Process Mineralogical Consulting Ltd.

A Mineralogical Description of a Head Sample from the XXXX Project

Prepared for

XXXXX RESOURCES

Project # JUN2012-04

Date: November 2, 2012

NOTE:
This report refers to the samples as received.

SUMMARY REPORT

One sample identified as "XX Head" was submitted to Process Mineralogical Consulting Ltd for mineralogical examination. The purpose of the examination was to determine the deportment and distribution of gold within the sample detailing grain size and association.

METHODOLOGY

The sample was received, weighed and a representative portion riffled for gold assay using fire assay techniques. The sample was then screened on a 38µm screen to produce two fractions and a representative portion was riffled from each fraction for gold assay. The individual fractions were then pre-concentrated using a combination of heavy liquids and Superpan tabling. The heavy liquid separation was carried out on the individual size fractions using Lithium Meta-tungstate at a density split point of 2.90g/cc in a centrifuge to concentrate an optimal amount of the heavy minerals present in each sample. A representative portion of the 2.9g/cc float product was riffled and submitted for gold assay. The 2.90g/cc Sink fractions were submitted for further concentration using the Haultain Superpanner to prepare a high gold concentrate (Tip), a sulphide concentrate (Midd) and a heavy silicate concentrate (Tail) as illustrated in Diagram 1. The resulting Superpan products were submitted for polished section preparation where replicate polished sections were prepared from the Midd (2) and Tail (3) products and a single polished section prepared from the Tip product. Riffled portions of the Midd, Tail and Slimes products were also submitted for Au assays. The replicate polished sections were systematically scanned using bright phase recognition software equipped on a Tescan Vega 3 Scanning Electron Microscope equipped with an Energy Dispersive Spectrometer (SEM-EDS) to determine the elemental composition of the higher atomic weight elements (Au). The grains were measured based upon the pixel areas and the semi-quantitative elemental composition analyzed. The associations with other minerals were noted and the data assembled to present the grain size distribution, weight distribution and gold mineral association. Backscatter Electron Images (BEI) were taken of selected grains to demonstrate mineral texture and associations. Mineral abundance determinations were made of the individual size fractions of each sample using the Tescan Integrated Mineral Analyzer (TIMA). Additionally, Secondary Ion Mass Spectrometry (SIMS) work was carried out on the XX Float Concentrate sample (submitted under Project #SEP2-12-01) to determine the Au content in the pyrite family (pyrite, arsenopyrite and arsenian pyrite). These values were utilized in this dataset to account for the sub-micron Au in these minerals in the XX head sample.

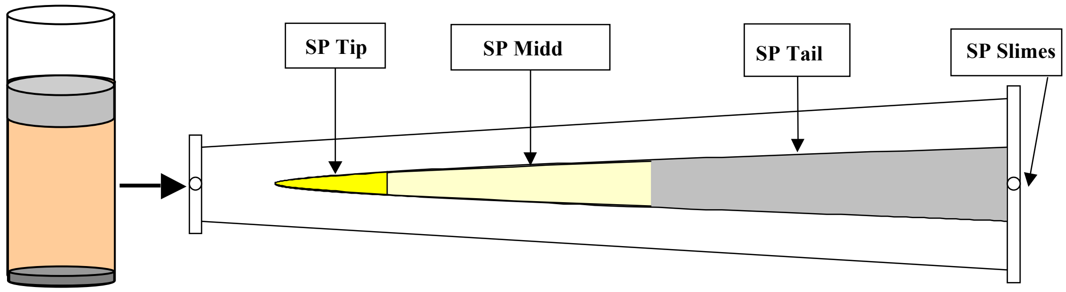

Diagram 1: Schematic of gravity concentration procedures

RESULTS

The results of the mineralogical investigation are presented in the graphs and tables included in this section, and demonstrate the following:

- The sample is primarily composed of non-opaque gangue minerals, which include quartz (28%) and plagioclase (39%) with moderate amounts of other silicate minerals (biotite, orthoclase and clay minerals). Pyrite was observed in minor amounts (4%), trace amounts of arsenian-pyrite (0.5%) and arsenopyrite (0.5%).
- The primary gold bearing mineral present in the sample is native gold, with minor amounts of electrum. The semi-quantitative EDX analysis of the gold grains indicates the gold content ranges from 48 to 100% with an average gold content of 98%.
- Distribution of gold between the separation products indicates that ~80% of the gold was recovered into the heavy liquid sink products with 70% in the combined Tip and Midd for the XX Head sample.
- Gold-bearing minerals occur with a normal distribution between 0.5µm and 18µm with an average of 3 µm often occurring as inclusions in pyrite and arsenopyrite.

- Textural determinations made by Backscatter Electron Imaging (Appendix 1) indicate that gold-bearing minerals occur primarily as attachments to pyrite and non-opaque gangue, with a moderate amount locked in pyrite and 7 % as free gold-bearing grains.
- Overall, the visible gold distribution in Table 2 indicates ~7% is present as free grains, ~35% is associated with sulphide minerals, and ~13% is associated with non-opaque gangue minerals.
- Significant amounts of the gold in this sample remains as solid solution in arsenopyrite (31%), arsenian pyrite (~10%) and pyrite (4%) as shown in the SIMS report (Appendix 4)
- The distribution of ~35% as fine visible inclusions in sulphides averaging ~3µm in size added with the free gold grains observed, indicates flotation followed by CN Leach may recover ~40 % of the gold. The large quantities of gold as sub-microscopic (solid solution) gold in arsenopyrite and pyrite would suggest that ~45% of the gold would be recovered by pressure oxidation (POX). The remaining ~15% of the gold remains as locked/attached grains to non-opaque gangue.

The accompanying tables, graphs and appendices of backscatter electron images and raw data provide further detail to the distribution of gold-bearing minerals present in each sample.

Table 1: Mineral abundance of XX Head sample determined by TIMA analysis

Mineral Abundance- XX Head			
Fraction	`+38	`-38	Head
Fraction %	58.8	41.2	-
Arsenopyrite	0.43	0.62	0.51
Arsenian Pyrite	0.48	0.48	0.48
Pyrite	4.63	3.6	4.2
Other Sulphides	0.07	0.25	0.14
Pyroxene	2.16	2.5	2.3
Quartz	32.8	21.3	28.1
Orthoclase	2.45	6.6	4.1
Plagioclase	35.9	45.4	39.8
Talc	0.37	0.03	0.23
Amphibole	1.49	0.47	1.1
Biotite	5.07	5.3	5.2
Clay	4.01	0.73	2.7
Other Silicates	3.57	5.7	4.4
Oxide	2.10	5.5	3.5
Phosphate/Carbonate	3.78	1.6	2.9
Other	0.63	0.0	0.38

Table 2: Association Distribution of Gold including "Invisible" Gold in Pyrite Group

Association Summary			**Gold Distibution %**		
	Type of Association	**Frequency**	**Head**	+38	-38
1	**Free**	14	6.6	6.5	6.0
2	**Locked in Pyrite**	82	8.8	12.7	1.7
3	**Exposed / Attached to Pyrite**	33	17.8	20.2	12.1
4	**Locked in Arsenopyrite**	18	0.9	1.4	0.1
5	**Exposed / Attached to Arsenopyrite**	16	4.2	5.4	1.8
6	**Locked in Non-opaque Gangue**	15	1.1	0.2	2.3
7	**Exposed / Attached to Non-opaque Gangue**	7	12.1	18.7	0.4
8	**Associated with Oxides**	2	0.01	0.0	0.03
9	**Associated with Tetrahedrite or Sphalerite**	2	3.0	0.0	7.1
10	**Solid Solution in Arsenopyrite**	-	31.3	23.0	49.3
11	**Solid Solution in Arsenian Pyrite**	-	9.7	8.4	12.6
12	**Solid Solution in Pyrite**	-	3.6	3.4	4.0
13	**In Sp Slimes**	-	1.0	-	2.6
TOTAL		187	100	100	100

Table 3: Solid Solution vs. Visible Gold Determination

Estimated "Invisible" Gold				
Fraction	Overall	`+38	`-38	Head
Mass %	Au(ppm)	58.8	41.2	-
Arsenopyrite	*88.25*	0.38	0.55	0.45
Arsenian Pyrite	*26.89*	0.13	0.13	0.13
Pyrite	*1.23*	0.06	0.04	0.05
Invisible Au (calc)		**0.57**	**0.72**	**0.63**
Discrete Gold		1.09	0.39	0.81
Total Au (Assay)		1.66	1.11	1.44

Table 4: Distribution of Gold Between Upgrade Products in XX Head

Product	Weight (g)	Weight %	Au Assay (g/t)	% Distribution
+38 Float	267.1	58.1	0.19	7.83
+38 SP Tail	9.3	2.0	5.44	7.80
+38 sp Mid	17.3	3.8	21.10	56.29
+38 SP Tip	1.0	0.2	**17.22**	2.66
-38 Float	141.4	30.8	0.50	10.90
-38 SP Tail	7.6	1.7	1.94	2.27
-38 sp Mid	2.4	0.5	11.70	4.3
-38 SP Tip	0.5	0.1	**80.27**	6.19
-38 Slime	12.8	2.8	0.88	1.74
Head (calc)	**459.4**	**100.0**	**1.41**	**100.00**
Head (assay)			**1.44**	

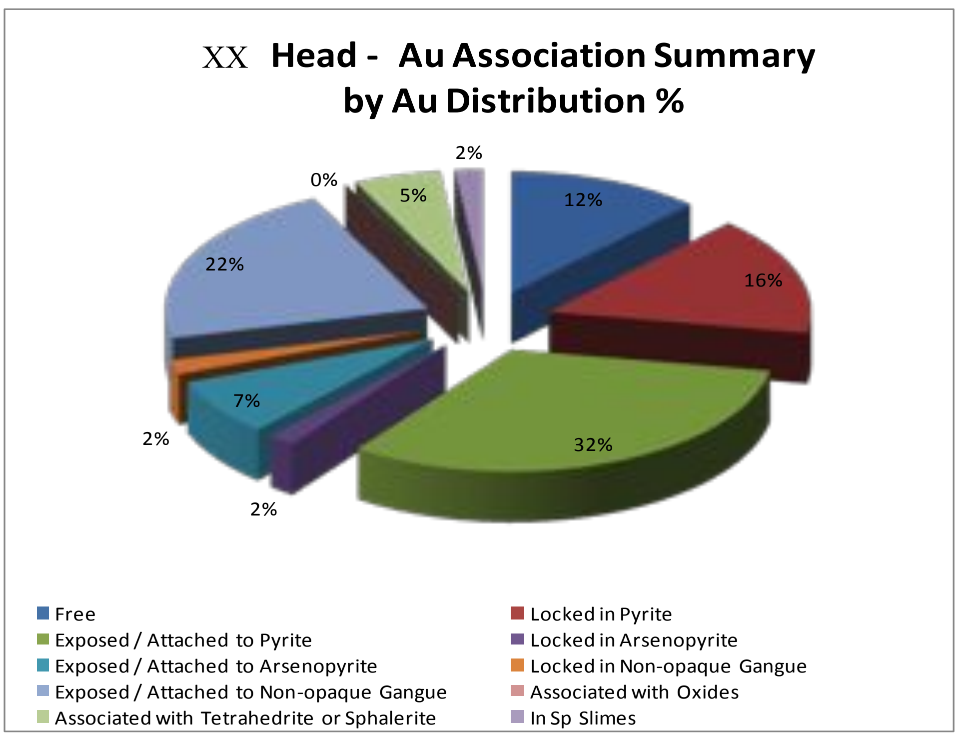

Figure 1: Gold-bearing Mineral Association Weighted by Au Distribution in XX Head

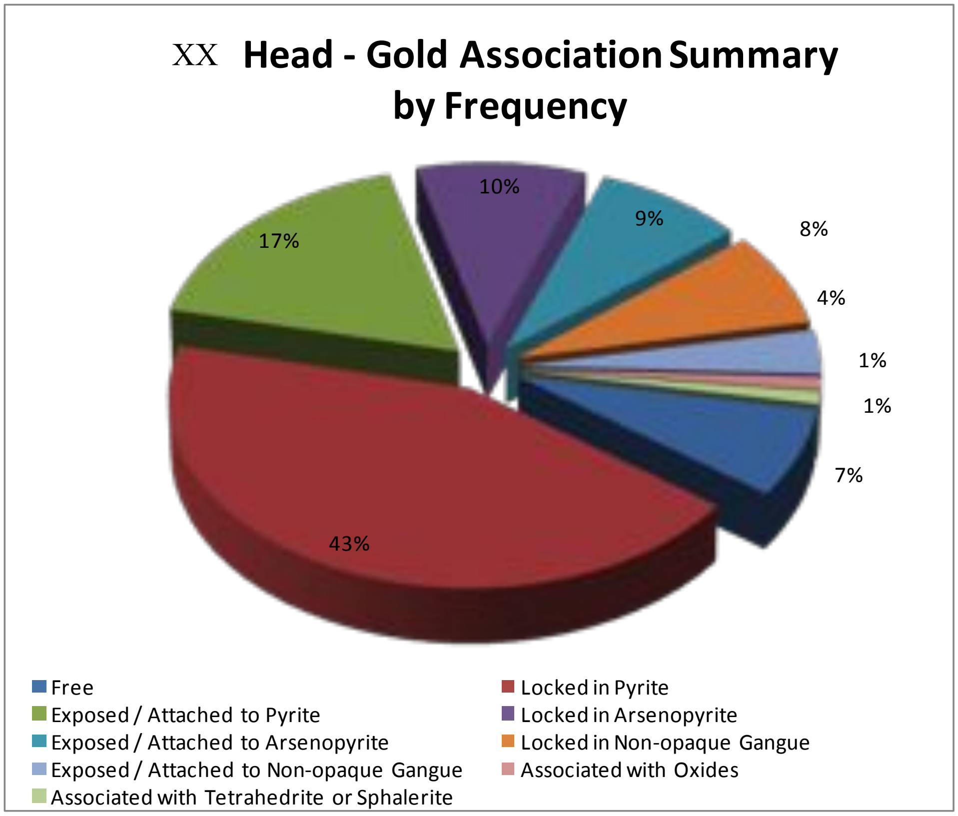

Figure 2: Visible Gold-bearing Mineral Association Frequency in XX Head

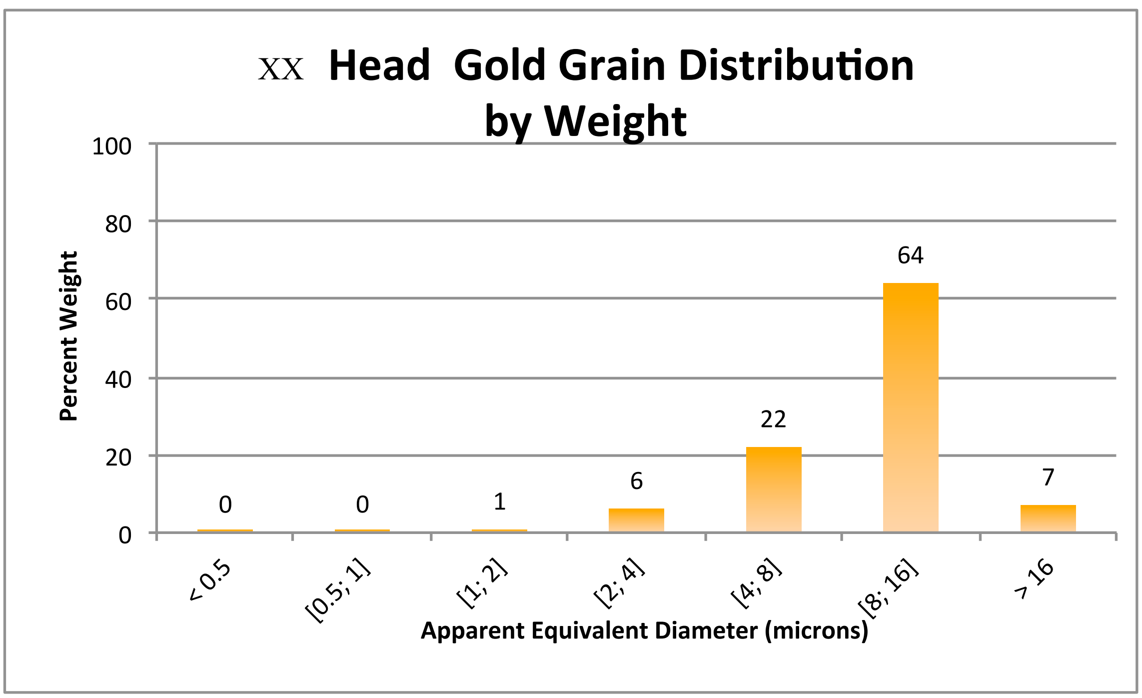

Figure 3: Visible Gold Grain Weighted Size Distribution in XX Head

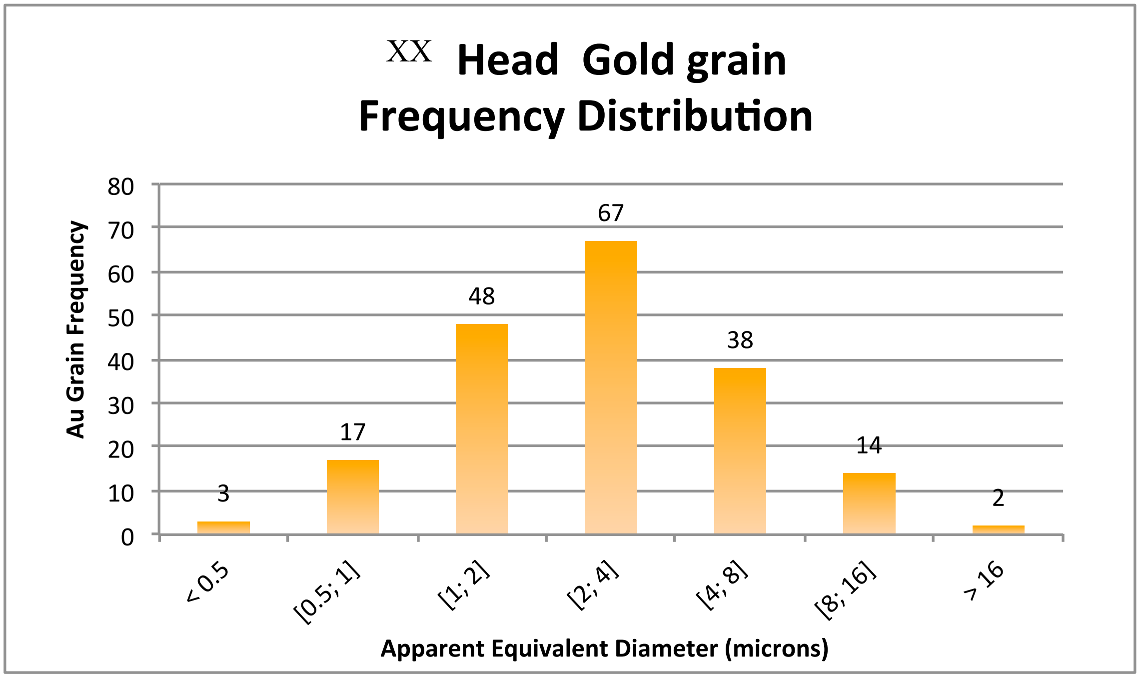

Figure 4: Visible Gold Grain Size Distribution Frequency in XX Head

FINDINGS

The occurrences of visible gold in the sample are primarily fine (<16µm) with significant amounts associated with sulphide minerals. The heavy liquid separation concentrated ~80% of the gold, suggesting gravity concentration may be an alternative for pre-concentration, although the fine nature of grains may limit this application. The mass distribution of gold in the separation products indicates that ~19% remains in the heavy liquid float products which is support through our observations with 15% of the visible gold occurring as locked or attached grains to non-opaque gangue minerals. The remaining 4% of the gold will be present as solid solution / sub-microscopic gold in the arsenopyrite / pyrite grains attached or locked to non-opaque gangue minerals. The textural occurrences of gold observed are primarily as fracture fillings in sulphide minerals and as finely disseminated grains interstitial to non-opaque gangue minerals. An increase in the grinding of the material may provide opportunity for leaching due to permeability along grain boundaries; although the very fine nature may limits this effect.

Significant amounts of gold are present in solid solution in the pyritic minerals; the arsenopyrite has an observed maximum of 427 ppm gold with an average gold content of 88.25 ppm. The pyrite in the SIMS report has been divided for mineralogical purposes into arsenian pyrite and pyrite, where arsenian pyrite contains arsenic that is greater than 5000 ppm and pyrite contains less than 5000 ppm. The arsenian pyrite has a maximum gold content of 127 ppm with an average content of 26.9 ppm; the pyrite has an observed maximum content of 2.1 ppm with an average of 1.2 ppm gold. The combination of SIMS and TIMA indicates that the gold found in solid solution comprises 44% of the total gold in the sample. This combined with the visible gold associated with sulphide minerals indicates that ~79% is in someway associated with sulphide minerals. This and the fine nature of the gold and suggest flotation followed by pressure oxidation or smelting as the most effective method to obtain the highest recovery.

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Appendix 1

Backscatter Electron Images of Gold Occurrences

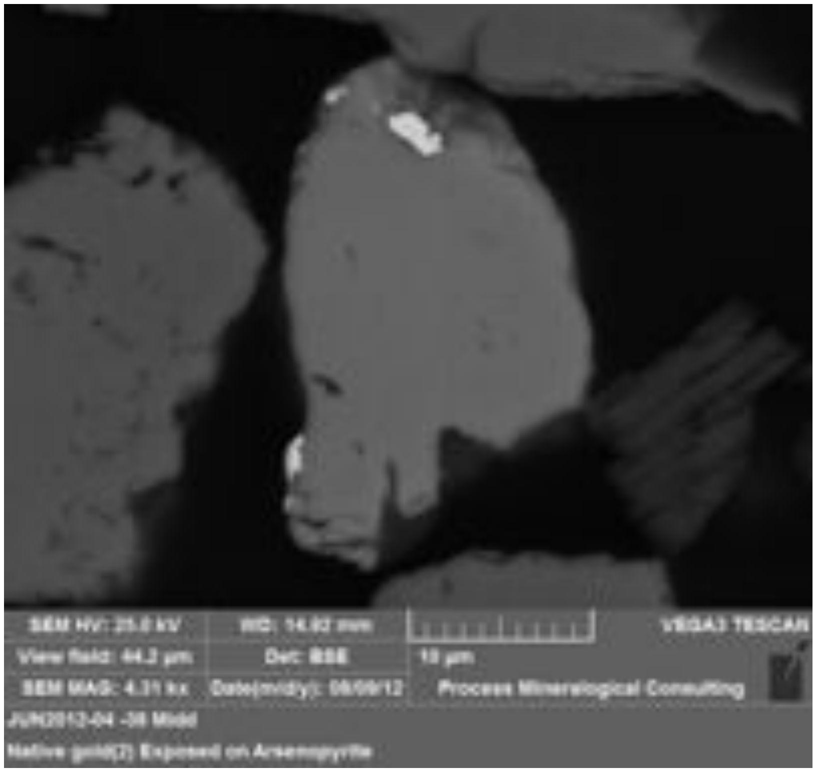

Figure 1: Three Native Gold Grains Exposed on Arsenopyrite

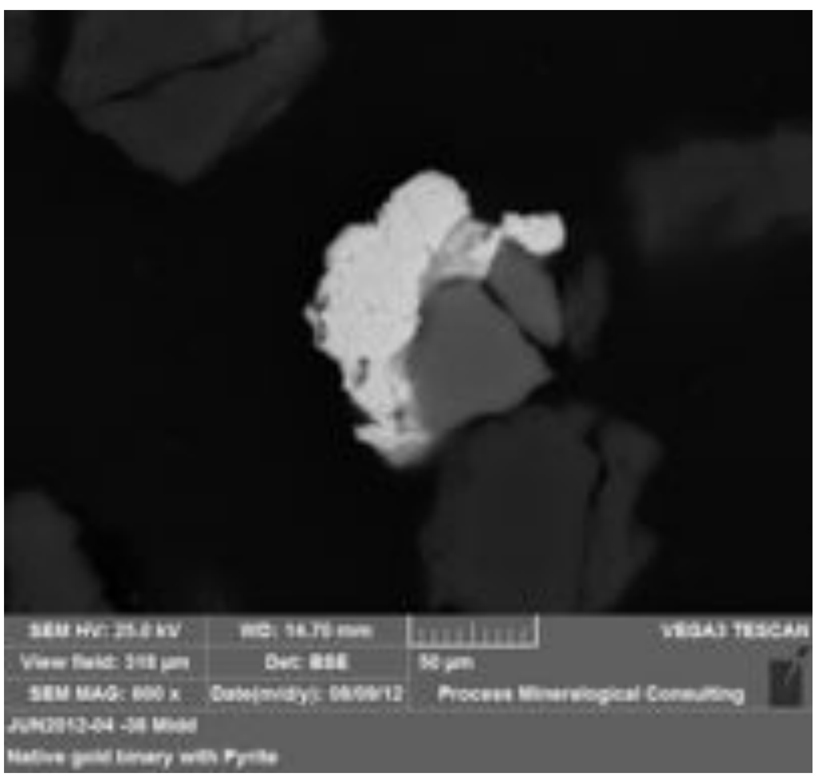

Figure 2: Pyrite binary with Native Gold

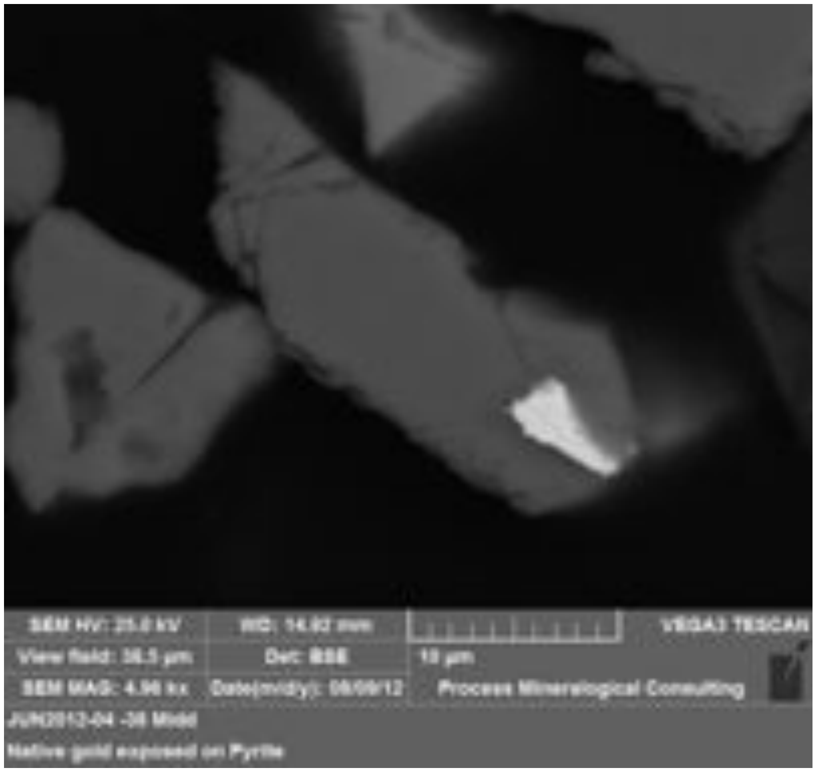

Figure 3: Native Gold Exposed on Pyrite

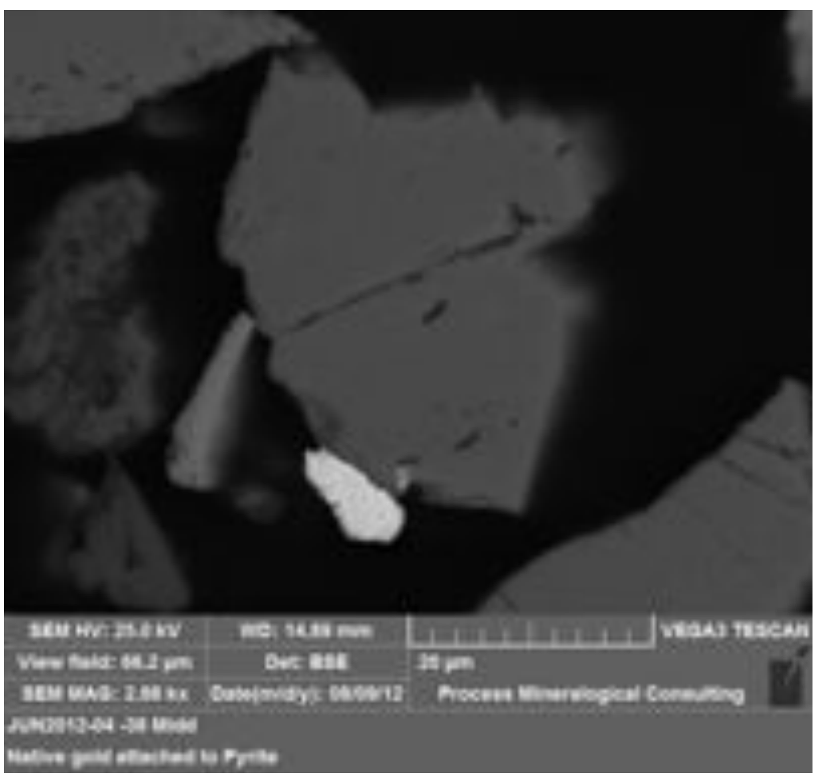

Figure 4: Native Gold attached to Pyrite grain

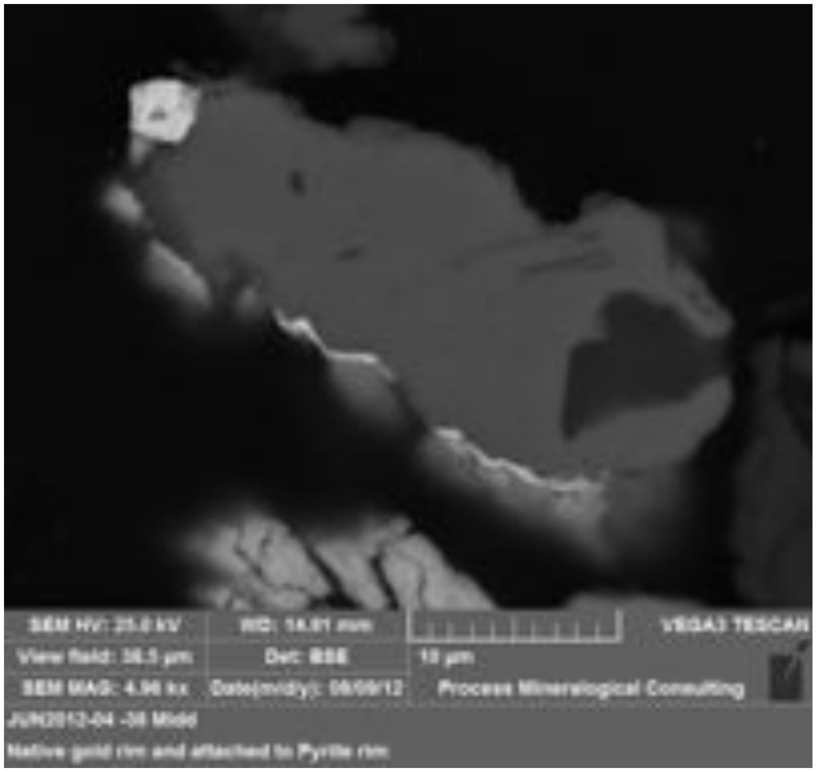

Figure 5: Native Gold rim on Pyrite grain with Native Gold attachment

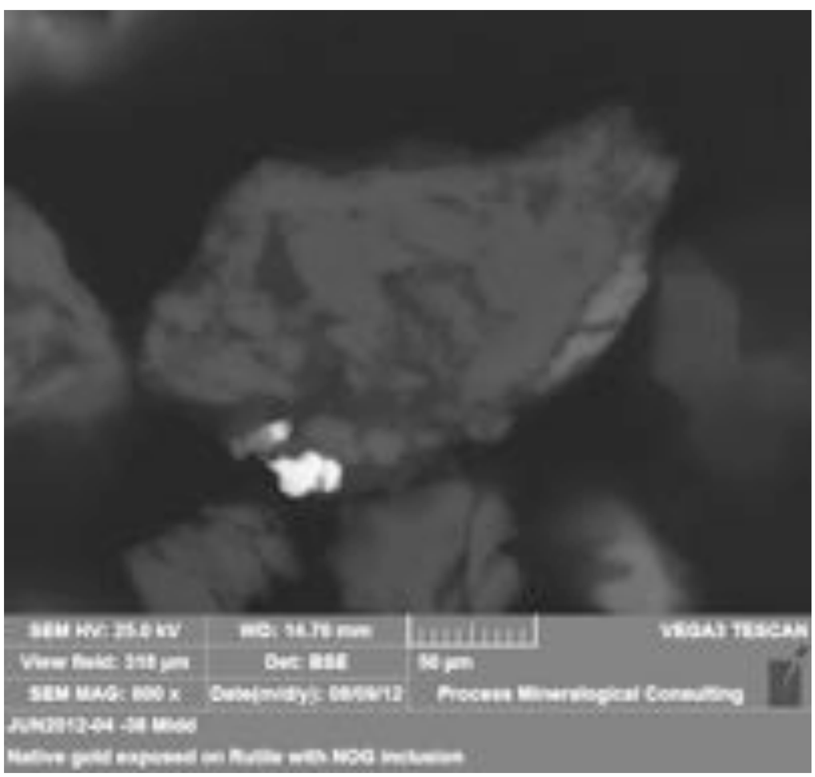

Figure 6: Native Gold attached to Rutile with NOG inclusions

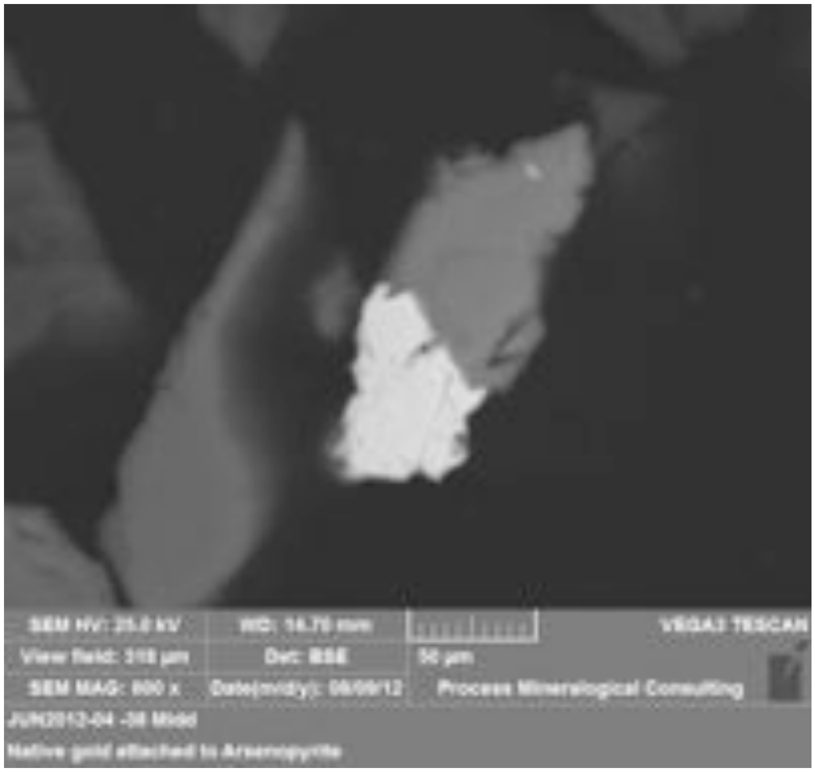

Figure 7: Native Gold binary with Arsenopyrite with small Galena inclusion

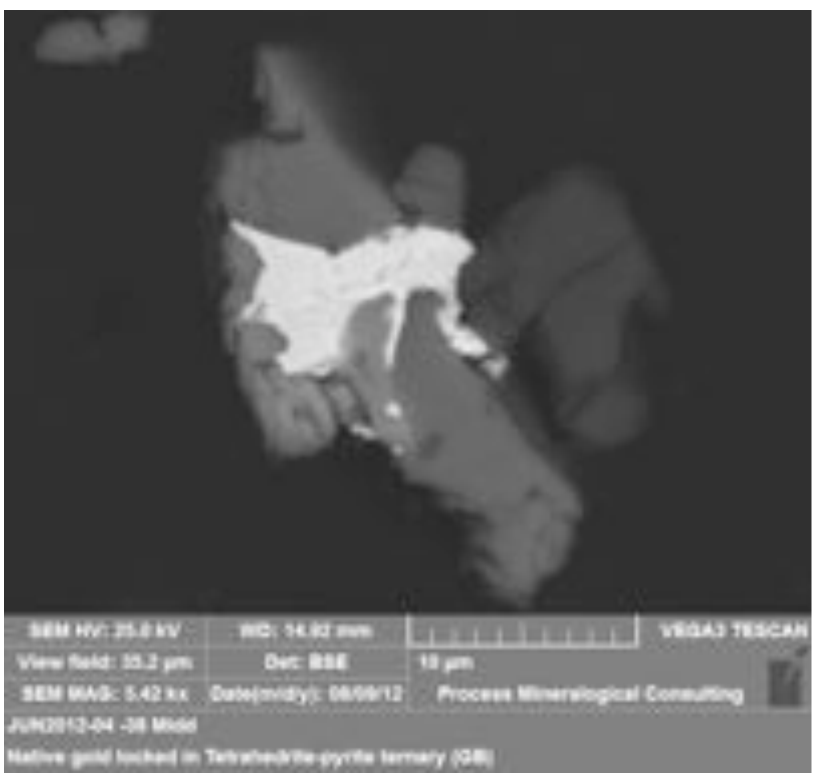

Figure 8: Native Gold in grain boundary of Pyrite and Tetrahedrite

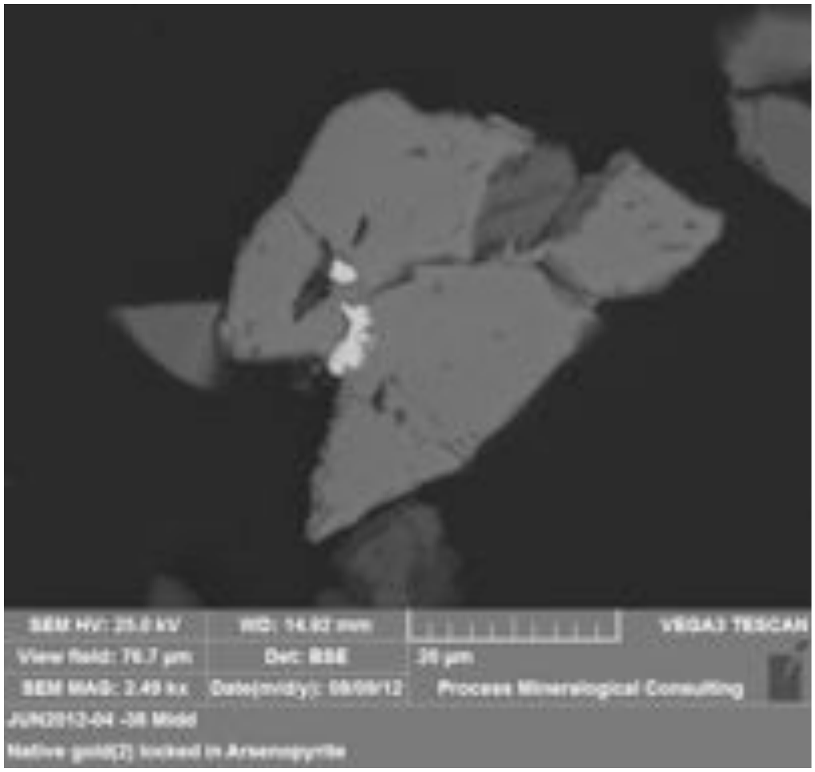

Figure 9: Interstitial Native Gold in Arsenopyrite fracture.

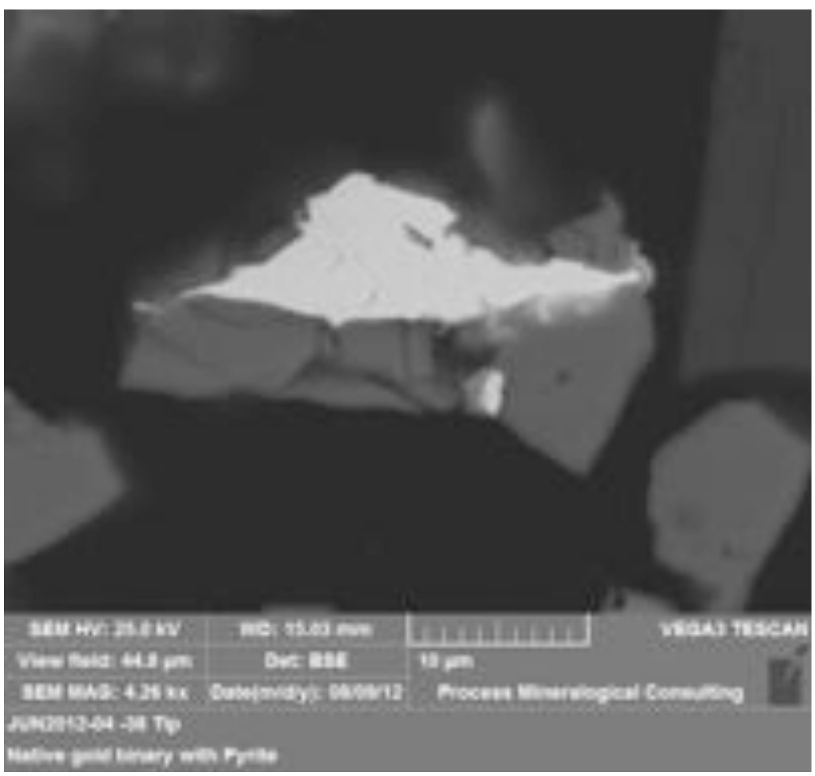

Figure 10: Native Gold binary with Pyrite

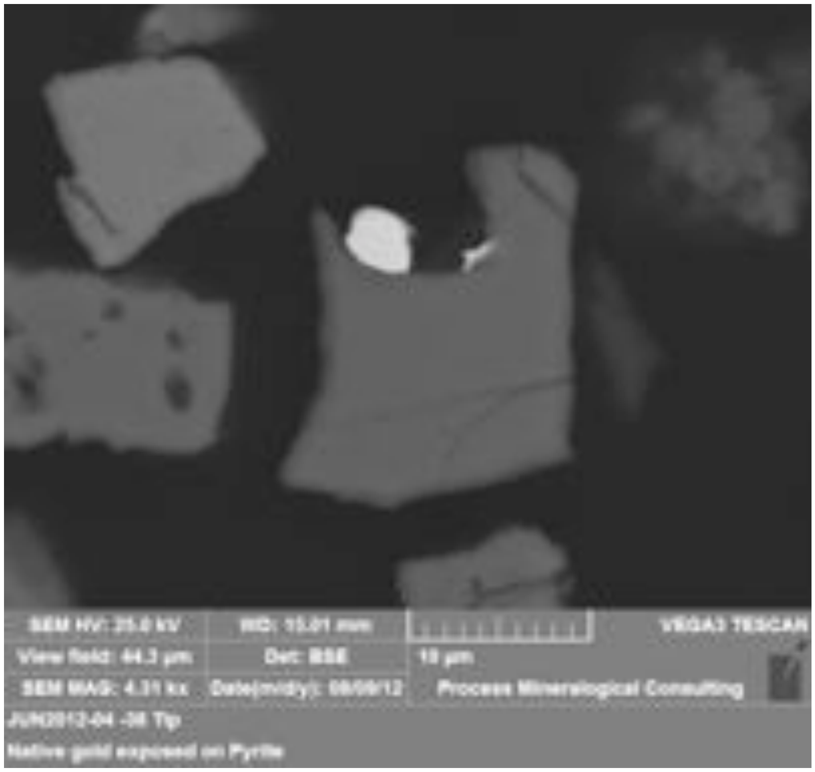

Figure 11: Native Gold attached to Pyrite

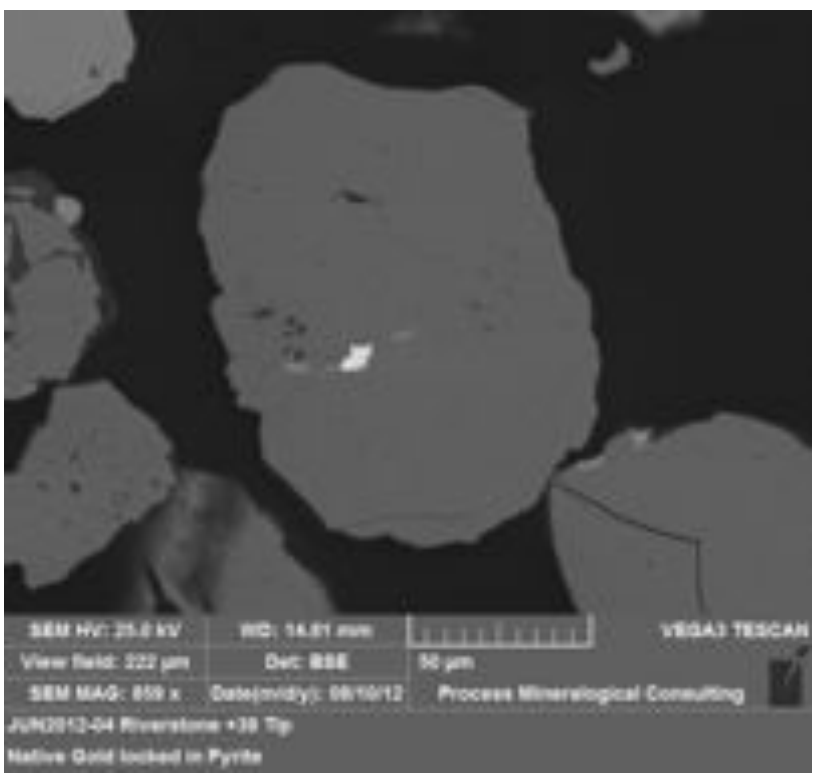

Figure 12: Native Gold locked in Pyrite

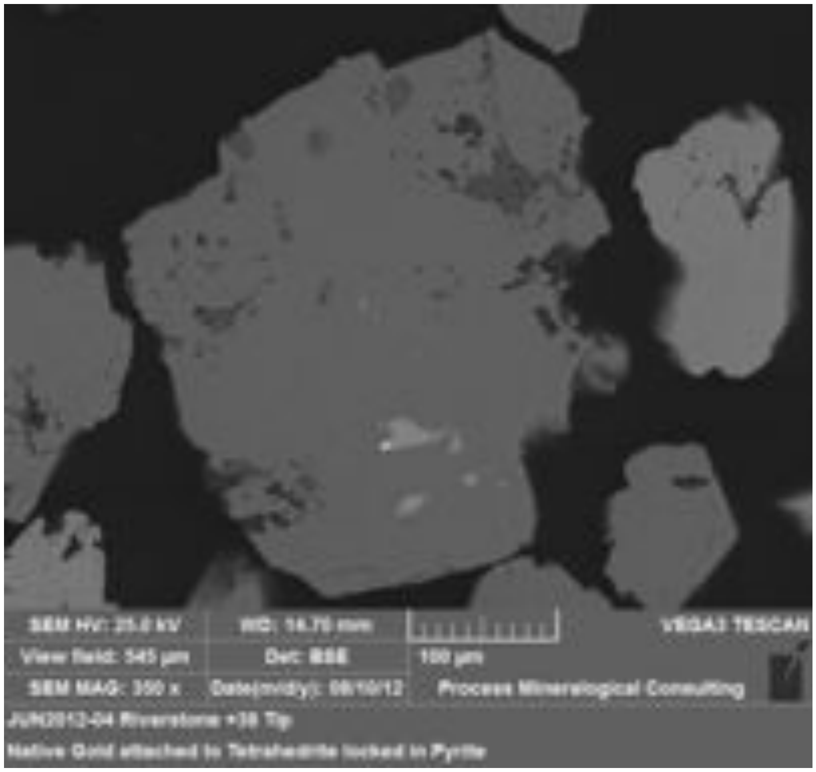

Figure 13: Native Gold Locked in Pyrite as attachment to Tetrahedrite

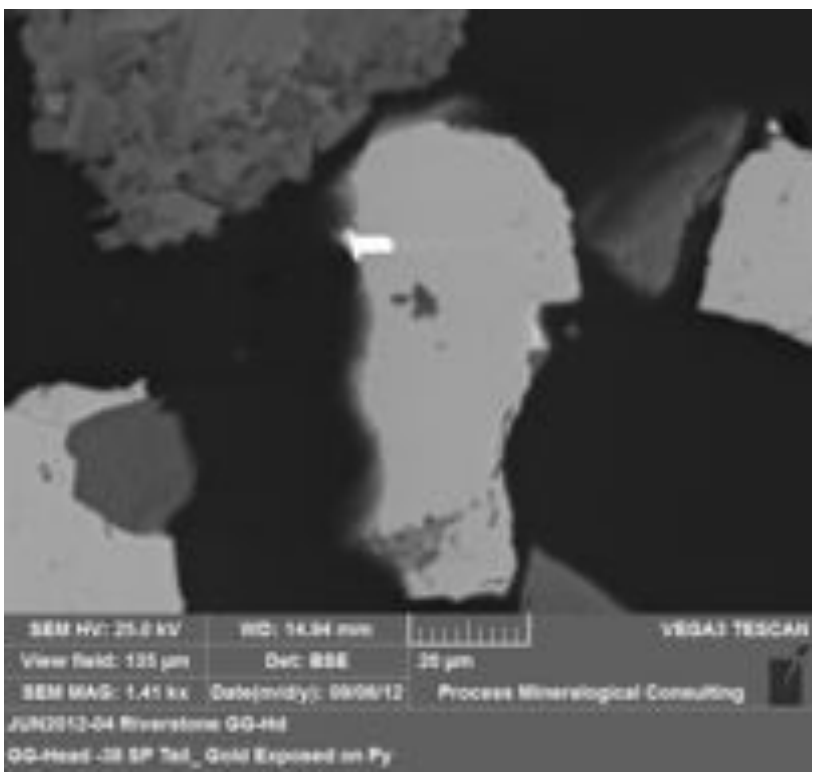

Figure 14: Native Gold Exposed on Pyrite

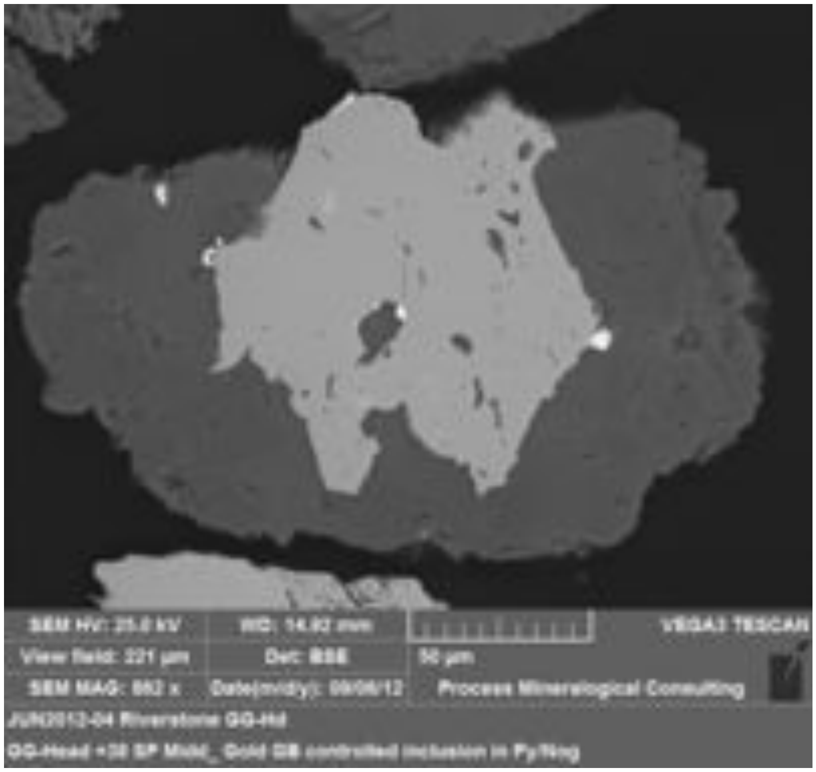

Figure 15: Native Gold locked in Pyrite/Non Opaque Gangue grain boundaries

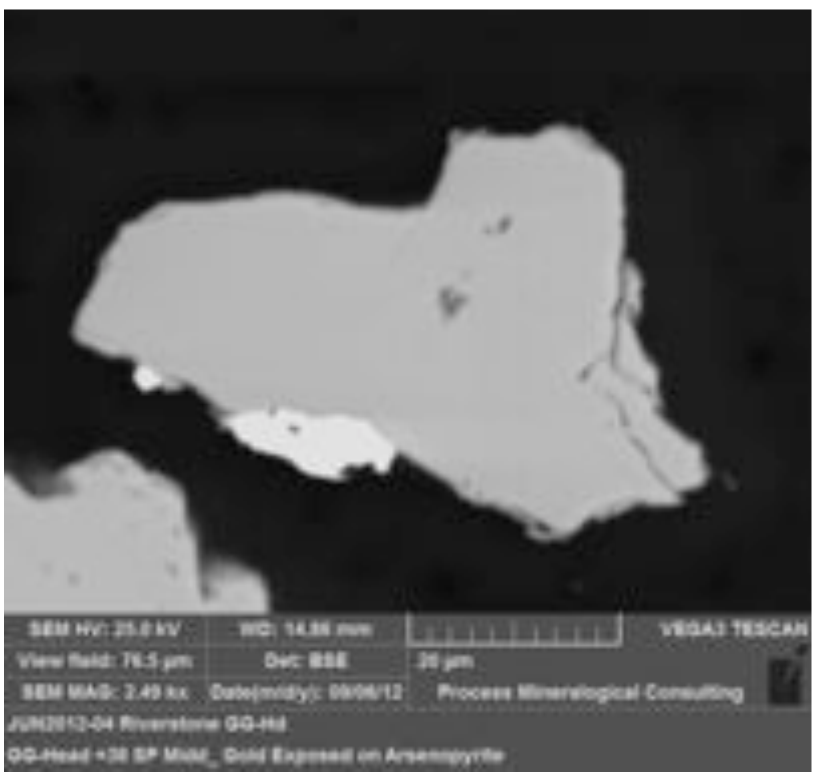

Figure 16: Native Gold exposed on Arsenopyrite

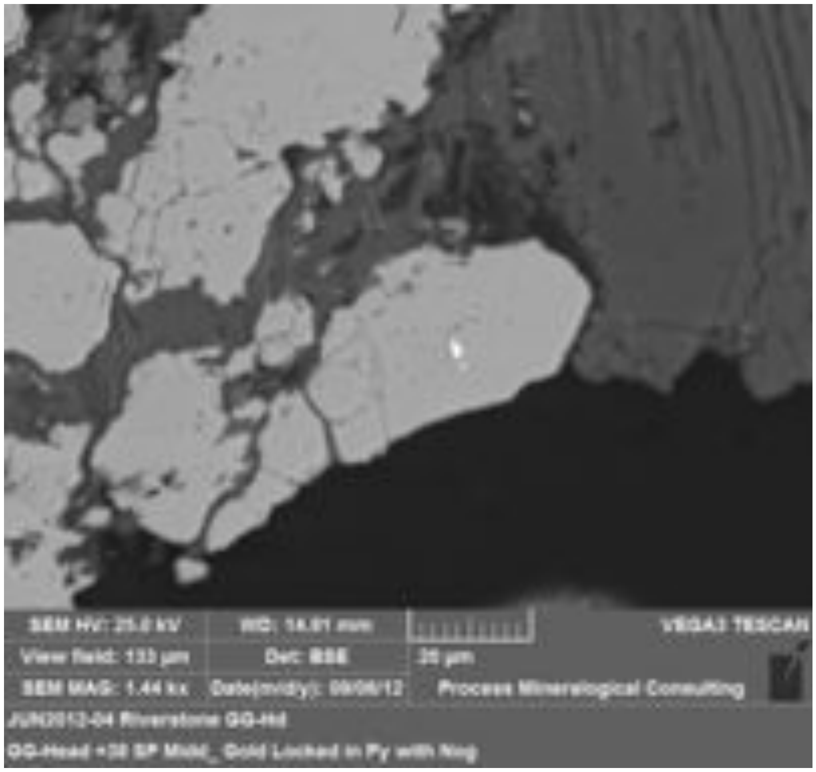

Figure 17: Native Gold Locked in Pyrite exposed on Non Opaque Gangue

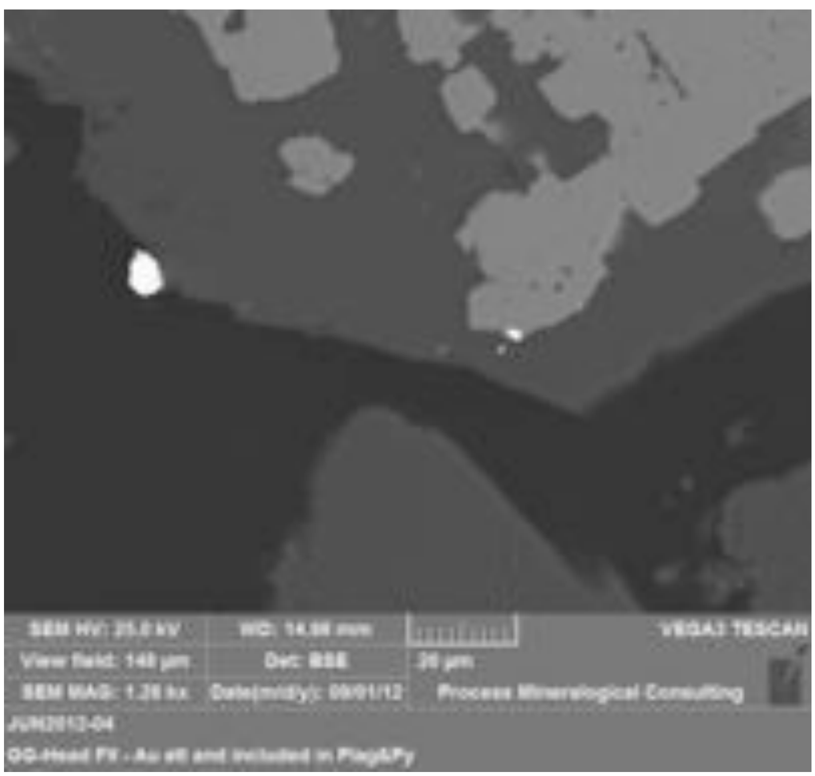

Figure 18: Electrum attached to Non Opaque Gangue with Pyrite Inclusions

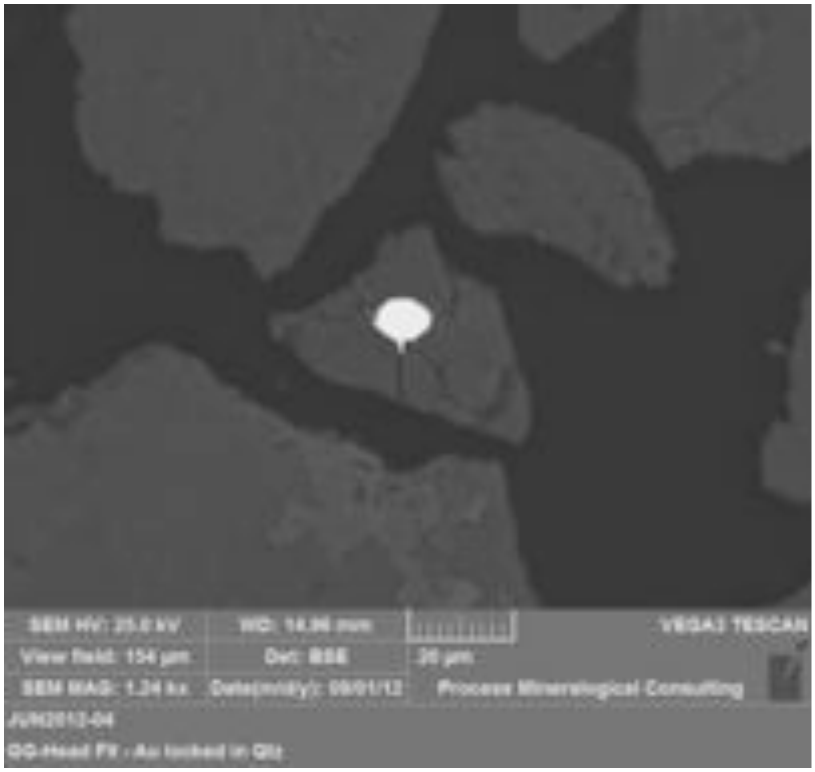

Figure 19: Native Gold locked in fractured Non Opaque Gangue

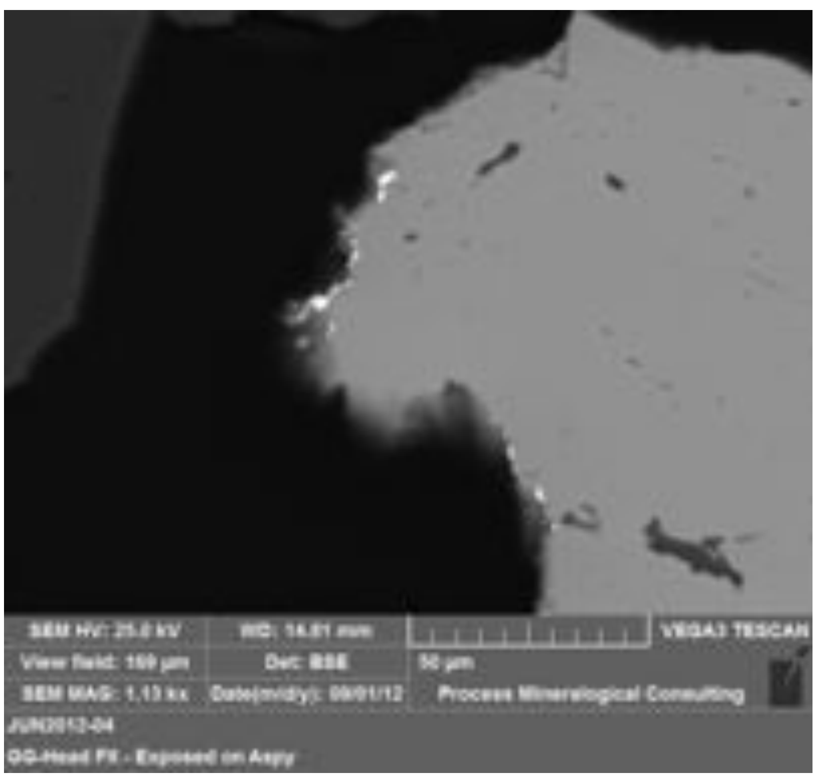

Figure 20: Native Gold exposed as friable rim on Arsenopyrite

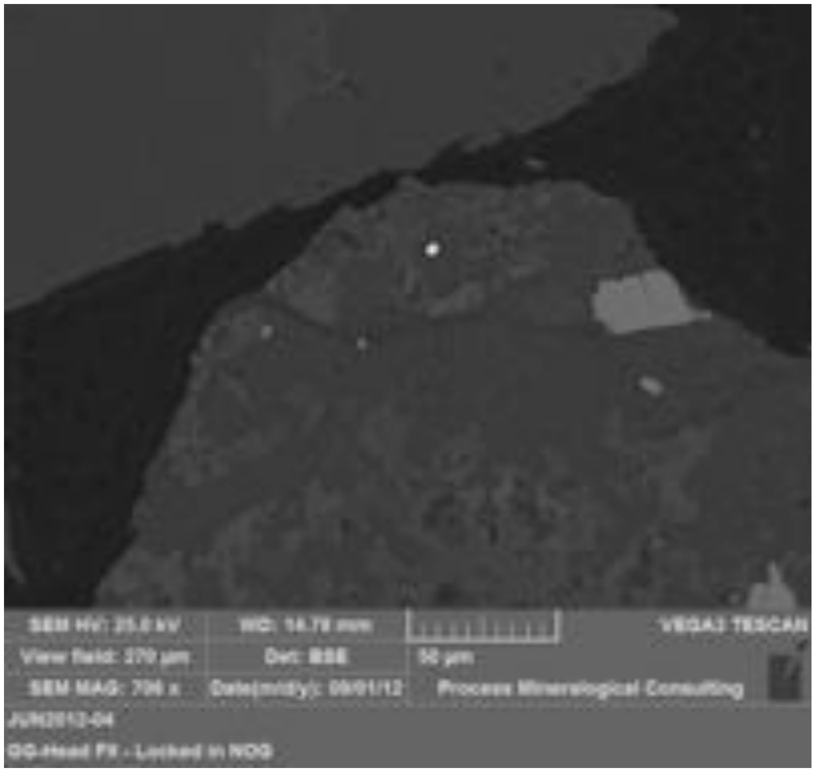

Figure 21: Native Gold locked in Non Opaque Gangue

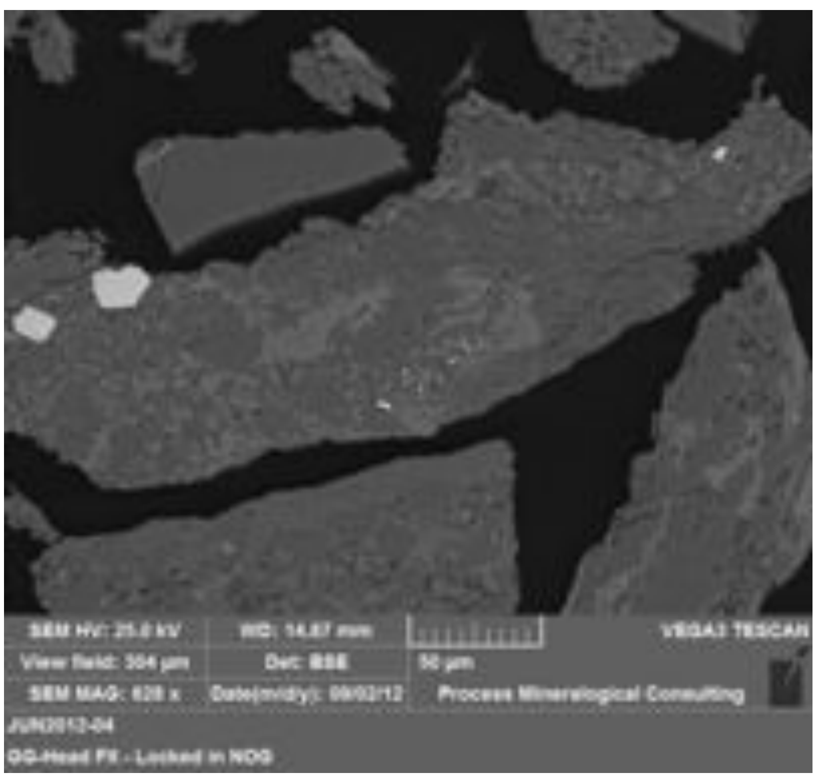

Figure 22: Native Gold locked in Non Opaque Gangue with Pyrite inclusions

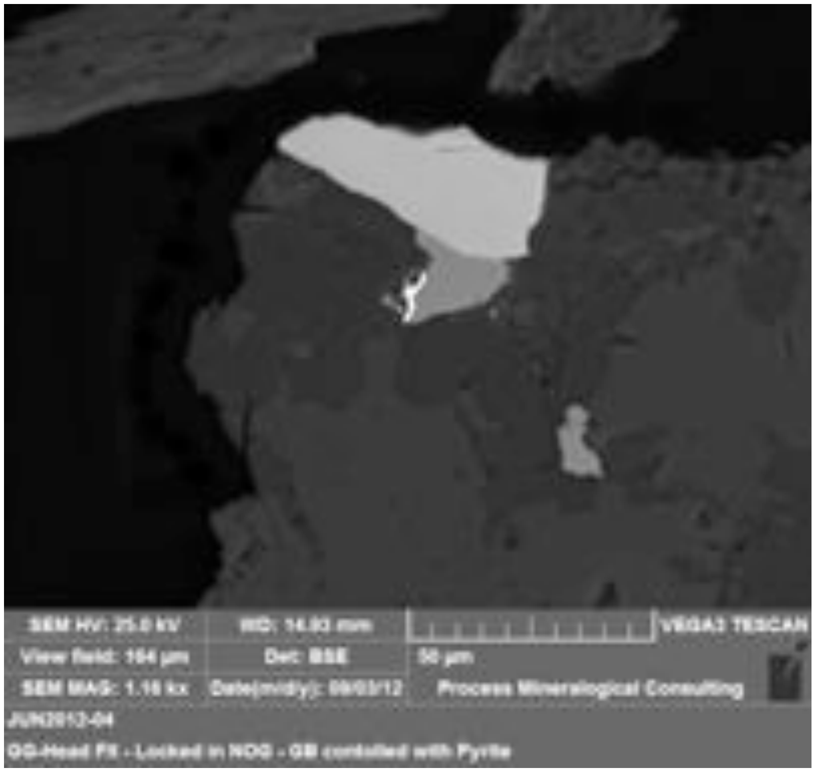

Figure 23: Native Gold locked in Non Opaque Gangue – Pyrite grain boundary

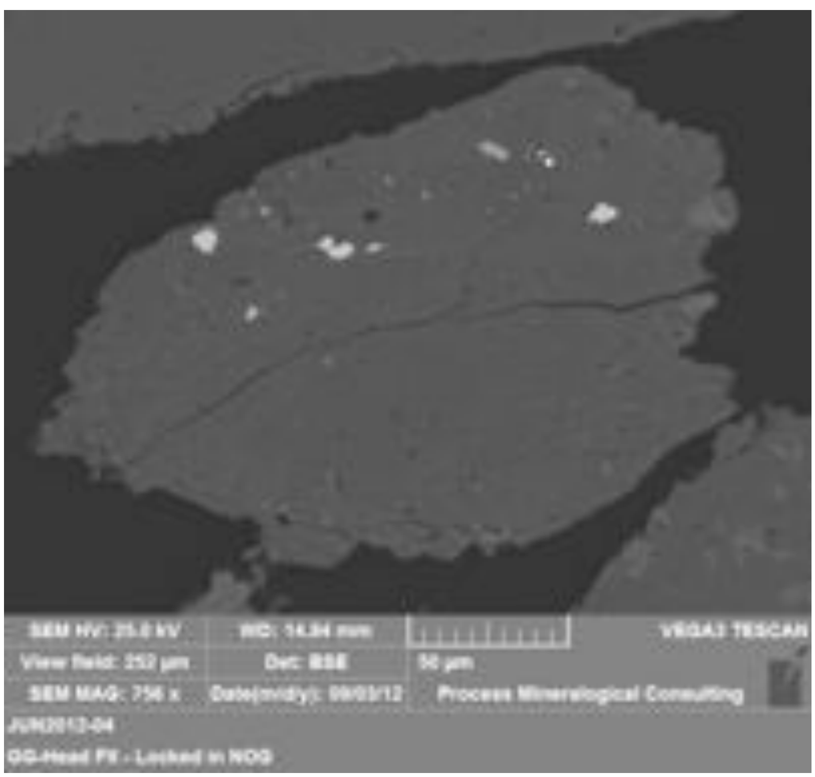

Figure 24: Native Gold locked in Non Opaque Gangue fracture with Pyrite inclusions

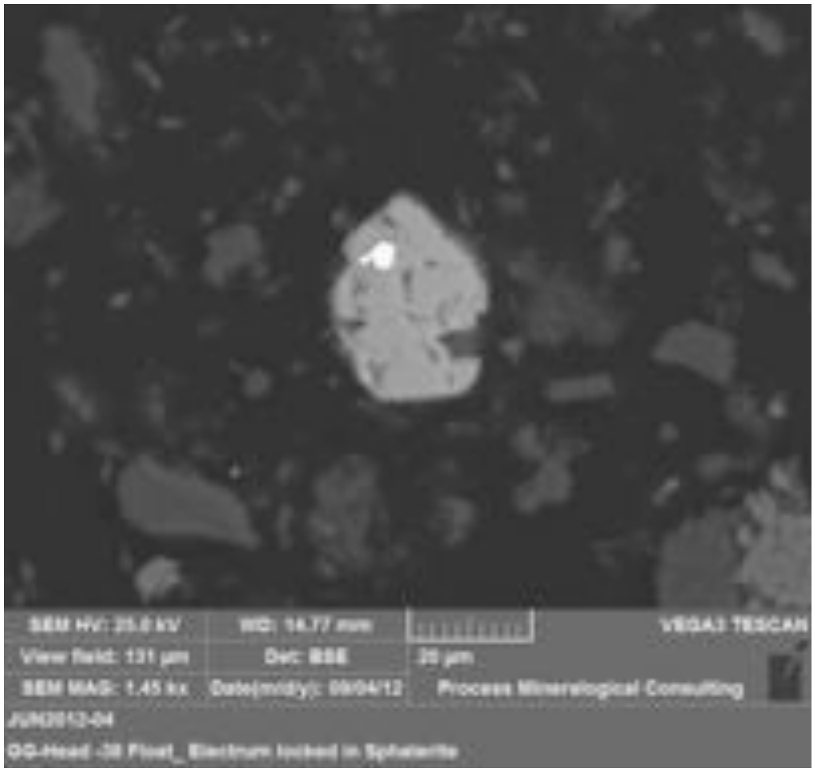

Figure 25: Electrum locked in Sphalerite

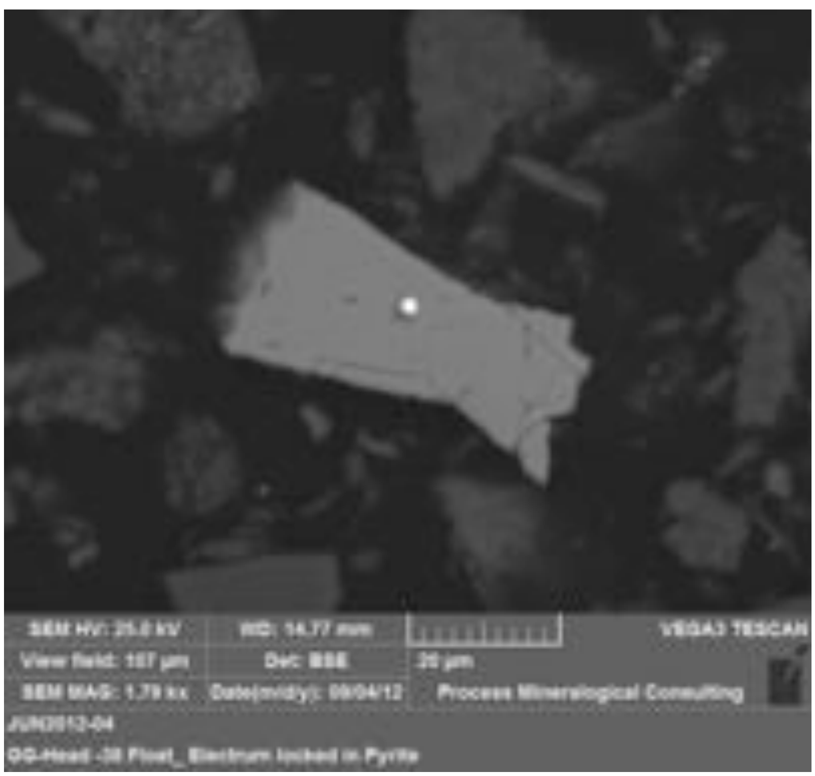

Figure 26: Electrum locked in Pyrite

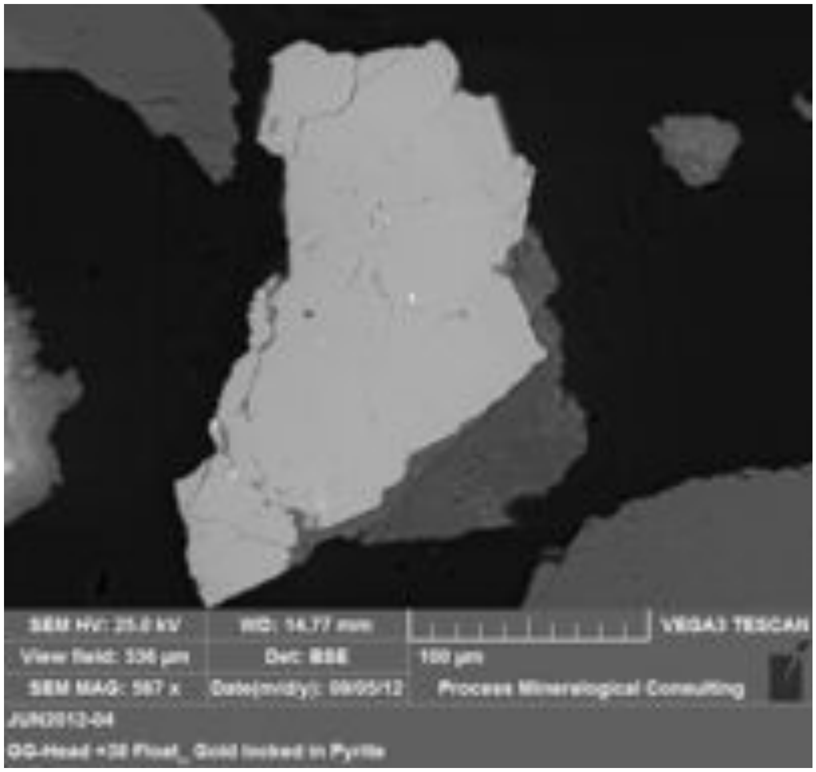

Figure 27: Native Gold Locked in Pyrite with Non Opaque Gangue attached

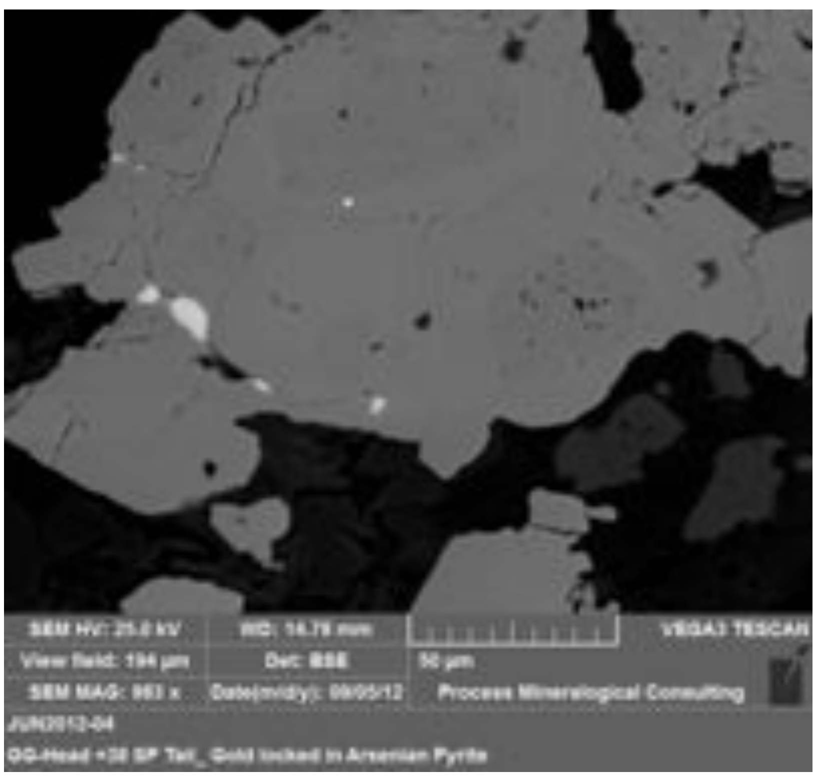

Figure 28: Native Gold locked in Arsenian Pyrite fracture

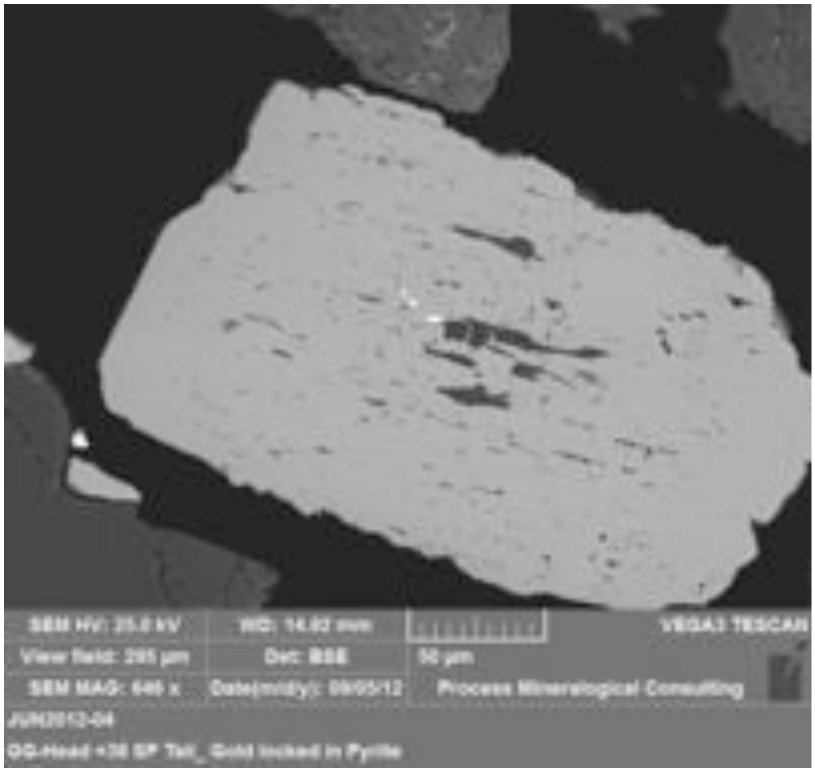

Figure 29: Native Gold locked in Pyrite

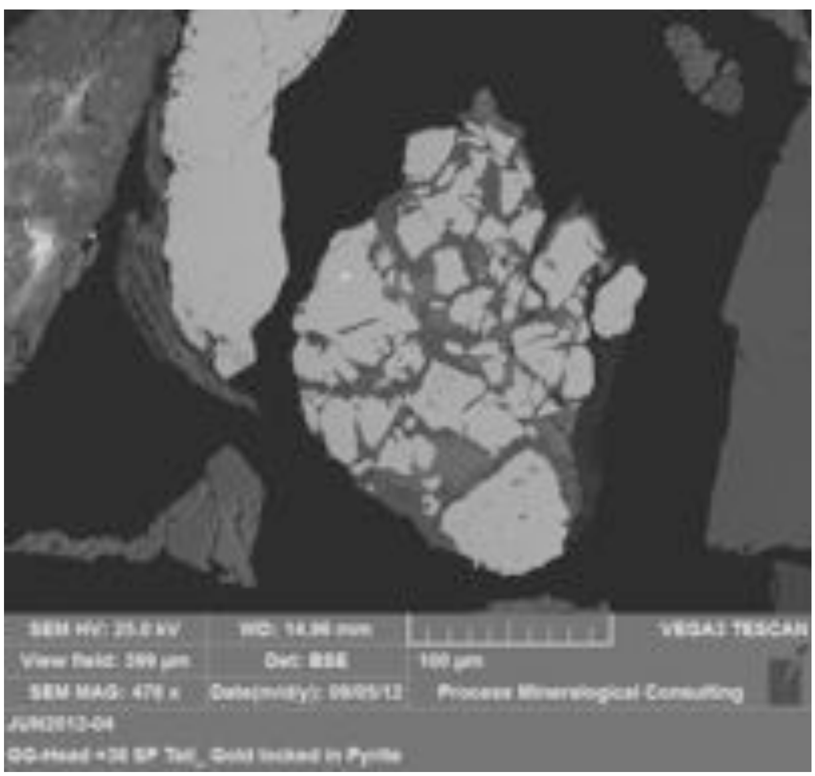

Figure 30: Native Gold Locked in Brecciated Pyrite

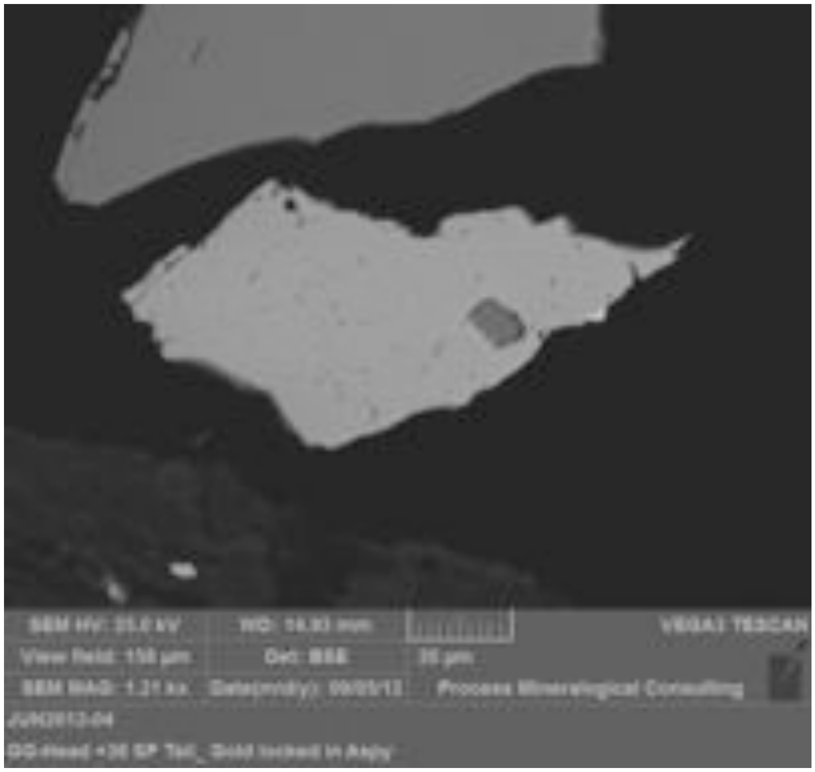

Figure 31: Native Gold Exposed on Arsenopyrite

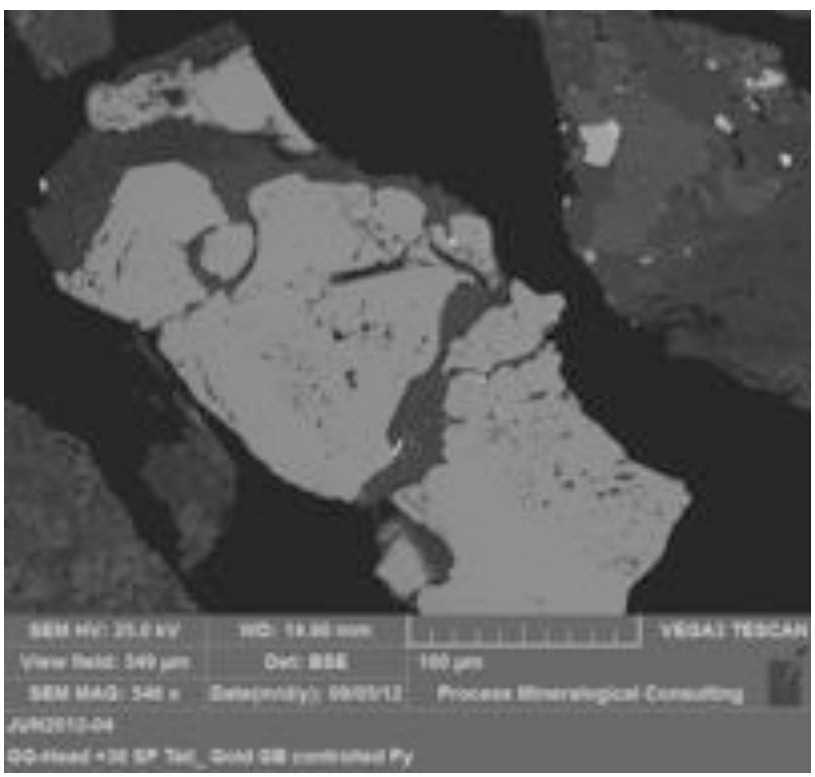

Figure 32: Native Gold locked in Pyrite- Non Opaque Gangue grain Boundary

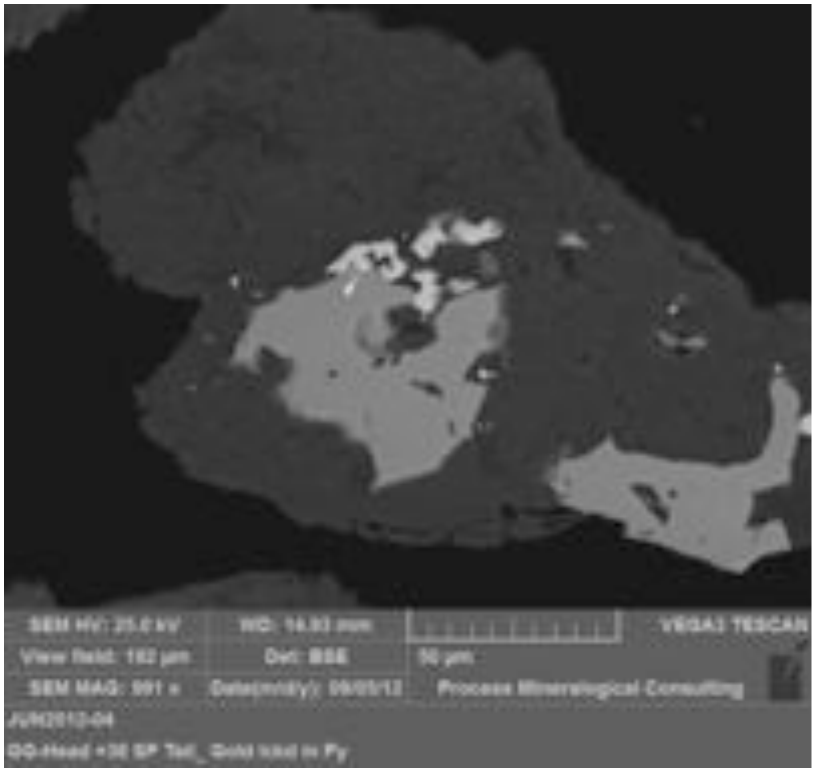

Figure 33: Native Gold locked in Pyrite in Non Opaque Gangue

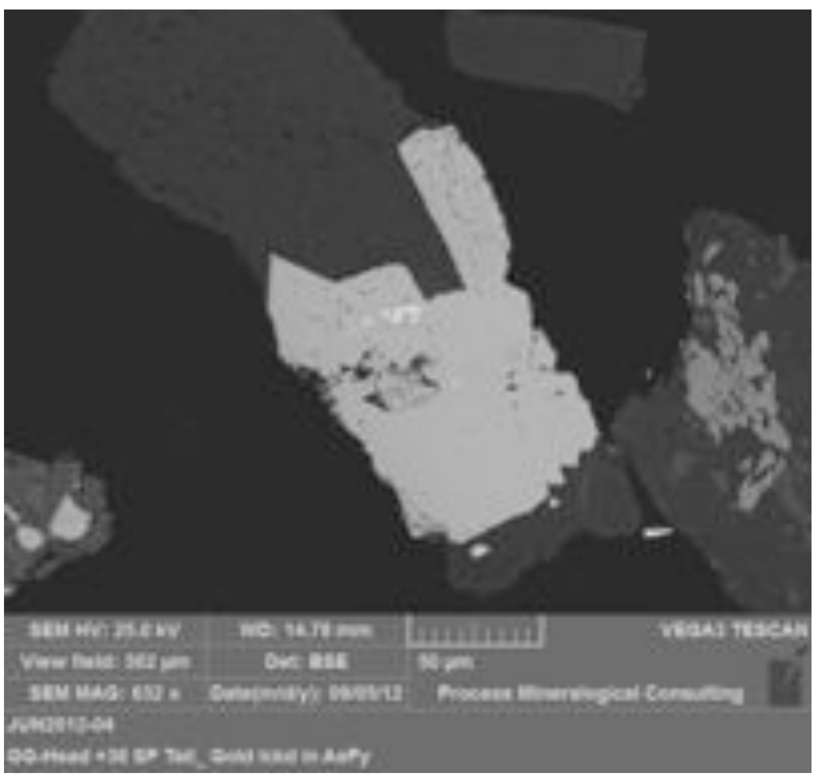

Figure 34: Native Gold locked in Arsenopyrite in Non Opaque Gangue

Appendix 2

Raw Data for All Visible Gold Occurrences

Table 1.1: Raw Data for All Occurrences in XX Head

Gold Grain	Area* (square microns)	Equivalent Diameter* (microns)	Exp. Spherical Volume* (cubic microns)	Ag (Wt.%)	Au (Wt.%)	Mineral	Association Type	Comments
-38 Float	12.2	3.9	32	52	48	Electrum	9	Electrum Locked in Sphalerite
-38 Float	6.5	2.9	12	0	100	Native Gold	3	Attached to Py
-38 Float	1.1	1.2	1	0	100	Native Gold	7	Au attached to Qtz
-38 Float	2.3	1.7	3	0	100	Native Gold	2	Au locked in Py
-38 Midd	67.1	9.2	413	12	88	Native Gold	5	Attached to Arsenopyrite
-38 Midd	5.0	2.5	8	1	99	Native Gold	5	exposed on Arsenopyrite
-38 Midd	2.0	1.5	2	1	99	Native Gold	5	exposed on Arsenopyrite
-38 Midd	0.3	0.6	0	1	99	Native Gold	4	Locked in Arsenopyrite
-38 Midd	0.2	0.5	0	1	99	Native Gold	3	Exposed on Pyrite
-38 Midd	48.5	7.9	254	1	99	Native Gold	3	Binary with pyrite
-38 Midd	4.6	2.4	7	1	99	Native Gold	3	Exposed on Pyrite
-38 Midd	2.0	1.6	2	1	99	Native Gold	3	Attached to pyrite
-38 Midd	21.6	5.2	75	1	99	Native Gold	3	Attached to pyrite
-38 Midd	0.7	0.9	0	1	99	Native Gold	3	Exposed on Pyrite
-38 Midd	0.3	0.6	0	1	99	Native Gold	3	Exposed on Pyrite
-38 Midd	0.9	1.0	1	1	99	Native Gold	5	exposed on Arsenopyrite
-38 Midd	6.2	2.8	12	1	99	Native Gold	8	Attached to Rutile
-38 Midd	20.1	5.1	68	1	99	Native Gold	5	Attached to Arsenopyrite
-38 Midd	1.6	1.4	2	1	99	Native Gold	4	Locked in Arsenopyrite
-38 Midd	5.0	2.5	8	1	99	Native Gold	3	Exposed on Pyrite
-38 Midd	1.7	1.5	2	1	99	Native Gold	4	Locked in Arsenopyrite
-38 Midd	3.2	2.0	6	1	99	Native Gold	2	Locked in Pyrite
-38 Midd	0.5	0.8	0	1	99	Native Gold	3	Exposed on pyrite
-38 Midd	4.1	2.3	6	1	99	Native Gold	1	Free
-38 Midd	0.5	0.8	0	1	99	Native Gold	4	Locked in Arsenopyrite
-38 Midd	0.4	0.7	0	1	99	Native Gold	8	Exposed on Rutile
-38 Midd	18.2	4.8	59	1	99	Native Gold	3	Exposed on Pyrite
-38 Midd	1.0	1.1	1	1	99	Native Gold	3	Exposed on Pyrite
-38 Midd	3.8	2.2	6	1	99	Native Gold	3	Attached to Pyrite
-38 Midd	18.8	4.9	61	1	99	Native Gold	3	Binary with pyrite
-38 Midd	0.8	1.0	1	1	99	Native Gold	2	Locked in Pyrite
-38 Midd	2.1	1.6	2	1	99	Native Gold	2	Locked in Pyrite
-38 Midd	1.0	1.1	1	1	99	Native Gold	2	Locked in Pyrite
-38 Midd	42.6	7.4	209	1	99	Native Gold	3	Attached to Pyrite
-38 Midd	4.5	2.4	7	1	99	Native Gold	3	Exposed on Pyrite
-38 Midd	7.3	3.0	15	1	99	Native Gold	2	Locked in Pyrite
-38 Midd	2.2	1.7	2	1	99	Native Gold	9	Exposed on tetrahedrite
-38 Midd	30.6	6.2	127	1	99	Native Gold	5	binary with Arsenopyrite
-38 Midd	81.0	10.2	549	1	99	Native Gold	1	Free
-38 Midd	0.4	0.7	0	1	99	Native Gold	2	Locked in Pyrite
-38 Midd	1.2	1.3	1	1	99	Native Gold	4	Locked in Arsenoyrite
-38 Midd	0.1	0.3	0	1	99	Native Gold	4	Locked in Arsenoyrite
-38 Midd	0.3	0.6	0	1	99	Native Gold	3	Exposed on Pyrite
-38 Midd	0.8	1.0	1	1	99	Native Gold	3	Exposed on Pyrite
-38 Midd	24.0	5.5	88	1	99	Native Gold	2	locked in tetrahedrite-pyrite
-38 Midd	2.0	1.6	2	1	99	Native Gold	5	exposed on Arsenopyrite
-38 Midd	2.0	1.6	2	1	99	Native Gold	5	exposed on Arsenopyrite
-38 Midd	0.3	0.6	0	1	99	Native Gold	4	Locked in Arsenoyrite
-38 Midd	5.4	2.6	10	1	99	Native Gold	1	Free
-38 Midd	2.8	1.9	3	1	99	Native Gold	4	Locked in Arsenoyrite
-38 Midd	1.1	1.2	1	1	99	Native Gold	4	Locked in Arsenoyrite
-38 Midd	8.3	3.3	18	1	99	Native Gold	4	Locked in Arsenoyrite
-38 Midd	8.1	3.2	17	1	99	Native Gold	3	Exposed on Pyrite
-38 Midd	1.1	1.2	1	1	99	Native Gold	7	Attached to dolomite
-38 Midd	0.7	0.9	0	1	99	Native Gold	7	exposed on dolomite (GB)
-38 Tails	3.1	2.0	4	10	90	Native Gold	1	Free
-38 Tails	1.5	1.4	1	0	100	Native Gold	5	Exposed on Arsenopyrite
-38 Tails	1.9	1.6	2	0	100	Native Gold	2	Locked in Py
-38 Tails	5.0	2.5	8	0	100	Native Gold	6	Locked in Qtz
-38 Tails	2.7	1.8	3	0	100	Native Gold	3	Exposed on Py
-38 Tails	1.1	1.2	1	0	100	Native Gold	5	Exposed on Arsenopyrite
-38 Tails	4.2	2.3	6	0	100	Native Gold	6	Locked in NOG
-38 Tails	8.0	3.2	17	0	100	Native Gold	6	Locked in NOG
-38 Tails	1.5	1.4	1	0	100	Native Gold	6	Locked in NOG

Table 1.2: Raw Data for All Occurrences in XX Head <continued>

Gold Grain	Area* (square microns)	Equivalent Diameter* (microns)	Exp. Spherical Volume* (cubic microns)	Ag (Wt.%)	Au (Wt.%)	Mineral	Association Type	Comments
-38 Tip	67.0	9.2	412	7	93	Native Gold	3	Binary with Pyrite
-38 Tip	0.2	0.5	0	1	99	Native Gold	4	Exposed on Arsenopyrite
-38 Tip	57.5	8.6	328	1	99	Native Gold	1	Free
-38 Tip	2.2	1.7	2	1	99	Native Gold	3	Binary with Pyrite
-38 Tip	2.1	1.6	2	1	99	Native Gold	4	Exposed on Pyrite
-38 Tip	8.0	3.2	17	0	100	Native Gold	1	Free
-38 Tip	6.9	3.0	14	0	100	Native Gold	1	Free
-38 Tip	14.5	4.3	42	0	100	Native Gold	1	Free
+38 Float	6.6	2.9	13	5	95	Native Gold	2	Locked in Pyrite
+38 Float	33.2	6.5	143	3	97	Native Gold	4	Exposed on Py
+38 Float	11.6	3.8	30	3	97	Native Gold	2	Locked in Py
+38 Float	17.1	4.7	53	0	100	Native Gold	6	Locked in Kolfanite
+38 Float	5.5	2.6	10	0	100	Native Gold	6	Locked in monohydrocalcite
+38 Float	2.8	1.9	3	0	100	Native Gold	2	Locked in Pyrite
+38 Float	10.5	3.6	25	0	100	Native Gold	2	Locked in Pyrite
+38 Float	47.3	7.8	245	0	100	Native Gold	2	Locked in Pyrite
+38 Float	2.8	1.9	3	0	100	Native Gold	2	Locked in Pyrite
+38 Float	6.1	2.8	11	0	100	Native Gold	6	Locked in monohydrocalcite
+38 Float	11.0	3.7	27	0	100	Native Gold	4	Locked in Aspy
+38 Float	4.8	2.4	7	0	100	Native Gold	2	Locked in Pyrite
+38 Float	23.7	5.5	87	0	100	Native Gold	2	Locked in Pyrite
+38 Float	2.8	1.9	3	0	100	Native Gold	2	Locked in Pyrite
+38 Float	13.2	4.1	36	0	100	Native Gold	2	Locked in Pyrite
+38 Float	165.6	14.5	1604	0	100	Native Gold	2	Locked in Pyrite
+38 Float	69.3	9.4	434	0	100	Native Gold	2	Locked in Pyrite
+38 Float	105.7	11.6	817	0	100	Native Gold	2	Locked in Pyrite
+38 Float	12.1	3.9	32	0	100	Native Gold	2	Locked in Pyrite
+38 Float	6.6	2.9	13	0	100	Native Gold	2	Locked in Py
+38 Float	2.8	1.9	3	0	100	Native Gold	4	Locked in ArsenianPy rim of Py
+38 Float	7.7	3.1	18	0	100	Native Gold	2	Locked in Py
+38 Float	16.5	4.6	50	0	100	Native Gold	2	Locked in Py
+38 Float	16.5	4.6	50	0	100	Native Gold	2	Locked in Py
+38 Float	8.3	3.2	18	0	100	Native Gold	2	Locked in Py brecciated in FeMgOxide
+38 Float	4.4	2.4	7	0	100	Native Gold	5	Exposed on Aspy
+38 Float	6.6	2.9	13	0	100	Native Gold	6	GB controlled on Py and Chlorite
+38 Float	2.8	1.9	3	0	100	Native Gold	6	GB controlled on Py and Chlorite
+38 Float	9.4	3.5	22	0	100	Native Gold	2	Locked in Py
+38 Float	20.4	5.1	69	0	100	Native Gold	2	Locked in Py
+38 Float	78.1	10.0	520	0	100	Native Gold	2	Locked in Aspy
+38 Float	8.3	3.2	18	0	100	Native Gold	2	Locked in Py
+38 Float	2.8	1.9	3	0	100	Native Gold	2	Locked in Py
+38 Float	13.2	4.1	36	0	100	Native Gold	2	Locked in Py
+38 Float	35.2	6.7	157	0	100	Native Gold	2	Locked in Py
+38 Float	16.0	4.5	48	0	100	Native Gold	2	Locked in Py
+38 Float	2.8	1.9	3	0	100	Native Gold	2	Locked in Py
+38 Float	7.7	3.1	18	0	100	Native Gold	6	GB controlled inclusion in NOG/Py
+38 Float	7.7	3.1	18	0	100	Native Gold	2	Locked in Py
+38 Float	12.7	4.0	34	0	100	Native Gold	2	Locked in Py
+38 Float	2.8	1.9	3	0	100	Native Gold	6	GB controlled inclusion in K-spar/Py
+38 Float	2.8	1.9	3	0	100	Native Gold	6	Locked in NOG
+38 Float	7.7	3.1	18	0	100	Native Gold	2	Locked in Py
+38 Float	26.4	5.8	102	0	100	Native Gold	2	Locked in Py
+38 Float	6.6	2.9	13	0	100	Native Gold	2	Locked in Py
+38 Float	6.6	2.9	13	0	100	Native Gold	6	Locked in NOG
+38 Float	4.4	2.4	7	0	100	Native Gold	7	Exposed on NOG
+38 Float	57.2	8.5	326	0	100	Native Gold	2	Locked in Py
+38 Float	4.4	2.4	7	0	100	Native Gold	6	GB controlled inclusion in Py/NOG
+38 Float	7.2	3.0	14	0	100	Native Gold	6	GB controlled inclusion in Py/NOG
+38 Float	2.8	1.9	3	0	100	Native Gold	2	Locked in Py
+38 Float	8.3	3.2	18	0	100	Native Gold	2	Locked in Py
+38 Float	4.4	2.4	7	0	100	Native Gold	2	Locked in NOG
+38 Float	41.3	7.2	139	0	100	Native Gold	2	Locked in Py
+38 Float	6.6	2.9	13	0	100	Native Gold	2	Fracture control in Py
+38 Midd	67.1	9.2	414	7	93	Native Gold	4	Exposed on Py
+38 Midd	4.4	2.4	7	6	94	Native Gold	5	Exposed on Arsenopyrite

Table 1.3: Raw Data for All Occurrences in XX Head <continued>

Gold Grain	Area* (square microns)	Equivalent Diameter* (microns)	Eqv. Spherical Volume* (cubic microns)	Ag (Wt.%)	Au (Wt.%)	Mineral	Association Type	Comments
+38 Midd	4.4	2.4	7	5	95	Native Gold	5	Exposed on Arsenopyrite
+38 Midd	6.6	2.9	13	3	97	Native Gold	2	Locked in Py
+38 Midd	16.0	4.5	48	0	100	Native Gold	4	Locked in Arsenopyrite
+38 Midd	19.3	5.0	64	0	100	Native Gold	2	Locked in Py
+38 Midd	11.0	3.7	27	0	100	Native Gold	2	Locked in Py
+38 Midd	146.9	13.7	1340	0	100	Native Gold	3	Exposed on Py
+38 Midd	14.3	4.3	41	0	100	Native Gold	2	Locked in Py
+38 Midd	2.8	1.9	3	0	100	Native Gold	2	Locked in Py
+38 Midd	25.9	5.7	99	0	100	Native Gold	3	Exposed on Py
+38 Midd	11.0	3.7	27	0	100	Native Gold	2	Locked in Py
+38 Midd	27.5	5.9	109	0	100	Native Gold	2	Locked in Py
+38 Midd	23.7	5.5	87	0	100	Native Gold	3	Exposed on Py
+38 Midd	7.7	3.1	16	0	100	Native Gold	7	GB controlled inclusion in Py/Nog
+38 Midd	2.8	1.9	3	0	100	Native Gold	2	Locked in Py
+38 Midd	11.6	3.8	30	0	100	Native Gold	4	Locked in Arsenopyrite
+38 Midd	5.5	2.6	10	0	100	Native Gold	2	Locked in Py
+38 Midd	9.4	3.5	22	0	100	Native Gold	2	Locked in Py
+38 Midd	5.5	2.6	10	0	100	Native Gold	3	Exposed on Py
+38 Midd	181.6	15.2	1841	0	100	Native Gold	7	Exposed on Qtz
+38 Midd	6.6	2.9	13	0	100	Native Gold	4	Locked in Arsenopyrite
+38 Midd	79.2	10.0	531	0	100	Native Gold	5	Exposed on Arsenopyrite
+38 Midd	4.4	2.4	7	0	100	Native Gold	2	Locked in Py
+38 Midd	4.4	2.4	7	0	100	Native Gold	2	Locked in Py
+38 Midd	17.1	4.7	53	0	100	Native Gold	2	Locked in Py
+38 Midd	7.7	3.1	16	0	100	Native Gold	2	Locked in Py
+38 Midd	2.8	1.9	3	0	100	Native Gold	2	Locked in Py
+38 Midd	17.6	4.7	56	0	100	Native Gold	2	Locked in Py
+38 Midd	5.5	2.6	10	0	100	Native Gold	4	Locked in Arsenopyrite
+38 Midd	2.8	1.9	3	0	100	Native Gold	2	Locked in Py
+38 Midd	12.1	3.9	32	0	100	Native Gold	2	Locked in Py
+38 Midd	13.2	4.1	36	0	100	Native Gold	4	Locked in Arsenopyrite
+38 Tail	17.6	4.7	23	31	69	Electrum	1	Free
+38 Tail	47.8	7.8	64	26	74	Electrum	7	Exposed on Digenite
+38 Tail	36.7	6.8	49	26	74	Electrum	1	Free
+38 Tail	455.9	24.1	608	25	75	Electrum	1	Free
+38 Tail	2.7	1.8	4	25	75	Electrum	1	Free
+38 Tail	128.4	12.8	171	18	82	Native Gold	1	Free
+38 Tail	340.9	20.8	455	17	83	Native Gold	1	Free
+38 Tip	0.3	0.6	0	0	100	Native Gold	3	exposed on pyrite
+38 Tip	5.3	2.6	9	0	100	Native Gold	2	Locked in pyrite
+38 Tip	2.0	1.6	2	0	100	Native Gold	2	Locked in pyrite
+38 Tip	0.6	0.8	0	0	100	Native Gold	2	Locked in pyrite
+38 Tip	5.1	2.5	9	0	100	Native Gold	2	Locked in pyrite
+38 Tip	16.8	4.6	52	0	100	Native Gold	2	Locked in pyrite
+38 Tip	2.2	1.7	3	0	100	Native Gold	2	Locked in pyrite
+38 Tip	30.9	6.3	129	0	100	Native Gold	3	exposed on pyrite
+38 Tip	29.5	6.1	120	0	100	Native Gold	2	Locked in Pyrite
+38 Tip	2.8	1.9	4	0	100	Native Gold	2	Locked in Pyrite
+38 Tip	5.1	2.5	9	0	100	Native Gold	3	exposed on pyrite
+38 Tip	0.3	0.6	0	0	100	Native Gold	2	Locked in Pyrite
+38 Tip	2.5	1.8	3	0	100	Native Gold	4	Locked in Arsenopyrite
+38 Tip	4.5	2.4	7	0	100	Native Gold	3	Attached to pyrite
+38 Tip	1.1	1.2	1	0	100	Native Gold	2	Locked in Pyrite
+38 Tip	0.3	0.6	0	0	100	Native Gold	7	attached to Tetrahedrite Locked in pyrite
+38 Tip	2.8	1.9	4	0	100	Native Gold	5	exposed on Arsenopyrite
+38 Tip	2.0	1.6	2	0	100	Native Gold	2	Locked in pyrite
+38 Tip	2.5	1.8	3	0	100	Native Gold	2	Locked in pyrite
+38 Tip	3.4	2.1	5	0	100	Native Gold	2	Locked in pyrite
+38 Tip	0.6	0.8	0	0	100	Native Gold	2	Locked in pyrite
+38 Tip	3.4	2.1	5	0	100	Native Gold	2	Locked in pyrite

Appendix 3

Visible Gold Distribution Data by Product

XX Head

Association Summary +38 Float

+38 Float	Type of Association	Frequency	%Weight
1	Free	0	0
2	Locked in Pyrite	39	94
3	Exposed / Attached to Pyrite	1	3
4	Locked in Arsenopyrite	2	1
5	Exposed / Attached to Arsenopyrite	1	0
6	Locked in Non-opaque Gangue	11	3
7	Exposed / Attached to Non-opaque Gangue	1	0
8	Associated with Oxides	0	0
9	Associated with Tetrahedrite or Sphalerite	0	0
Total		55	100

Association Summary +38 Tail

+38 Tail	Type of Association	Frequency	%Weight
1	Free	6	96
2	Locked in Pyrite	0	0
3	Exposed / Attached to Pyrite	0	0
4	Locked in Arsenopyrite	0	0
5	Exposed / Attached to Arsenopyrite	0	0
6	Locked in Non-opaque Gangue	0	0
7	Exposed / Attached to Non-opaque Gangue	1	4
8	Associated with Oxides	0	0
9	Associated with Tetrahedrite or Sphalerite	0	0
Total		7	100

Association Summary +38 Midd

+38 Midd	Type of Association	Frequency	%Weight
1	Free	0	0
2	Locked in Pyrite	18	10
3	Exposed / Attached to Pyrite	5	39
4	Locked in Arsenopyrite	5	3
5	Exposed / Attached to Arsenopyrite	3	11
6	Locked in Non-opaque Gangue	0	0
7	Exposed / Attached to Non-opaque Gangue	2	37
8	Associated with Oxides	0	0
9	Associated with Tetrahedrite or Sphalerite	0	0
Total		33	100

Association Summary +38 Tip

+38 Tip	Type of Association	Frequency	%Weight
1	Free	0	0
2	Locked in Pyrite	16	59
3	Exposed / Attached to Pyrite	4	40
4	Locked in Arsenopyrite	1	1
5	Exposed / Attached to Arsenopyrite	1	1
6	Locked in Non-opaque Gangue	0	0
7	Exposed / Attached to Non-opaque Gangue	0	0
8	Associated with Oxides	0	0
9	Associated with Tetrahedrite or Sphalerite	0	0
Total		22	100

Association Summary -38 Float

	Type of Association	Frequency	%Weight
1	Free	0	0
2	Locked in Pyrite	1	8
3	Exposed / Attached to Pyrite	1	40
4	Locked in Arsenopyrite	0	0
5	Exposed / Attached to Arsenopyrite	0	0
6	Locked in Non-opaque Gangue	0	0
7	Exposed / Attached to Non-opaque Gangue	1	3
8	Associated with Oxides	0	0
9	Associated with Tetrahedrite or Sphalerite	1	49
Total		4	100

Association Summary -38 Tail

	Type of Association	Frequency	%Weight
1	Free	1	8
2	Locked in Pyrite	1	4
3	Exposed / Attached to Pyrite	1	7
4	Locked in Arsenopyrite	0	0
5	Exposed / Attached to Arsenopyrite	2	5
6	Locked in Non-opaque Gangue	4	75
7	Exposed / Attached to Non-opaque Gangue	0	0
8	Associated with Oxides	0	0
9	Associated with Tetrahedrite or Sphalerite	0	0
Total		9	100

Association Summary -38 Midd

	Type of Association	Frequency	%Weight
1	Free	3	28
2	Locked in Pyrite	7	6
3	Exposed / Attached to Pyrite	18	35
4	Locked in Arsenopyrite	9	1
5	Exposed / Attached to Arsenopyrite	9	29
6	Locked in Non-opaque Gangue	0	0
7	Exposed / Attached to Non-opaque Gangue	2	0
8	Associated with Oxides	2	1
9	Associated with Tetrahedrite or Sphalerite	1	0
Total		51	100

Association Summary - 38 Tip

	Type of Association	Frequency	%Weight
1	Free	4	51
2	Locked in Pyrite	0	0
3	Exposed / Attached to Pyrite	3	49
4	Locked in Arsenopyrite	1	0
5	Exposed / Attached to Arsenopyrite	0	0
6	Locked in Non-opaque Gangue	0	0
7	Exposed / Attached to Non-opaque Gangue	0	0
8	Associated with Oxides	0	0
9	Associated with Tetrahedrite or Sphalerite	0	0
Total		8	100

Association Summary +38 Fraction

	Type of Association	Frequency	%Au Distribution
1	Free	6	10
2	Locked in Pyrite	73	19
3	Exposed / Attached to Pyrite	10	31
4	Locked in Arsenopyrite	8	2
5	Exposed / Attached to Arsenopyrite	5	8
6	Locked in Non-opaque Gangue	11	0
7	Exposed / Attached to Non-opaque Gangue	4	29
8	Associated with Oxides	0	0
9	Associated with Tetrahedrite or Sphalerite	0	0
Total		117	100

Association Summary -38 Fraction

	Type of Association	Frequency	%Au Distribution
1	Free	8	19
2	Locked in Pyrite	9	5
3	Exposed / Attached to Pyrite	23	38
4	Locked in Arsenopyrite	10	0
5	Exposed / Attached to Arsenopyrite	11	6
6	Locked in Non-opaque Gangue	4	7
7	Exposed / Attached to Non-opaque Gangue	3	1
8	Associated with Oxides	2	0
9	Associated with Tetrahedrite or Sphalerite	2	22
Total		72	98

Appendix 4
SIMS Report

SSW Reference: 45612.pro Final report

SURFACE SCIENCE WESTERN

BY ELECTRONIC MAIL

October 29, 2012

Mr. Geoffrey Lane
Chief Mineralogist
Process Mineralogical Consulting Ltd.
10630 240th Street
Maple Ridge, B.C. V2W3B2

Dear Geoff,

Attached is the final report on the analysis of your sample that was received in our laboratory on October 1, 2012. The following sample was received: powder sample from one con composite

You requested that we analyze the sample in an attempt to determine the gold content and distribution in selected minerals. Normal turnaround was requested for this work.

METHODOLOGY

The Dynamic SIMS technique is a benchmark technique for analysis of sub-microscopic (invisible) gold in minerals.**The sub-microscopic gold detected and quantified by the Dynamic SIMS instrument is refractory gold, i.e. it is locked within the crystalline structure of the mineral phase (most often in sulphide minerals) and it can not be directly released by the cyanide leach process. This type of gold may be present as finely disseminated colloidal size gold particles (<0.5µm) or as a solid solution within the sulphide mineral matrix.** During the D-SIMS analysis an ion beam removes consecutive layers of material from the surface of the polished mineral grains and generates depth profiles of the distribution of the chosen elements of interest. Examples of D-SIMS depth profiles (Figures 4-7) show the distribution of the basic matrix elements (S, Fe and As) as well as the trace elements, Au and As (for pyrite). **The spikes in the gold signal intensity in the depth profiles represent colloidal gold (Figures 4a and 5a) and the yellow colored areas represent the approximate size of this colloidal type, sub-microscopic gold. The typical size is in the range of 100-200nm.** D-SIMS depth profiles for solid solution sub-microscopic gold show a steady (flat) Au signal similar to the matrix elements but with different levels of intensity depending on the concentration of sub-microscopic gold present in the mineral phase (Figures 5b, 6,7).

The marked mineral particles of interest were analyzed using the Cameca IMS 3F SIMS instrument and concentration depth profiles for Au, As, S and Fe were produced. The quantification of the gold and arsenic was established using internal mineral specific standards. The experimental conditions are described in Appendix A.

SUMMARY

The objectives of this study were to quantify the sub-microscopic gold content in the following minerals: pyrite and arsenopyrite.

The description of the sample analyzed by D-SIMS is provided in Table 1. In total, 93 analyses are provided. Examples of the mineral phases analyzed are presented in Figure 1.

A comparison between the determined Au content among the various analyzed mineral phases and morphological varieties in the sample is presented in Figure 2. In addition to the quantification of sub-microscopic gold in these minerals, the arsenic content in pyrite was measured. The correlations between sub-microscopic gold and arsenic content in different morphological types of pyrite was established, Figure 3.

Major findings:

A. Identified gold carriers:

1. Arsenopyrite: major gold carrier

i) The following different morphological types of arsenopyrite in the sample were identified: coarse, porous and microcrystalline arsenopyrite, Figure 1.

ii) **The estimated average gold concentrations in the various morphological types of arsenopyrite in the sample are as follows, Table 2:**

- **Coarse: 90.94 ppm**
- **Porous: 87.92 ppm**
- **Microcrystalline: 84.25 ppm**

iii) Statistically, 100% of the SIMS concentration depth profiles in arsenopyrite showed presence of solid solution sub-microscopic gold, Figures 6 and 7.

2. Pyrite: major gold carrier

i) The following different morphological types of pyrite in the sample were identified: coarse, porous and microcrystalline pyrite, Figure 1.

ii) The estimated average gold concentrations in the various morphological types of pyrite in the sample are as follows, Table 3:

- **Coarse: 2.33 ppm**
- **Porous: 24.79 ppm**
- **Microcrystalline: 41.17 ppm**

iii) Statistically, 62% of the SIMS concentration depth profiles in pyrite showed presence of colloidal size sub-microscopic gold (Figure 4a), the rest being solid solution sub-microscopic gold, Figure 5b.

iv) There is a positive correlation between the measured sub-microscopic gold concentration in pyrite and the arsenic content, Figure 3.

If you have any questions, or require further assistance, please contact us.

Sincerely,

Brian R. Hart *Stamen Dimov*
Brian R. Hart Stamen Dimov

Research Scientists,
for Surface Science Western

Att./Data

LIST OF CONTENTS

I. Quantification of sub-microscopic gold

The measured gold concentrations are given in Tables 2-3. Concentrations measured in each grain and their average values per mineral type with the corresponding 95% confidence intervals are included in the tables.

Table 1. Description of the sample

Sample ID	Mineral type	# of analyses
SEP2012-01 CONS COMP +38µm MSI403 PS mount M1: SP Tip	Pyrite Arsenopyrite	45 48
Total		93

Table 2: Measured concentrations of sub-microscopic gold in arsenopyrite

PS mount M1					
Arsenopyrite					
Coarse		Porous		Microcrystalline	
Grain I.D.	Au ppm	Grain I.D.	Au ppm	Grain I.D.	Au ppm
m1apc02	48.02	m1app01	468.98	m1apm58	39.64
m1apc07	67.37	m1app01a	134.87	m1apm60	6.74
m1apc08	78.01	m1app03	61.92	m1apm61	35.80
m1apc09	125.93	m1app04	7.40	m1apm62	39.73
m1apc10	18.30	m1app05	60.17	m1apm63	194.65
m1apc12	36.63	m1app06	162.81	m1apm64	188.95
m1apc16	17.77	m1app11	8.41		
m1apc20	426.57	m1app15	180.94		
m1apc22	54.88	m1app17	120.54		
m1apc25	184.54	m1app18	92.48		
m1apc27	4.25	m1app19	6.89		
m1apc28	14.88	m1app21	27.59		
m1apc29	62.23	m1app24	13.73		
m1apc30	34.50	m1app26	126.78		
m1apc33	394.97	m1app32	13.70		
m1apc42	26.11	m1app43	16.40		
m1apc44	4.60	m1app45	22.37		
m1apc51	9.16	m1app47	8.93		
m1apc52	36.34	m1app48	156.41		
m1apc53	23.56	m1app49	67.14		
m1apc59	20.84				
m1apc69a	311.24				
Average	**90.94**		**87.92**		**84.25**
±λ	**53.38**		**48.18**		**68.78**

±λ: 95 % confidence interval
$\lambda = 2\ \sigma/\sqrt{n}$; σ is the standard deviation; n is the number of analyses

Table 3: Measured concentrations of sub-microscopic gold and arsenic in pyrite

PS mount M1								
Pyrite								
Coarse			Porous			Microcrystalline		
Grain I.D.	Au ppm	As ppm	Grain I.D.	Au ppm	As ppm	Grain I.D.	Au ppm	As ppm
m1pyc100	3.48	15513	m1pyp48a	53.38	18370	m1pym119	17.37	17636
m1pyc102	2.32	8199	m1pyp65	58.55	20903	m1pym120	10.52	116071
m1pyc103	1.58	4966	m1pyp66	0.29	2397	m1pym121	3.77	12724
m1pyc104	0.72	4254	m1pyp67	0.31	312	m1pym124	46.77	21248
m1pyc118	10.33	11902	m1pyp68	2.24	12151	m1pym125	127.44	22896
m1pyc122	1.11	2441	m1pyp69	3.06	9083			
m1pyc123	1.16	8346	m1pyp70	2.07	4055			
m1pyc76	3.10	7640	m1pyp71	0.52	3658			
m1pyc83	2.77	14485	m1pyp72	47.57	16286			
m1pyc85	1.79	993	m1pyp73	98.04	25199			
m1pyc87	1.24	3098	m1pyp74	18.33	14737			
m1pyc89	1.01	1312	m1pyp75	1.20	5260			
m1pyc91	1.01	520	m1pyp80	6.15	10086			
m1pyc92	1.38	3298	m1pyp81	52.51	17883			
m1pyc93	3.05	2071	m1pyp82	20.14	10969			
m1pyc94	2.01	901	m1pyp84	23.01	16115			
m1pyc95	0.33	3624	m1pyp86	27.40	17532			
m1pyc97	5.52	10688	m1pyp88	0.81	4528			
m1pyc98	1.48	5328	m1pyp90	1.80	353			
m1pyc99	1.13	2280	m1pyp96	78.49	26086			
Average	**2.33**	**5593**		**24.79**	**11798**		**41.17**	**38115**
±λ	**1.00**	**2052**		**13.32**	**3571**		**45.56**	**39134**

±λ: 95 % confidence interval
$\lambda = 2\ \sigma/\sqrt{n}$; σ is the standard deviation; n is the number of analyses

Table 4: Determined by optical microscopy abundance of morphological types in pyrite and arsenopyrite

	Arsenopyrite		
	Coarse	**Porous**	**Microcrystalline**
Abundance,%	28	58	14
	Pyrite		
	Coarse	**Porous**	**Microcrystalline**
	21	66	13

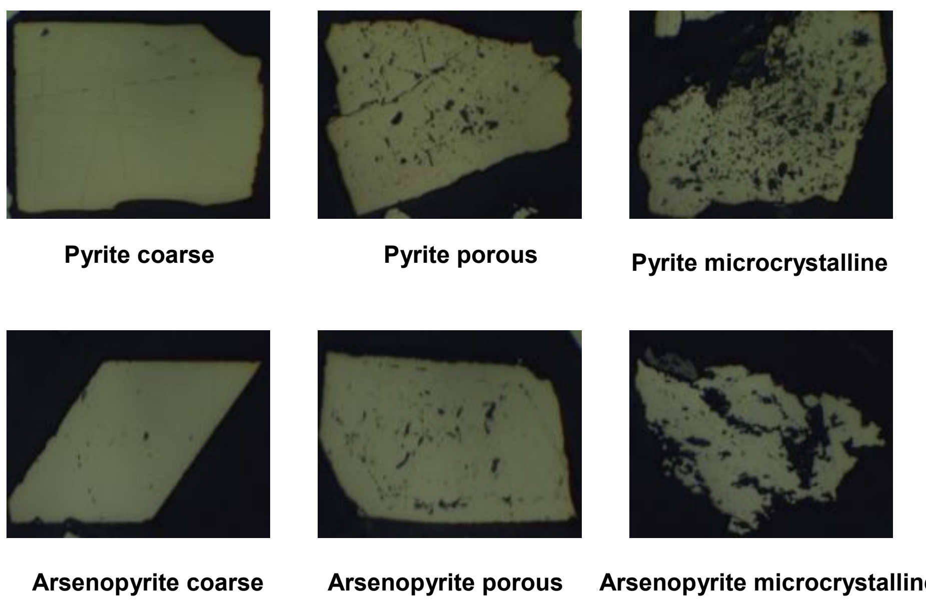

Figure 1. Examples of minerals/morphological types analyzed by D-SIMS

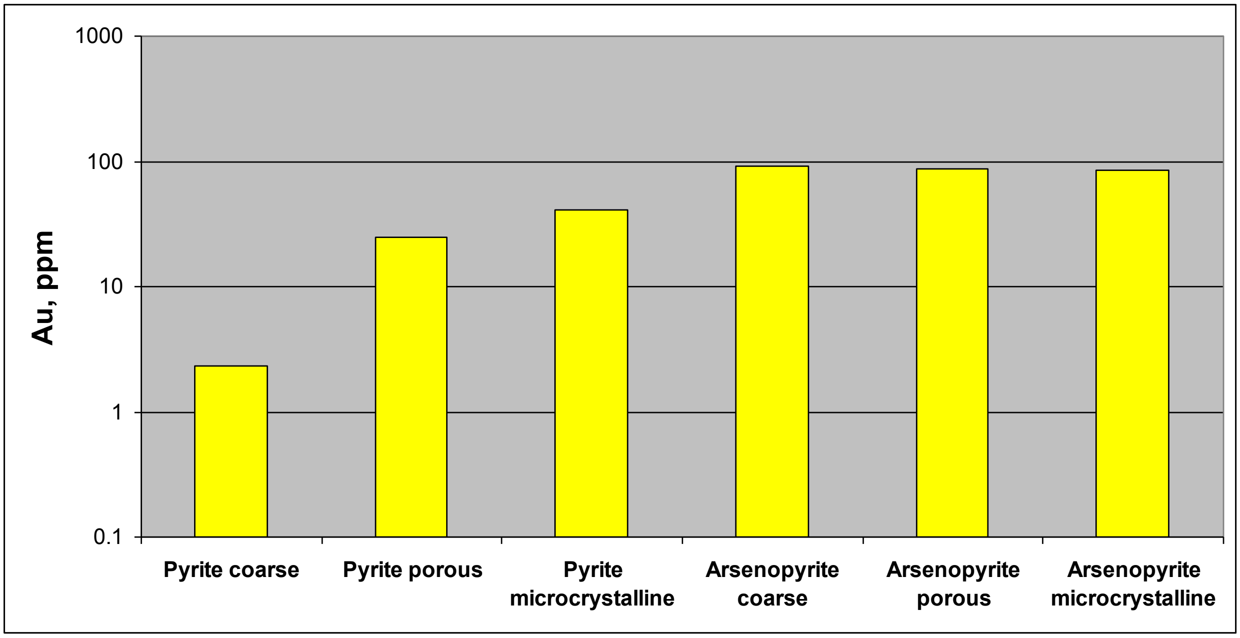

Figure 2. Comparison by mineral phase/morphological type of the measured mean values of sub-microscopic gold concentration.

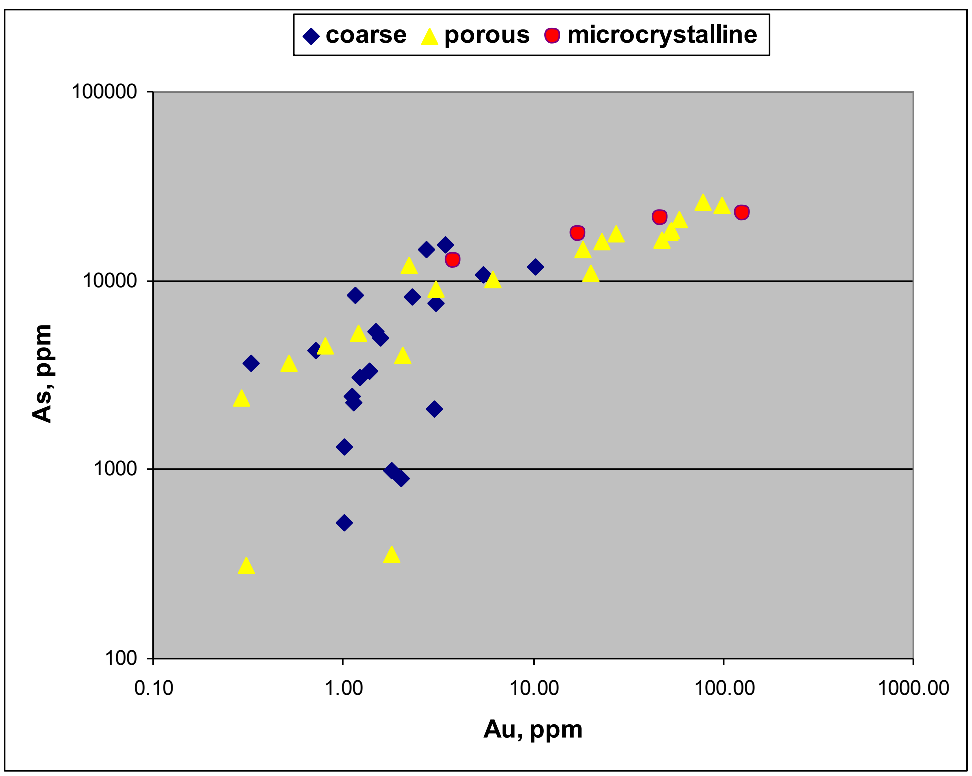

Figure 3. Scatter plot of gold and arsenic concentration in different morphological types of pyrite. Note: Au and As concentrations are plotted logarithmically.

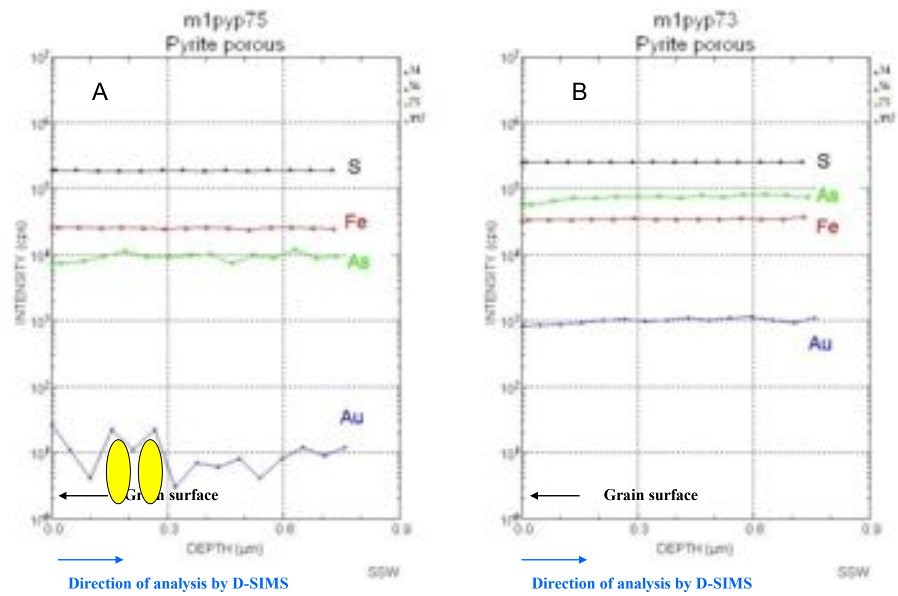

Figure 4. Concentration depth profiles of sub-microscopic gold in pyrite.
A) colloidal size sub-microscopic gold in a porous pyrite grain: Au= 1.20ppm
B) solid solution type sub-microscopic gold in a porous pyrite grain: Au= 98.04 ppm
<u>Note:</u> The spikes in the gold signal intensity in the depth profiles represent colloidal gold and the yellow colored areas represent the approximate size of the colloidal type sub-microscopic gold on the depth scale

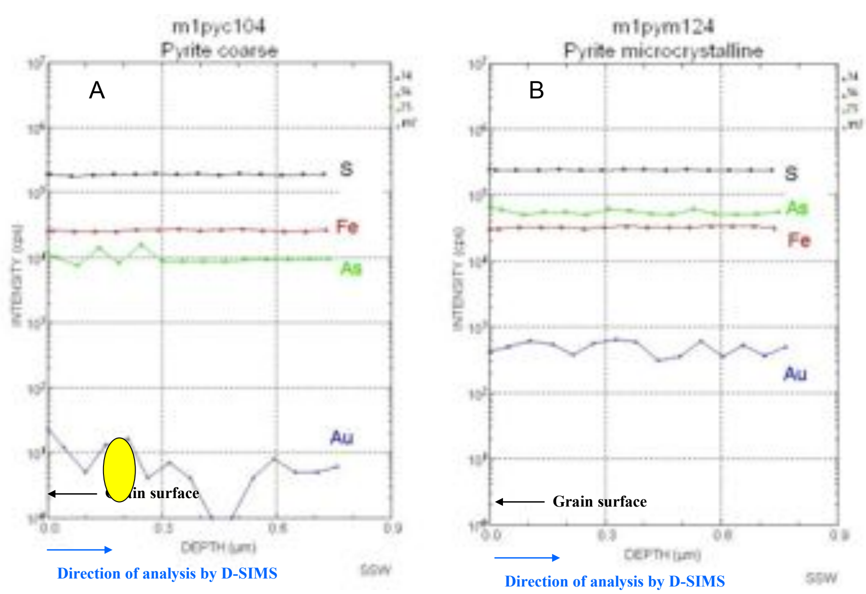

Figure 5. Concentration depth profiles of sub-microscopic gold in pyrite.
A) colloidal size sub-microscopic gold in a coarse pyrite grain: Au= 0.72ppm
B) solid solution/colloidal type sub-microscopic gold in a microcrystalline pyrite grain: Au= 46.77 ppm

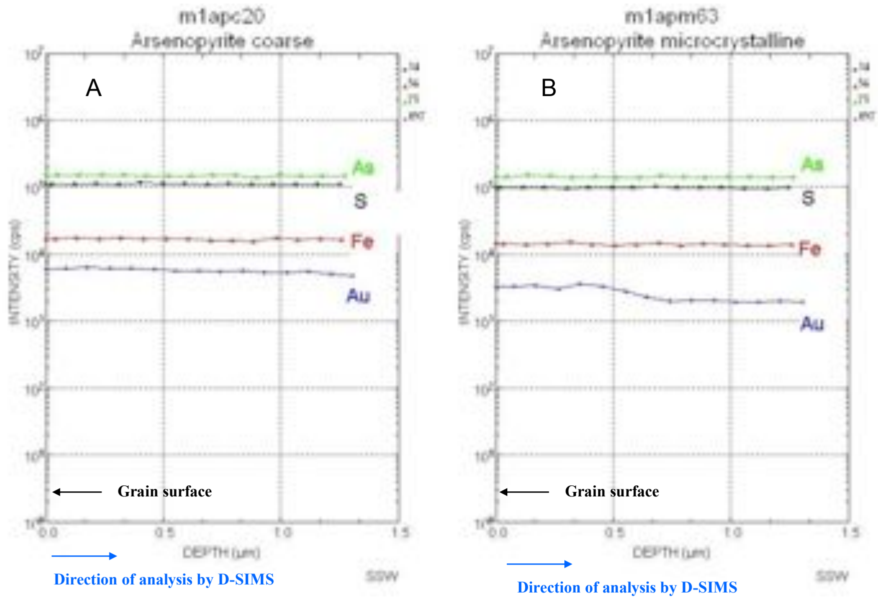

Figure 6. Concentration depth profiles of sub-microscopic gold in arsenopyrite.
A) solid solution type sub-microscopic gold in a coarse arsenopyrite grain: Au= 426.57ppm
B) solid solution type sub-microscopic gold in a microcrystalline arsenopyrite grain: Au= 194.65 ppm

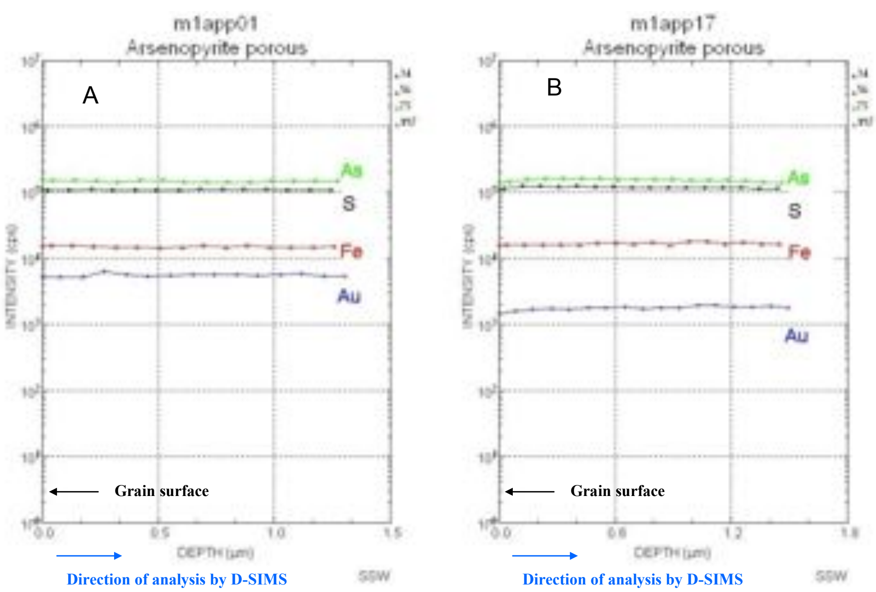

Figure 7. Concentration depth profiles of sub-microscopic gold in arsenopyrite.
A) solid solution type sub-microscopic gold in a porous arsenopyrite grain: Au= 468.98ppm
B) solid solution type sub-microscopic gold in a porous arsenopyrite grain: Au= 120.54 ppm

APPENDIX A

ANALYTICAL TECHNIQUE AND CONDITIONS

Technique: Secondary Ions Mass Spectrometry (SIMS)

Instrument: Cameca IMS-3f

Operating conditions for quantitative analysis:

- Primary ions: Cs^+
- Secondary ions: Au^-, S^-, Fe^-, As^-
- Primary ion energy: 10kV
- Primary current: 15nA
- Primary beam spot size: 15µm
- -180V offset to suppress molecular interferences in depth profile mode