo and Filo del Plomo	22	2,798
Marcasite Hill	14	2,616
Exploration holes elsewhere on the Property	47	12,715
Condemnation holes for tailing dam	25	8,617
Total	583	127,960

February 2010

72 of 249

Pan American Silver Corp:

Figure 10.1 Plan of drillholes completed at the Navidad Project

10.3.2 Geophysical exploration

Gravity and resistivity geophysical techniques may be valuable tools to map the distribution of the latite unit in the sub-surface or beneath covered areas. IP is an effective geophysical method to detect Galena Hill style sulphide-rich mineralisation even to a considerable depth below the surface. Ground magnetic, and by inference, aeromagnetic geophysical data is seen by staff geologists as an effective technique to aid in the interpretation of the Project-scale structural regime.

Structural interpretation will aid in understanding the distribution of the latite unit as affected by half-graben type faulting and possible thrust fault displacements.

Gravity surveys

Between March and May 2007 Quantec conducted a gravimetric survey over an area measuring approximately 10 km by 8.5 km in the area referred to as the core Navidad Project area. Measurements were recorded at 150 m stations along 82 parallel lines trending 030° located at 200 m intervals. A total of 2,998 grid stations were read in the survey area. Station locations were surveyed with a differential global positioning system (DGPS), ensuring accuracies of ± 5 cm. The objective of the survey was to map out

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density variations that potentially coincide with mineralisation and to provide data for structural interpretation.

Raw data for this survey has been interpreted by geophysical consultant Robert Ellis who has produced a residual Bouguer gravity model over the tested area. In this model the earlier acquired Proingeo data (2003) demonstrates a gravity high in the area of Galena Hill. Other gravity anomalies within the survey area remain to be tested by drilling.

Ground TEM survey

Between January and February 2007 Quantec ran a transient electromagnetic (TEM) survey on three test lines. The tests were performed to determine if a recognisable TEM response could be observed across areas of known mineralisation and in particular across massive sulphide mineralisation beneath Galena Hill. Each line was surveyed with transmitter 200 m by 200 m loops advanced at 50 m intervals, and then repeated with 100 m by 100 m loops advanced at 25 m intervals. The reading instrument was a Zonge GDP-16 receiver. Results were “flat” and no meaningful TEM response was detected.

Ground SP survey

A self-potential (SP) test was carried out during the same period as the TEM survey. The purpose of the SP test was to map naturally occurring voltage patterns produced by the oxidation of sulphides. Three 4,200 m test lines were selected to transverse known mineralised areas. Three averaged measurements were taken at 25 m intervals along the test lines. Results were considered to be too ambiguous to justify continuing with this method as a geophysical prospecting technique at Navidad.

Ground radiometric surveys

Ground radiometric testing was done with an Exploranium Gamma Ray Spectrometer GR 256 during the same period as the TEM survey and across the same three lines used for the SP test. The purpose was to determine if alteration related to mineral occurrence, particularly the introduction of potassium in the form of adularia, gives a coherent radiometric signature. Thirty-second measurements were taken at 25 m intervals on the test lines. Results for potassium were considered to be sufficiently correlative with areas of known mineralisation to justify radiometric measurements in the fixed-wing geophysical survey conducted in 2008.

Fixed-wing magnetometer and radiometric surveys

In 2008 a 9,700 line-km fixed-wing geophysical survey collected magnetic and radiometric data over 1,935 km² of selected Aquiline controlled mineral tenements in Chubut province. The survey was flown using 200 m line spacing and 2 km tie-lines spacing. The survey consisted of a northern and southern block. The northern block covered 1,670 km² and was designed to include all of the Cañadón Asfalto Formation on strike with the Navidad Project. The southern survey block covered 265 km² including a basin containing Cañadón Asfalto Formation sediments. These surveys are helping build ongoing regional exploration activities.

High resolution ground magnetometer surveys

During the last quarter of 2008 a 2,153 line-km high definition ground magnetometer survey was conducted over the entire Navidad Project area. The survey covered a surface area of 10,750 ha. Five roving magnetometers on 50 m line spacing were used to collect readings at one second intervals. Line orientation of the main survey was 030°. Two smaller surveys using 300° line orientations were conducted over the Navidad

February 2010

74 of 249

Pan American Silver Corp:

Trend and Loma de La Plata. Combined these surveys greatly aided in the definition of boundaries of magnetic rock units and identify structures that juxtapose rocks of different magnetic susceptibilities.

Ground 200 m dipole and CSAMT surveys

During 2008 seven test lines for a total of 53 line-km of deep looking IP and CSAMT were conducted by Quantec over the Navidad Project area. The objective of these surveys was to provide information from depth for both the extension of mineralisation and to better understand the structural architecture of the geology.

10.3.3 Geochemical exploration

A series of orientation geochemical surveys were conducted by Aquiline over known mineralised zones on the Navidad Project in early 2007. These included soil, stream silt and biogeochemical surveys. As a result new sampling protocols were established that markedly improved the geochemical response in both ore and path finder elements. The biogeochemical study provided distinct and complementary information to that of the soil geochemistry. This has led to the protocol of collecting twin biogeochemistry and soil geochemistry samples. The greater sensitivity of the new sampling protocols has allowed the initial phase of sampling to utilise a wider spacing on grids while maintaining good line to line correlation.

From the end of 2007 and into 2008 a large combined soil and biogeochemical survey was conducted over the Navidad Project area and the projected on-strike extensions of the zone under Quaternary cover. A total of 3,316 soil and 4,297 biogeochemical samples were collected. Results of the surveys have identified new zones of precious and path finder base metals that are being followed up by reconnaissance drill programs. The geochemical data is also being incorporated into the environmental base line studies.

10.3.4 Geological mapping

Beginning at the end of 2007 Aquiline geologists have conducted a programme of re-mapping and expanding the coverage of geologic mapping of the Navidad district. Currently 240 km² are mapped covering the entire Navidad Project and surrounding area. The main objective of this work is to improve the geological understanding of the geology and

controls to mineralisation. This is being done by refining the Project stratigraphy and establishing the location, relative sense of movement and timing of the complex structural elements. This work has led to an updated deposit model as discussed in detail under Section 8 of this report.

10.3.5 Mineral Resource estimates

In November 2007, Snowden prepared an updated Mineral Resource estimate for Aquiline for the Barite Hill, Galena Hill, Connector Zone, Navidad Hill, Calcite Hill, Calcite NW, and Loma de La Plata deposits. The November 2007 Mineral Resource estimates have been superseded by the April 2009 estimate.

10.3.6 Future exploration work

Continued exploration in the company's land package in the Navidad district will be directed towards additional Jurassic-age basins in the Gastre structural corridor with Cañadón Asfalto lithologies. Geochemical sampling techniques should be effective tools to efficiently explore these basins. The distribution of associated potassic-style alteration such as adularia within the regional basins may be detected through the interpretation of the 2008 airborne radiometric survey.

Pan American Silver Corp:

Approximately US\$500,000 was expended per month in Argentina on the exploration programme and related activities for the Navidad Property in 2009. Pan American will continue exploration drilling on several open or new targets along the mineralised trends. Infill drilling is planned for Loma de la Plata, Valle Esperanza, Barite Hill, and Galena Hill during 2010. These drillholes will also provide new samples for metallurgical analysis. Additional condemnation and geotechnical drilling is planned for potential future infrastructure sites.

February 2010

76 of 249

Pan American Silver Corp:

11 Drilling

Information in this section has been sourced from Snowden (2009), which was excerpted and updated from Kain (2007). The Qualified Person for drilling at the Navidad Project is Mr. John J. Chulick.

11.1 Diamond drilling methods

All diamond drilling on the Navidad Project since the first drillhole in November 2003 has been completed by Boart Longyear Connors Argentina S.A. of Mendoza, Argentina (subsequently taken over by Boart Longyear in 2007). One rig is employed on a discontinuous basis and is capable of drilling deeper than 400 m with HQ sized rods. Nearly all holes have been drilled at HQ3 diameter (61 mm) with 3 m long rods, except for rare instances where the drillhole was collared at HQ size diameter and subsequently reduced to NQ diameter down the drillhole. No liners or split-tube core barrels have been used in the drilling process. Frequently used drilling additives include Polyplus, Platinum Lube, and G-Stop. Common rod grease may be used for exceptionally deep holes. Drilling conditions are very good with drilling rates of approximately 120 m per day per machine. During 2008, up to three additional drill rigs operated on the Project: one continued with exploration drilling; the other two rigs were dedicated to a programme of in-fill and extensional drilling and orientated-core drilling in support of a geotechnical study of the Loma de La Plata deposit. One of the Loma de La Plata drill rigs was swapped for a period of time with a rig capable of drilling PQ3 diameter (83 mm) drill core for metallurgical sampling. The holes for metallurgical sampling doubled as in-fill drillholes. Split-tube core barrels were used during the orientated core drilling of Loma de La Plata for geotechnical analysis.

11.2 Drillhole collar surveys

Staff geologists set up drill collars in the field by locating the planned collar coordinates with a GPS unit or occasionally by tape measure from a nearby drillhole. The geologist aligns the azimuth of the rig by setting out a row of stakes oriented on the desired azimuth, frequently 030°, with a Brunton compass. The edge of the drill rig, such as the Nodwell track or the outer wall of the mounted housing unit, is aligned with the stakes.

Drillhole inclination is set by placing the inclinometer of the Brunton compass directly on the drill rod.

After drilling the hole, collar coordinates are periodically surveyed by a professional contract surveyor using total station methods or more recently with a differential GPS. The survey point of reference is a federal government geocentric reference frame (POSGAR) point. Coordinates are expressed in the Gauss Kruger Zone II system, relative to the Campo Inchauspe datum. Drillhole azimuths at the Navidad Project have historically used a magnetic declination correction of 08°E, but beginning in 2009 drillholes from number NV-949 onwards will use an updated correction of 06.5°E.

11.3 Downhole surveys

A number of different instruments have been employed at the Project to define the drillhole trace down the hole (Table 11.1). Aquiline previously used a system of taking downhole surveys either halfway downhole, or every third of the hole, or every quarter of the hole, depending on hole length. In October 2008 Aquiline implemented a system of standardising downhole surveys every 50 m, and beginning in 2009, in deposits

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where resources have previously been estimated, downhole readings are now taken at 30 m intervals. Currently no downhole survey of the bearing and dip is taken at the collar, but the first measurement is now taken not lower than 10 m below the drill collar. No surveys are taken of vertical holes. Snowden recommends that Pan American survey all drill holes regardless of their orientation with the first measurement taken at the collar of the hole.

The average distance between downhole surveys is 84 m between surveys, with a maximum distance of 232 m. Beginning with drillhole 616, survey measurements have averaged 52 m between readings. No serious drillhole deviation problems have been encountered in the drilling to date. Azimuth swing between downhole surveys ranges between 0° and 10°, with lifts of between 0° and 3°.

Table 11.1 Downhole survey methods at the Navidad Project

Date	Drillhole numbers	Method
November 2003 to June 2004	1 to 72	Tropari
July 2004 to April 2007	73 to 445	Sperry Sun
April 2007 to present	446 onwards	Reflex EZ-shot

11.4 Drill intercepts

Drill intercepts are given for prospects at the Navidad Project which are not included as part of the 2009 Mineral Resources.

11.4.1 Southern Argenta Trend (Yanquetru)

Several holes were drilled in the Yanquetru area to test at depth the Pb mineralisation observed in soil anomalies. Drillhole NV07-409 intersected a zone within the sediments from 106.3 m to 166.3 m that averaged 0.5% Zn over 57 m. From 187.3 m to 193.3 m, the drillhole intercepted 6 m averaging 21 g/t Ag and 0.2% Pb in the rhythmically

bedded turbidite-like greywacke below a 7 m thick horizon of latite. This mineralisation is interpreted to represent a lower grade, relatively zinc-rich distal zone of mineralisation lateral to the higher grade core deposits.

11.4.2 Marcasite Hill

Marcasite Hill is located at the southeast end of the Navidad Trend as it is presently known, approximately 1 km to the southeast of Barite Hill. It initially attracted attention due to a sharp IP response, and outcrop examination revealed veinlets and breccia with calcite, galena, and marcasite mineralisation, hosted in the upper latite unit. To date Marcasite Hill has been tested by 14 drill holes, NV07-435 through NV07-600, which are located in an irregular area of approximately 850 m by 450 m though the majority of the holes have been drilled in an area measuring 300 m by 200 m.

Beneath the latite, sedimentary units are encountered comprised principally by mudstone and lesser sandstones and sandy conglomerates that are similarly mineralised by calcite, galena, and marcasite/pyrite occurring in breccia and veinlets. The most noteworthy hole drilled in this sequence is NV07-596 with an intercept of 104 m at 0.42% Pb, 0.55% Zn, and low grade anomalies in Ag to 12 g/t with an average of 3 g/t Ag.

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11.4.3 Bajo del Plomo and Filo del Plomo

To date 20 holes have been drilled in the Bajo del Plomo and Filo del Plomo prospects along the Argenta Trend for a strike length of 1,400 m and down dip from the crest for approximately 400 m. It is believed that the total down-dip extension could be on the order of 600 m or more based on the continuation of this mineralisation in the so-called Tailings Dam area. The mineralisation is hosted in the upper latite, with an attitude of azimuth 315° dipping 20° northeast, and along the contact with the overlying sedimentary units where these are preserved. The mineralisation in the latite unit is found as irregular breccia fillings or in veinlets and typically consists of calcite, galena, and lesser barite. In general analytical results report high lead values with low silver. The most significant intercepts are found in hole NV07-486 for 13.15 m at 97 g/t Ag and 7.10% Pb, hole NV07-494 for 12.5 m at 72 g/t Ag and 1.30% Pb, and in hole NV07-644 for 13.4 m at 40 g/t Ag and 2.53% Pb.

11.4.4 Tailings Dam

In this area 26 holes were completed to evaluate the area proposed in the Preliminary Economic Assessment study as a site for a future tailings dam, hence this was in large measure a condemnation drilling programme. The holes were typically drilled to a depth of 300 m. They frequently terminated in mudstone, but several holes managed to intercept the upper latite unit which in several cases reported mineralisation of the style encountered at Filo del Plomo. The most noteworthy intercepts were found in hole NV08-695 for 4.80 m at 25 g/t Ag and 2.70% Pb, hole NV08-796 for 9.0m at 18 g/t Ag and 1.18% Pb, and in hole NV08-842 for 22.0 m at 32 g/t Ag and 0.63% Pb, with values up to 149 g/t Ag.

11.4.5 Sector Z and Valle La Plata

Sector Z is a hilly and structurally complex area at the northwest extreme of the Argenta Trend; to date it has been tested with 11 drill holes in two sub-areas. At Valle La Plata, between the Loma de La Plata deposit and Sector Z, seven holes have been drilled with generally wide spacing of 200 m to 300 m between collars. To date neither zone has demonstrated continuous significant mineralisation though several individual intercepts have been noteworthy. The most significant intercepts in Sector Z include hole NV08-670 for 14.70 m at 73 g/t Ag and 0.34% Pb, hole NV08-742 for 10.97m at 47 g/t Ag and 0.24% Pb.

The majority of the holes drilled in the Valle La Plata zone have cut short intervals with anomalous to moderately significant Ag

mineralisation in the upper latite unit. The most noteworthy intercepts include hole NV08-751 for 6.82 m at 105 g/t Ag and 0% Pb and hole NV08-760 for 4.0 m at 80 g/t Ag and 0% Pb.

February 2010

79 of 249

Pan American Silver Corp:

12 Sampling method and approach

The sampling method at the Navidad Project has followed similar protocols for the life of the Project. The Qualified Person for the sampling method and approach at the Navidad Project is Mr. John. J. Chulick.

12.1 Core logging

Aquiline followed the same sampling methodology for diamond drill core sampling at Navidad since acquiring the Project from IMA, with a few refinements. Approximately five staff geologists are responsible for logging drill core, which takes place at the core logging facilities in Gastre. Drill core from NV07-459 onwards are stored in Gastre, along with core selected as representative of each deposit (NV05-241 to NV05-245, NV06-278, NV06-324, NV06-343, NV06-363, NV06-372, NV06-379, NV06-403, NV07-442, and NV07-449). Drill core up to NV07-458 is stored in Gan Gan, except the representative drillholes stored in Gastre.

Drill core is stored and well maintained in wooden core boxes with a nominal capacity of approximately 3 m. The drillhole number, box number, and downhole interval are marked in felt tip marker on the side of the box. Wooden downhole core depth markers are placed in the core box by the driller indicating the drillhole number and end of run depth.

Staff geologists log the drill core in detail using standardised logging sheets on handheld computers for: lithology; alteration type, style, and intensity; mineralisation type, style, and intensity; and structural information. The entire drillhole is photographed prior to cutting. Geotechnical information including drill core recovery, RQD, weathering, texture, fracture frequency, type, roughness, infill, shape and angle, hardness, and other notes are recorded on a drill-run basis.

12.2 Sampling

Samples are taken continuously downhole within the prospective lithologies, along geological boundaries rather than by a pre-determined length, which represents best practice. Samples within geological similar units are selected at 3 m intervals. Samples are marked for cutting by indicating the sample interval with a yellow paint marker and stapling a waterproof sample number tag on the core box. The drill core is

cut in half with a diamond bladed core saw, using recycled water decanted from a settling tank. There is evidence that core samples are not always cleaned subsequent to cutting.

Wherever the drill core is too broken for cutting, samples are selected by hand or with a spatula, and very rarely a mechanical splitter is used for core intervals too small for cutting with the saw.

Samples are collected by staff, placed into a previously numbered plastic bag along with a waterproof sample number tag indicating the sample depth interval and the sample number corresponding to the tag stapled to the core box. The plastic sample bag and tag are then sealed with a tamper-proof plastic tie embossed with the sample number.

Several sample bags are then placed into larger poly-woven plastic bags, weighed, and transported to the Alex Stewart Mendoza sample preparation facility by drivers from the Gastre community or by staff.

The remaining drill core is stored under cover at Pan American's core storage facilities in Gastre and Gan Gan.

Pan American Silver Corp:

12.3 Density determinations

Density determinations are made on a box by box basis for the entire drillhole. Technicians record the downhole interval marked on the box and the length of the sample contained within the box to obtain the recovery percentage. The volume of the sample is calculated by multiplying the core diameter (6.1 cm) by the recovered core length. The density is then calculated by weighing the core box, subtracting the weight of the wooden core box (previously set at 3,580 g, but now set at the average weight of each new shipment of boxes), and dividing by the volume of the recovered sample. Boxes with more than 15% core loss are excluded from the database.

There are a number of potential sources of error when determining density values using this method, including the accuracy of the scale in use, the accuracy of the drill core recovery estimation, using a set weight for a wooden core box, and the crossing of lithological and/or mineralisation boundaries within the core box. Snowden (2007) made recommendations for more reliable methods for determining density values.

Since October 2008 drillholes numbered NV08-876 and above have had their density determined using the water displacement method, in addition to the box method. Older drillholes under examination have also had density determinations made using the water displacement method. An approximately 20 cm long piece of competent core is selected, quartered with a saw, washed, and dried on a hot plate for between five and ten minutes. The weight of the dry sample is recorded, and the sample is suspended on a length of string and completely submerged into a 1,000 ml capacity cylinder containing 600 ml of water. The displaced water volume is recorded, and the density is calculated by dividing the volume of the displaced water by the weight of the dry sample.

Snowden considers that this methodology may also introduce error in the density determination due to the relatively small size of the sample and the potential introduction of water in porous samples. Snowden recommends that Pan American select whole core samples and coat the entire sample with wax or varnish to prevent the sample from retaining water.

12.4 Independent statement on sampling methods

Snowden are of the opinion that drillhole logging and sampling procedures used by Pan American could conform to standard industry practice by following the recommendations outlined in Section 12.5.

Snowden was not able to verify historical drilling and sampling practices.

12.5 Recommendations

Snowden recommends the implementation of the following practices to improve the quality of the sampling data:

- Determine the density of drill core prior to splitting with the diamond saw. Samples should be coated to prevent water retention. Specific gravity samples should be selected according to a representative suite of lithologies, mineralisation, and alteration types, through spatially representative locations throughout the area covered by drilling.
- Discontinue the practice of using recycled water during core cutting and rinse the cut samples prior to sampling, to prevent the risk of cross-contamination.

February 2010

81 of 249

Pan American Silver Corp:

13 Sample preparation, analyses, and security

Information in this section has been sourced from Snowden (2009).

The Qualified Person for the sample preparation, analyses, and security at the Navidad Project is Mr. John J. Chulick.

13.1 Sample preparation, analyses, and security

13.1.1 Laboratory

All diamond drill core samples at the Navidad Project have been analysed by Alex Stewart Assayers Argentina S.A. (Alex Stewart) of Mendoza, Argentina. Alex Stewart is ISO 9001:2000 accredited for the preparation and chemical analysis of mining exploration samples. On two separate occasions in 2003 and 2007, Smee and Associates conducted a laboratory inspection and considered the laboratory to conform to industry best practice methods for analysis (Smee, 2003 and Smee, 2007).

13.1.2 Sample preparation

Upon receipt of the sample submission, each sample bag is weighed and the entire sample is removed from the bag and placed in a drying pan. Samples are dried at 70°C for up to 40 hours.

After drying, the entire sample is removed from the drying pan and jaw crushed to #10 mesh to reduce its fragment size so that 95% of the sample is less than 2 mm in size (which is monitored by subsequent screen tests). The entire sample is passed through a riffle splitter several times before a final split of 1.2 kg is collected.

At this point a 1.2 kg duplicate of the coarse reject is collected randomly from each analytical batch. This coarse reject duplicate is subsequently re-numbered as the original sample number with the suffix "DC" and then treated as a normal sample. The residual coarse reject is stored.

The sample is then pulverised ensuring that at least 80% of the material is less than 75 µm in size (80% passing through #200 mesh, also monitored by screen tests). A representative 250 g split of the sample pulp is taken as the sample and pulp

duplicates are routinely collected by the laboratory and assayed as part of their analytical quality control measures. The remaining pulp reject (approximately 950 g) is stored for future reference.

The crusher and pulveriser are cleaned with barren quartz between each sample.

13.1.3 Sample analyses

All drill core samples at the Navidad Project have been analysed by fire assay for silver with gravimetric finish and gold for AAS finish and ICP-ES for 19 elements using the ICP ORE technique.

For Ag fire assay, a 30 g charge is fused with 230 g of flux in a furnace with temperature control at 1,050°C to produce lead buttons with a weight of at least 30 g. The lead buttons are weighed and any sample with a button less than 30 g is repeated. The cupellation of the lead buttons occurs in a furnace with temperature control at 950°C. Two standards of pure metallic silver are included in each cupellation batch to quantify the Ag loss during the process. The prills are weighed in a microbalance and Ag dissolved with HNO₃ and Au with Aqua Regia.

Pan American Silver Corp:

Gold content is determined by AAS and the silver value is calculated as the difference between the weight of the AAS Au and Ag. The final Ag value considers Ag lost by cupellation and adds Ag based on the two metallic silver standards. Silver detection limits are 2 g/t Ag and occasionally 1 g/t Ag.

In addition, all samples are also analysed by the ICP-ORE technique that uses strong multi-acid digestion on a sample size of 0.2 g with concentrations determined by ICP-ES. The method uses a very strong oxidising attack to ensure the complete dissolution of sulphides and has been optimised to handle a wide range of concentrations of base and other metals, but with higher than normal detection limits for typical ICP analyses. The sample is dissolved with NPC (3% potassium chlorate in HNO₃), HBr and HCl. The elements included in the package are Ag, As, Bi, Ca, Cd, Co, Cu, Fe, Hg, Mg, Mn, Mo, Ni, P, Pb, S, Sb, Ti, and Zn. The detection limits for silver, lead, copper, and zinc are 5 ppm Ag, 0.01% Pb, 0.005% Cu, and 0.01% Zn.

The QC protocol employed by Alex Stewart consists in batches of 50 samples for fire assay and up to 100 samples for ICP. Fire assay batches include one preparation blank, one analytical blank, one coarse duplicate, four pulp duplicates, one international certified standard for base metal and silver, one uncertified in-house standard, and two standards made from pure silver to calibrate losses in cupellation. ICP batches include two blanks, four standards, and 10% duplicates.

13.1.4 Sample security and chain of custody

Samples are transported from the drill rig to storage facilities in Gastre by staff, where a staff geologist logs and photographs the drill core. Drill core is cut and sampled by a staff technician, placed in a plastic bag and sealed with a numbered tamper-proof tag corresponding to the sample number. Five to six samples are placed in a large nylon-woven sack which is then also sealed with a tamper-proof nylon tie. The sack, generally containing about 50 kg of samples, is weighed by a staff technician and transported by staff or a member of the local community to the Alex Stewart sample preparation facilities in Mendoza, where each individual sample is maintained under the control of Alex Stewart. After sample preparation and analyses are complete, all pulps and coarse rejects are shipped by Alex Stewart to a covered warehouse facility rented in Mendoza, where the samples are stored permanently.

13.1.5 Independent statement on sample preparation, analyses, and security

Snowden are of the opinion that sample preparation, analyses, and security of diamond drill core samples for the Navidad Project are of industry standard and are suitable for use in Mineral Resource estimates.

13.2 Quality control measures

Aquiline routinely inserted certified standards, blanks, and field duplicates with sample submissions as part of their sample assay quality assurance/quality control (QAQC) programme, and provided Snowden with the data for review. Analysis of QAQC data is made to assess the reliability of sample assay data and the confidence in the data used for the resource estimation.

13.2.1 Certified standard samples

Certified standard samples are used to measure the accuracy of analytical processes and are composed of material that has been thoroughly analysed to accurately determine its grade within known error limits. A standard is considered to have failed if the assay

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result is above or below three standard deviations of the mean certified standard value defined by the standard manufacturer. If a standard has failed then it may be necessary to re-analyse the sample batch associated with the standard.

A total of 3,734 standard samples have been submitted at a frequency of 1 in every 21 samples. Aquiline used standards for Ag and Pb comprised of material collected from site and prepared by Acme laboratories in Santiago, Chile, ALS Chemex in La Serena, Chile, ALS Chemex in Vancouver, Canada, and Assayers Canada in Vancouver. The list of standards employed by Aquiline and used to assess the quality of assays used in the April 2009 Mineral Resource estimate is presented in Table 13.1. Not all standards have been certified for Cu.

By late 2008 these standards had been depleted, and Aquiline purchased three new standards certified for Ag, Pb, Cu, and Zn, prepared and packaged by CDN Labs of Delta, British Columbia. The standards have been certified by seven laboratories including Alex Stewart of Mendoza, ALS Chemex of Vancouver, Acme of Vancouver, Acme of Santiago, SGS of Lima, ALS Chemex of La Serena, and G&T Metallurgical of Kamloops. Only three standards had been submitted at the time of the April 2009 Mineral Resource estimate, therefore no analysis has been made of their results.

Table 13.1 Certified values of standards

Standard	Certified mean grade by FA-GRAV (g/t Ag)	Standard deviation by FA-GRAV (g/t Ag)	Certified mean grade by ICP-OES (% Pb)	Standard deviation by ICP-OES (% Pb)	Certified mean grade by ICP-OES (% Cu)	Standard deviation by ICP-OES (% Cu)
GMB01	110.62	3.28	6.73	0.13	0.011	0.0029
LGH	67.61	2.85	2.26	0.04	-	-
MGH	230.96	5.87	4.54	0.09	-	-

NHBG01	6940.2	166.11	14.52	0.58	6.24	0.103
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Standard GMB01

1,062 samples of low grade standard GMB01 were submitted from 2003 until 2008. The results from the silver gravimetric methods are shown in Figure 13.1 and have a good accuracy. Copper ICP data results are also good, while lead ICP data exhibit a slightly high bias, which is not considered significant.

February 2010

84 of 249

Pan American Silver Corp:

Figure 13.1 Low grade standard GMB01 results

Low grade standard GMB01 by FA-GRAV for Ag

Low grade standard GMB01 by ICP-OES for Pb

February 2010

85 of 249

Pan American Silver Corp:

Low grade standard GMB01 by ICP-OES for Cu

Standard LGH

Standard LGH was used by Aquiline in August 2007 to replace standard GMB01. A total of 849 LGH reference samples were analysed (Figure 13.2). Ag results from FA-GRAV analyses are well constrained about the mean certified value. Pb results are more scattered but most results are within tolerance limits. 24 standard samples failed for Pb, representing approximately 3% of the samples analysed between May 2007 and December 2008. A high bias (on average) approximately equal to one standard deviation above the mean certified value is present (approximately 1%). The bias does not appear to be a cause for concern; however, Pan American is recommended to follow up on any failed standard samples with the laboratory.

Figure 13.2

Low grade standard LGH results

Low grade standard LGH by FA-GRAV for Ag

February 2010

86 of 249

Pan American Silver Corp:

Low grade standard LGH by ICP-OES for Pb

Standard MGH

Aquiline began using the medium grade standard MGH in January 2007. A total of 977 MGH reference samples were analysed over a period from January 2007 until January 2009 (Figure 13.3). Analyses of Ag standards yielded high biases of approximately one standard deviation above the mean certified standard value (approximately 2%).

The Pb analysis exhibits a similar pattern to the low grade LGH standard. There is a weak high bias of approximately 1% and 2.4% of the standard samples have failed, which is an acceptable result.

Figure 13.3 Medium grade standard MGH results

Medium grade standard MGH by FA-GRAV for Ag

February 2010

87 of 249

Pan American Silver Corp:

Medium grade standard MGH by ICP-OES for Pb

Standard NHBG01

846 high grade NHBG01 reference samples were submitted between December 2003 and April 2008, with accurate results (Figure 13.4). Pb and Cu analysis yields good results, with data points tightly constrained slightly above the mean certified standard value (Figure 13.4).

Figure 13.4 High grade standard NHBG01 results

High grade standard NHBG01 by FA-GRAV for Ag

February 2010

88 of 249

Pan American Silver Corp:

High grade standard NHBG01 by ICP-OES for Pb

High grade standard NHBG01 by ICP-OES for Cu

13.2.2 Blank Samples

Blank samples are composed of material that is known to contain grades that are less than the detection limit of the analytical method in use. A blank sample is considered to have failed if the returned assay is greater than ten times the detection limit. Analysis of blank samples is useful for determining if cross-contamination of samples is occurring in the sample preparation or analysis process.

Aquiline submitted blank samples comprising barren basalt rock chips on a frequency of 1 in 37 samples. Blank sample results are good with a low number of failed samples (Table 13.2).

February 2010

89 of 249

Pan American Silver Corp:

Table 13.2 Blank sample results

Analytical method	Detection limit	Number of samples	Number of failed samples
Ag FA-GRAV	1 g/t	935	8
Pb ICP-OES	0.01%	2,111	3
Cu ICP-OES	0.001%	2,111	6

13.2.3 Duplicate drill core samples (field duplicates)

Field duplicate samples are duplicate samples that are taken at the primary sampling point. At the Navidad Project, where diamond drillhole core is sampled by taking half of the core extracted from the ground, a field duplicate is taken by submitting the remaining half of the core. Aquiline were selecting quarter core samples as field duplicates until mid 2007, when they began selecting half core samples. Field duplicates are submitted to measure the precision of the entire sampling, sample preparation, and analysis process. Field duplicates also provide a measure of the inherent variability of the mineralisation (the nugget effect).

2,186 duplicate sample results submitted since 2003 are available for analysis, for a submission frequency rate of 1 in 36 samples. 942 of the duplicate samples returned silver assays with values greater than the detection limit of the analytical instrument, for a submission frequency rate of 1 in 83 samples. Pan American should focus on field duplicate sampling in the mineralised zone, for a submission frequency of 1 in 20 samples.

A number of plots and graphs can be used to quantify precision and bias in the duplicate samples. These plots include:

Scatter plot: assesses the degree of scatter of the duplicate result plotted against the original (first) assay value, which allows for bias characterisation and regression calculations.

Precision plot: half of the absolute difference (HAD) of the sample pair values plotted against their average. The reference line indicates different levels of precision.

Relative difference plot: relative difference of the paired values divided by their average.

Ranked HARD plot: half absolute relative difference of samples plotted against their ranked value (samples are ordered from lowest to highest grade and ranked by percentile). For field duplicate samples in high nugget style deposits, the sample threshold is accepted to be 30% or below at the 90th percentile.

The results of the Navidad duplicate drill core samples show good precision and no evidence of sampling bias. Silver duplicate analyses tend to show some scatter, but are within acceptable tolerance limits. Precision plots yield good results at the field level, as an average of 80% of the data plot within 20% of their respective duplicate samples, while an average of 55% of the data plot within 10%. The results of the field duplicate samples are shown in Figure 13.5, Figure 13.6, and Figure 13.7.

Pan American Silver Corp:

Figure 13.5 Ag field duplicate samples analysed by FA-GRAV from 2003 until 2009

Normal scatter plot with threshold guidelines of 30%
Relative difference plot with threshold guidelines of 30%

February 2010

91 of 249

Pan American Silver Corp:

Precision plot

Ranked HARD plot

February 2010

92 of 249

Pan American Silver Corp:

Figure 13.6 Pb field duplicate samples analysed by ICP-OES from 2003 until 2009

Normal scatter plot with threshold guidelines of 30%

Relative difference plot with threshold guidelines of 30%

February 2010

93 of 249

Pan American Silver Corp:

Precision plot

Ranked HARD plot

February 2010

94 of 249

Pan American Silver Corp:

Figure 13.7 Cu field duplicate samples analysed by ICP-OES from 2003 until 2009

Normal scatter plot with threshold guidelines of 30%

Relative difference plot with threshold guidelines of 30%

February 2010

95 of 249

Pan American Silver Corp:

Precision plot

Ranked HARD plot

February 2010

96 of 249

Pan American Silver Corp:

13.2.4 Independent statement of Navidad quality control samples

Snowden considers the results of the standard, blank, and field duplicate samples submitted for the Navidad Project to be of industry standard and do not indicate any significant source of bias, cross contamination, or inaccuracy.

February 2010

97 of 249

Pan American Silver Corp:

14 Data verification

Information in this section has been sourced from Snowden (2009).

14.1 Field and laboratory quality control data reviews

In June 2003, Smee and Associates Consulting Ltd (Smee) were engaged to audit the laboratories of Alex Stewart in Mendoza and ALS Chemex laboratories of Coquimbo and Santiago, Chile, and to make recommendations as to the suitability of the methods used by these laboratories for the high grade samples expected to be submitted from the Navidad Project (Smee, 2003). The work involved a formal audit of the Alex Stewart laboratory, a visit to the ALS Chemex laboratory in Santiago, and a formal audit of the ALS Chemex laboratory at Coquimbo. Smee concluded that both laboratories were capable of meeting the required standards, but there would be some operational and turn around differences between the two options.

In April 2005, Smee conducted a review of the 2004 Navidad QAQC data and an audit of the procedures used at the Alex Stewart laboratory in Mendoza, Argentina (Smee, 2005a). No site visit was undertaken. Smee considered the laboratory facilities in Mendoza to comply with industry best practice methods for analysis, and that the QAQC Project data as at April 2005 was accurate, precise, free from contamination, and suitable for inclusion in Mineral Resource estimates. Smee recommended improvements in managing QAQC data; capturing and analysing the Alex Stewart internal QAQC data; initiating a plan of action for identifying QAQC failures and the corrective action required; improvements to diamond drill core cutting (orienting core and marking a cutting line); and taking half core samples for duplicates rather than quarter core samples.

In December 2005, Smee conducted a review of the 2004 and 2005 QC data and made recommendations as to the suitability of the analytical data to be included in resource estimations (Smee, 2005b). No site visit was undertaken. Smee considered the laboratory facilities in Mendoza were performing the analyses using industry accepted procedures and quality control protocols, and that the QAQC Project data as at December 2005 was accurate, precise, free from contamination, and suitable for use in resource estimations.

Smee recommended the purchase of a commercial software database to assist the capture of the analytical and quality control data.

In February 2008, Smee and Associates Consulting Ltd visited the Project and conducted a review of the Navidad QAQC data and procedures (Smee, 2008). Smee recommended improvements for the data compilation and in managing the QAQC data; to build a table of failures to document the course of action taken to correct or accept the failures; to document and describe the nature of the inserted blank and to determine the background values of the blank samples in order to establish a more precise warning limit. Smee calculated the sampling precision for some of the project deposits that showed that most areas have an overall sampling precision of nearly $\pm 20\%$, which is expected for this style of mineralisation. Smee indicated that Calcite Hill mineralisation has a precision of $\pm 30\%$ which is considered to be high for this style of mineralisation and recommended investigating the source of this variation. It was recommended that the corresponding lithology symbol be attached to the duplicate samples to determine which lithology has the poorest precision. These recommendations have subsequently been implemented by Aquiline.

Pan American Silver Corp:

14.2 Snowden independent site visits

Ms. De Mark conducted a site inspection of the Navidad Property from 10 September to 13 September 2007 and from 28 April to 30 April 2009. Ms. De Mark was involved in discussions with key Aquiline personnel (Table 14.1) and undertook the following activities:

- Reviewed geological plans and cross sections.
- Reviewed selected diamond drillhole logs and diamond drill core intersections.
- Reviewed diamond drill core logging, cutting, and sampling procedures.
- Selected mineralised intersections for independent analyses.
- Confirmed the coordinates of selected diamond drillhole collars by GPS.
- Inspected Aquiline's two operating diamond drilling rigs during the 2007 site visit. No diamond drill rigs were in operation at the time of Snowden's 2009 visit.

Table 14.1 Key Aquiline personnel involved in data verification discussions

Visit year	Name	Position
2007, 2009	John Chulick	Vice President of Exploration
2007, 2009	Sergio Kain	Senior Project Geologist
2007	Sophia Adamopoulos	Senior Project Geologist
2009	Dean Williams	Chief Geologist
2009	Damian Spring	Chief Mining Engineer

14.2.1 Independent review and sampling of mineralised intersections

Ms. De Mark examined mineralised intersections in 49 drillholes from the Barite Hill, Galena Hill, Connector Zone, Navidad Hill, Calcite Hill, Calcite NW, Loma de La Plata and Valle Esperanza deposits in 2007 and 2009 (Table 14.2). A number of the mineralised intersections selected by Snowden for review in 2009 were no longer available, as the drill core had been used for metallurgical testing. These missing intersections included drillholes NV08-658, NV07-618, NV08-681, NV08-732, NV08-765,

NV08-718, NV07-609, NV08-781, NV08-713, NV08-792, NV07-515, and NV07-543. No discrepancies were noted.

In 2007, Ms. De Mark confirmed the presence of diamond drill core for the Project, which is stored under cover at the Aquiline drill core storage facilities in Gastre. Further, she collected 30 quarter core duplicate samples from 25 drillholes (Table 14.3), and confirmed the presence of visible Ag mineralisation in drillhole NV07-442 (which returned assays of 22,818 g/t Ag from 223.55 m to 224.05 m downhole).

In 2007, the 30 independent quarter core samples were cut and sampled under Snowden supervision, and shipped to Vancouver, where the samples were submitted to Acme Laboratories of Vancouver, B.C. One sample of blank rock chips and two standard pulps were also submitted for analyses. Samples were crushed to 70% passing #10 mesh, split to 250 g, and pulverised to 95% passing #150 mesh. Au and Ag were analysed by fire assay on a 30 g sample. Base metal sulphides and precious metals were analysed by ICP-ES using hot Aqua Regia digestion of a 1 g sample.

Pan American Silver Corp:

The 31 independent samples selected by Snowden from 31 drillholes in April 2009 (Table 0.3) were cut and sampled under Snowden supervision, and shipped to Vancouver, where the samples were submitted to ALS Laboratories of North Vancouver, B.C. One sample of blank rock chips and four standard pulps were also submitted for analyses. Samples were crushed to 70% passing <2 mm mesh, pulverised to 85% passing <75 µm mesh, and split with a riffle splitter to obtain a 30 g charge. Ag was analysed by fire assay with gravimetric finish, and Pb was analysed using high grade four acid digestion and ICP-AES.

The purpose of independent sampling is to verify the presence of significantly mineralised intersections. Because of the limited number of samples, the size of the sample (quarter core), and slightly different sample preparation and analysis techniques used by the alternate laboratory, independent samples should not be considered as a QAQC sample. Snowden is of the opinion that the results of the independent samples selected in 2007 and 2009 are acceptable for duplicate samples of the style of mineralisation concerned.

Table 14.2 Snowden mineralised drill core intersection review

Review year	Hole number	Deposit	From	To
2007	NV06-309	Calcite NW	82.29	128.82
2007	NV06-355	Navidad Hill	33.4	59.78
2007	NV06-357	Navidad Hill	8.0	31.1
2007	NV06-358	Navidad Hill	0.0	19.05
2007	NV06-359	Navidad Hill	2.6	21.42
2007	NV06-367	Galena Hill	26.42	53.78
2007	NV06-369	Galena Hill	3.0	26.48
2007	NV06-370	Galena Hill	49.1	57.35
2007	NV06-374	Galena Hill	25.53	37.57
2007	NV06-378	Connector Zone	64.8	90.0
2007	NV06-381	Connector Zone	27.34	41.13
2007	NV06-386	Navidad Hill	36.7	64.45
2007	NV07-414	Calcite NW	20.1	39.1
2007	NV07-416	Calcite NW	39.8	54.1
2007	NV07-418	Calcite NW	56.0	64.4
2007	NV07-421	Calcite NW	25.14	50.14

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2007	NV07-422	Calcite NW	24.56	54.7
2009	NV07-442	Barite Hill	216.14	240.75
2009	NV07-396	Barite Hill	90.2	120.2
2009	NV08-666	Galena Hill	119.09	157
2009	NV07-552	Galena Hill	3	26.48
2009	NV07-560	Connector Zone	15.33	47.75
2009	NV08-867	Connector Zone	193.8	235.36

February 2010

100 of 249

Pan American Silver Corp:

Review year	Hole number	Deposit	From	To
2009	NV08-726	Connector Zone	189.4	235.65
2009	NV07-615	Calcite Hill	39.06	52.14
2009	NV07-485	Calcite Hill	14.6	40.54
2009	NV07-617	Calcite Hill	6	36.5
2009	NV07-423	Calcite NW	35.17	68.5
2009	NV07-533	Calcite NW	28.78	45.44
2009	NV07-584	Calcite NW	0	22.7
2009	NV07-645	Calcite NW	46.43	76.48
2009	NV08-906	Loma de La Plata	299.78	340.82
2009	NV07-571	Loma de La Plata	151.56	201.88
2009	NV07-513	Loma de La Plata	24.67	56.87
2009	NV07-611	Loma de La Plata	207.58	231.84
2009	NV07-522	Loma de La Plata	51.3	75.29
2009	NV08-843	Loma de La Plata	217.66	266.16
2009	NV08-856	Loma de La Plata	87.46	111.6
2009	NV07-622	Loma de La Plata	261.1	274.18
2009	NV07-434	Loma de La Plata	0	18
2009	NV08-730	Valle Esperanza	170.59	206.19
2009	NV08-730	Valle Esperanza	249.57	271.63
2009	NV08-740	Valle Esperanza	239.25	256
2009	NV08-740	Valle Esperanza	391.63	416.42
2009	NV08-790	Valle Esperanza	49.97	66.5
2009	NV08-790	Valle Esperanza	77.85	92.12
2009	NV08-802	Valle Esperanza	128.1	161.52
2009	NV08-841	Valle Esperanza	268.12	282.36
2009	NV08-655	Valle Esperanza	180.2	202
2009	NV08-655	Valle Esperanza	220	230.2
2009	NV08-690	Valle Esperanza	179.98	212.6
2009	NV08-694	Valle Esperanza	198.36	237
2009	NV08-685	Valle Esperanza	218.8	232.65

February 2010

101 of 249

Pan American Silver Corp:

Table 14.3 Snowden independent samples

Review year	Deposit	Drillhole number	Original sample number	Snowden sample number	From	To	Original Ag g/t	Original Pb%	Snowden duplicate Ag g/t	Snowden duplicate Pb%
2007	Calcite NW	NV06-309	35026	18	85.5	88.5	403	0.21	390	0.19
2007	Navidad Hill	NV06-355	37702	23	50	51.5	442	0.27	163	0.51
2007	Navidad Hill	NV06-357	37799	29	22.15	23.17	392	0.13	140	0.18
2007	Navidad Hill	NV06-358	37839	27	4.8	5.4	240	0.28	175	0.39
2007	Navidad Hill	NV06-359	37879	26	4.6	6.04	239	0.11	196	0.1
2007	Navidad Hill	NV06-359	37885	24	10.25	11	1680	0.41	1176	0.52
2007	Galena Hill	NV06-367	38362	22	29.3	31.1	879	21.88	796	19.69
2007	Galena Hill	NV06-367	38363	25	31.1	32.2	503	18.65	492	19.38
2007	Galena Hill	NV06-369	38462	21	7.1	10.1	87	2.86	99	3.22
2007	Galena Hill	NV06-370	38583	30	55.85	55.6	2466	1.64	2125	2.02
2007	Galena Hill	NV06-374	38851	20	30.4	31.81	376	10.79	390	9.46
2007	Connector Zone	NV06-378	39098	16	83.1	85.8	289	0.06	581	0.09
2007	Connector Zone	NV06-381	39200	15	30.9	32.4	505	0.71	488	0.79
2007	Navidad Hill	NV06-386	39479	28	53.55	54.9	739	0.3	1073	0.33
2007	Calcite NW	NV07-414	41665	17	22.3	25.3	159	0.1	164	0.09
2007	Calcite NW	NV07-414	41671	14	34.3	36.2	159	0.11	148	0.15
2007	Calcite NW	NV07-416	41784	13	51.18	52	1074	3.41	464	3.95
2007	Calcite NW	NV07-418	41889	5	37	40	2227	4.18	129	0.07
2007	Calcite NW	NV07-421	42005	6	28	31	23	0.47	6	0.43
2007	Calcite NW	NV07-422	42047	12	46	47.55	390	0.19	372	0.24
2007	Calcite NW	NV07-425	42187	10	67	70	365	1.26	517	2.41
2007	Barite Hill	NV07-442	43442	19	222.19	222.58	7072	<0.01	1221	0.24

Pan American Silver Corp:

Review year	Deposit	Drillhole number	Original sample number	Snowden sample number	From	To	Original Ag g/t	Original Pb%	Snowden duplicate Ag g/t	Snowden duplicate Pb%
2007	Barite Hill	NV07-442	43443	8	222.58	222.92	5469	0.01	1876	0.01
2007	Barite Hill	NV07-445	43780	7	198.15	199.6	1733	0.24	1197	0.12
2007	Barite Hill	NV07-463	45791	9	197.41	199	189	0.05	102	0.08
2007	Barite Hill	NV07-463	45793	11	199	200.49	111	0.04	110	0.02
2007	Barite Hill	NV07-467	46178	3	85	86.4	77	13.28	98	15.67
2007	Barite Hill	NV07-476	47116	4	19	22	99	3.01	151	4.37
2007	Calcite Hill	NV07-484	47656	1	36.6	39.05	304	0.07	288	0.07
2007	Calcite Hill	NV07-484	47658	2	40.3	42.6	815	0.17	518	0.16
2007	-	Standard	LGH-0324	31	-	-	111	6.73	73	2.32
2007	-	Blank	-	32	-	-	0	0	16	0.01
2007	-	Standard	MGH-0992	33	-	-	231	4.54	241	4.32
2009	Barite Hill	NV07-396	39986	93404	100.94	102.8	540	0.06	521	0.07
2009	Calcite NW	NV07-423	42089	93402	55	58	875	0.22	625	0.26
2009	Loma de La Plata	NV07-434	42689	93401	0	3	1628	0.005	3600	0.01
2009	Barite Hill	NV07-442	43444	93403	222.92	223.55	305	0.005	1575	0.00
2009	Calcite Hill	NV07-485	47682	93422	28.05	30.1	905	0.31	1200	