Characterization of the Lac Jeannine Tailings Material

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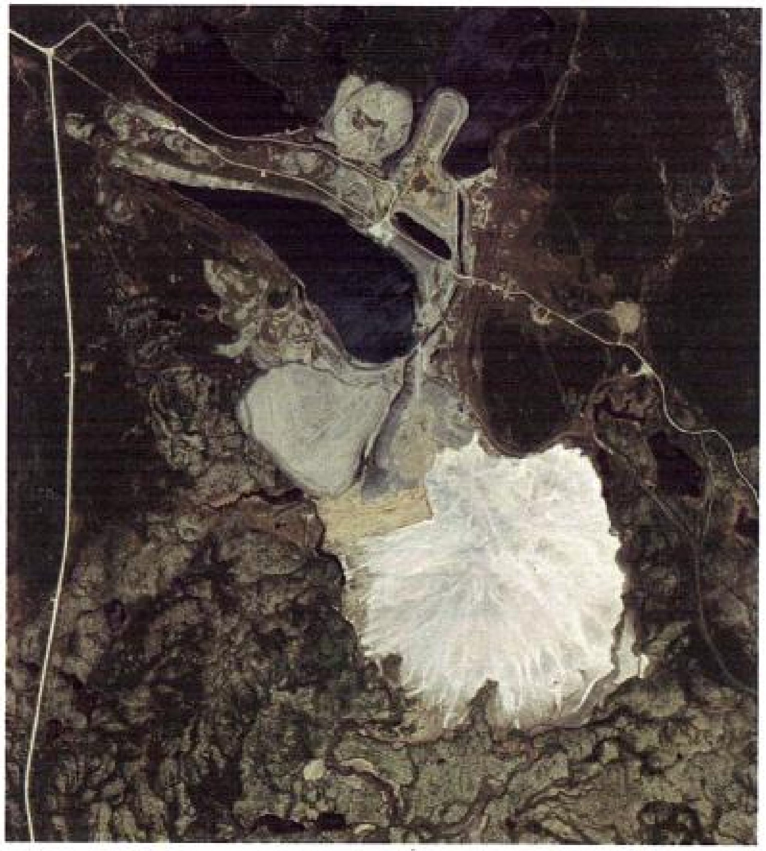

2015-01/01

for

CARTIER IRON CORPORATION

July 18th 2015

STUDY REPORT

Characterization of the Lac Jeannine Tailings Material

Project: 2015-01/01

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EXECUTIVE SUMMARY

François Lavoie (the "Author") was mandated by John Langton, President of Cartier Iron Corporation ("Cartier Iron"), to oversee and lead a test program on a bulk sample of Lac Jeannine tailings material. The purpose of this test program was to characterize the material in order to study the possibility of producing an economic iron oxide concentrate from the tailings.

The tailings at Lac Jeannine comprise an on-site deposit of dry, mainly sand-sized, silica particles and iron-rich fines generated from processing of ore from the former Lac Jeannine Mine open-pit operations (1961-1976). The accessible (sub-aerial) part of the tailings cover approximately 2.7 km^2.

The Author was tasked with a review and compilation of legacy (historic) data and with the supervision of metallurgical tests designed to determine the characteristics of a bulk sample (JLMet15-01), composited from six (6), 45-gallon drums of material that were collected from six sites across the Lac Jeannine tailing dump in October of 2013, using a small excavator (John Deere 85D).

Characterization of sample JLMet15-01 at COREM showed that:

- the material is mainly hematite (iron) and quartz (silica), and grades 9.86% Total iron (FeT);
- the -212 (finer than 212) micron fraction, comprising 16 percent of the sample material mass, is very well liberated (>85%) and contains 55.7% of the recoverable total iron;
- the +600 (greater than 600) micron fraction has a relatively low average liberation (30%) but accounts for 33.3% of the iron, due to its 42% mass-proportion;
- most of the non-liberated iron is present as finely disseminated hematite inclusions in quartz grains, and would require further grinding to liberate.

Previous work ([1] and ***Appendix A***) estimated that the Lac Jeannine site contains a total of 153 Mt of tailings, of which 127 Mt are contained in the sub-aerial tailings pile and are considered to be available for reprocessing. The other 26 Mt of tailings, generated from processing of ore from the Fire Lake Mine, were deposited in the Lac Jeannine open-pit, and are now under water. These estimates were based solely on the calculated dimensions of the disposal area and historic production figures [1].

From samples analysed during the current and previous studies, and based on historical production data [1], it is estimated that the average total-iron (FeT) grade of the Lac Jeannine tailings is between 7.5% and 11% FeT. The 2007 Quinto study [1] reported the likelihood of zones of segregated particle size and grade within the tailing pond. This is to be expected, given what is known of the tails-discharge methods employed at Lac Jeannine, and is typical of most iron-tailings ponds.

It is concluded that:

- reprocessing of the Lac Jeannine tailings should focus on the +600 micron and -212 micron sized fractions, as they contain most of the recoverable iron;
- a drill-coring and analysis program of the tailings would improve understanding of the material segregation within the tailings pile, and could help identify areas with high iron content. The prospective delineation of such zones could have economic implications to the project, potentially generating higher cash flow and faster payback.

An estimation of CAPEX and OPEX related to reprocessing of the Lac Jeannine tailings is currently underway by a third party, and will be reviewed prior to proceeding with further pilot testing.

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1 INTRODUCTION

François Lavoie was mandated by John Langton, President of Cartier Iron Corporation, to supervise a test program on a bulk sample of Lac Jeannine tailings material. The purpose of the test program was to characterize the tailings material in order to determine its potential as a source for an economic iron oxide concentrate.

Cartier Iron owns the mineral claims that encompass the closed Lac Jeannine Mine site, including the tailings from the Lac Jeannine concentrator, which was opened in 1961 to process ore from the Lac Jeannine open-pit iron mine. The tailings material consists mainly of roughly equant hematite and quartz particles and fines, ranging from 1.70 mm to 0.04 mm.

The Lac Jeannine ore-processing plant operated twelve identical processing lines. Following autogenous grinding, iron ore was separated using a gravimetric circuit (spiral classifiers). The iron concentrate from the gravimetric circuit was filtered and shipped to Port-Cartier by rail, whereas the gravimetric tailings were re-cycled to hydro-cyclones for additional processing and separation. Cyclone overflow was thickened using conventional thickener. Cyclone and thickener underflow were combined prior to being pumped to the tailing disposal area. ***Figure 1*** shows the flow sheet for the Lac Jeannine concentrator.

In 1976, at the end of life of the Lac Jeannine Mine, the Lac Jeannine concentrator was used to process ore from the nearby Fire Lake Mine. During the first two years of processing (1977-1978), the Fire Lake tailings were deposited on top of the Lac Jeannine tailings dump; thereafter, the Lac Jeannine open-pit was used as a disposal area.

In 1984 the Lac Jeannine concentrator was shut down and the site reclaimed.

The 2007 Quinto study [1] estimated that 127 Mt are available in the Lac Jeannine tailing dump for reprocessing. An additional 26 Mt of tailings from the processing of Fire Lake ore is contained within the flooded Lac Jeannine open pit, but would only be accessible if the pit were de-watered.

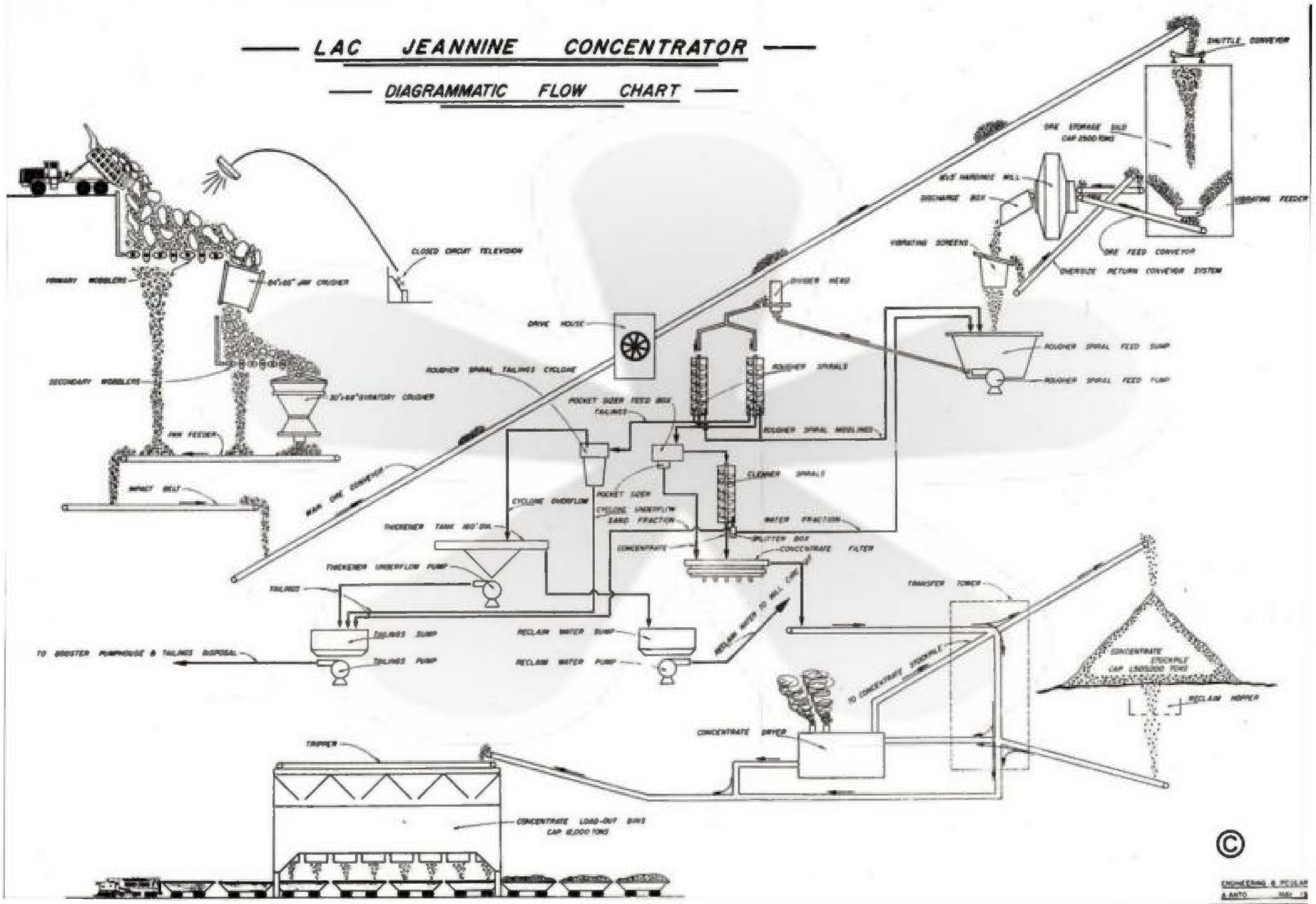


Figure 1: Lac Jeannine concentrator flow sheet

2 PREVIOUS WORK

The following section presents a summary of the previous analytical and metallurgical test work performed on the Lac Jeannine for Quinto Mining Corporation ("Quinto") [1].

Process Research Associates Ltd. (PRA) carried out analyses and metallurgical tests on two (2) Lac Jeannine samples for Bumigeme Inc., who were commissioned by Quinto to conduct a metallurgical assessment and prepare an Opportunity Study on the potential reprocessing of the Lac Jeannine tailings.

Results from all the tests performed are presented in the Quinto and PRA reports [1,2](***Appendix A*** and ***Appendix B***).

Eight grab samples (193201 - 193208), of between 2.0 to 5.5 kilograms, were collected by Phil Boudrias in 2006 from the near-surface of the Lac Jeannine tailings dump, and submitted to PRA for testing. Seven (7) samples (193201, and 193203—193208) were amalgamated into a composite sample (Composite 1), whereas sample 193202 was treated separately.

The following tests were conducted on each sample by PRA:

- Head assay (Whole Rock assay);
- Size distribution;
- Assay by size;
- Davis Tube at 7500 Gauss;

In addition to these tests, a Wilfley Table test was performed on a sub-sample (P_{80}) of Composite 1 that was ground to 184 µm.

Table 1 presents the whole rock assays of sample Composite 1, and the average whole rock assays of sample 193202, whereas ***Figure 2*** and ***Figure 3*** present the particle size distribution (PSD) and assay by size results, respectively.

Table 1: Whole Rock Assays of Sample Composite 1 ([2] - page 3) and Average Whole Rock Assays of Sample 193202 ([2] - page 9)

Sample "Composite 1"	
Iron content (FeT*)	14.10%
SiO_2 content	75.46%
Al_2O_3 content	1.49%
CaO content	0.36%
MgO content	0.29%
Sample 193202	
Iron content (FeT*)	55.60%
SiO_2 content	15.92%
Al_2O_3 content	0.99%
CaO content	0.19%
MgO content	<0.01%

**Note: FeT = %Fe2O3 x 0.6994*

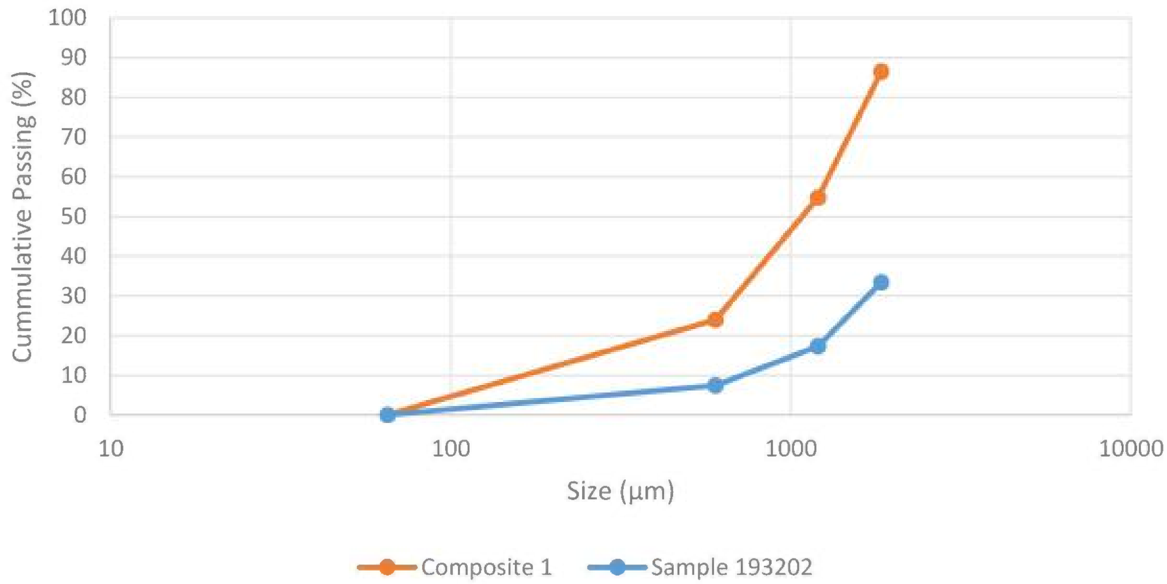


Figure 2: Particle Size Distribution (PSD) of samples composite 1 and 193202 [2]

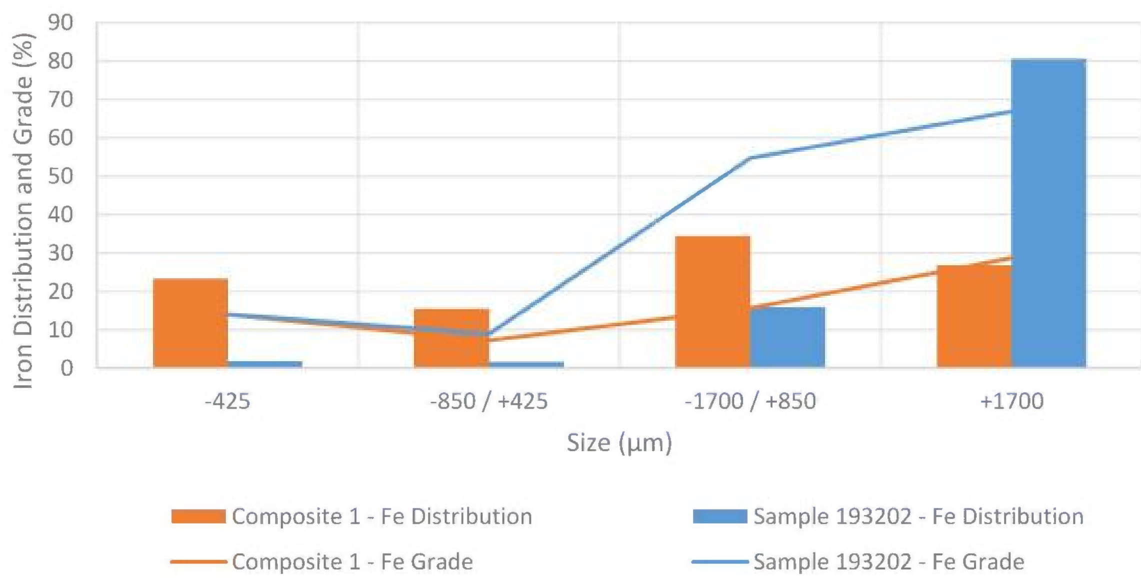


Figure 3: Assay by size of samples composite 1 and 193202 [2]

Although not documented, it is clear from the chemical assay results (***Table 1***) that sample 193202 was a hand-segregated or “cherry picked” quantity of mainly coarse hematite material, and is in no way representative of the tailings material. Accordingly, test work results of sample 193202 have generally been omitted from this Report; however, certain physical characteristics of the sample material are pertinent, and have been referenced.

Geologists from Cartier Iron who visited the tailings in 2013 found small areas of the tailings that were covered by a thin layer of course hematite particles (***Figure 4*** and ***Figure 5***). It seems apparent that one of these areas was the source for sample 193202, which assayed ***79.5% Fe_2O_3*** (55.6% FeT)([2] - page 9).

As no information is available about the locations or collection-procedures employed for any of the samples sent to PRA in 2006, their representativeness is also somewhat dubious, and therefore the results reproduced herein should be considered with caution.

Figure 4: Area of Lac Jeannine tailings with thin layer of coarse hematite particles (silvery-grey area)

Figure 5: Close-up section of Lac Jeannine tailings showing thin layer of coarse hematite particles on top of typical rust-red, sandy tailings material

Results of the Davis Tube tests performed on sample Composite 1 are summarised in ***Table 2***.

Table 2: Davis Tube Results for Sample Composite 1 ([2] - page 6)

Sample Composite 1				
Product	Mass		Assay (%)	Distribution (%)
	grams	%	Fe	Fe
Magnetic concentrate	1.2	0.7	64.8	2.9
Non-magnetic concentrate	184.0	99.3	14.6	97.1
Calculated feed	**185.2**	**100.0**	**15.0**	**100.0**

Sample Composite 1 achieved excellent iron concentrate grades of 64.8% Fe

Iron recoveries from the Davis Tube tests were extremely low (2.9%); however, the main iron bearing mineral at Lac Jeannine is hematite, which is not recovered by Davis Tube tests as the magnetic field generated during testing is insufficient to recover hematite particles. This is corroborated by the Davis Tube results that were performed on sample 193202, which, although comprised mainly of hematite particles, also showed very poor iron recoveries of 0.7% (***Table 3***).

Table 3: Davis Tube Results for Sample 193202 ([2] - page 12)

Sample 193202				
Product	Mass		Assay (%)	Distribution (%)
	grams	%	Fe	Fe
Magnetic concentrate	1.1	0.6	68.5	0.7
Non-magnetic concentrate	197.1	99.4	53.6	99.3
Calculated feed	**198.2**	**100.0**	**53.6**	**100.0**

It is concluded that low intensity magnetic separation (LIMS) should not be retained as an option to process the Lac Jeannine tailings.

Table 4 shows the results of a Wilfley Table separation test performed on sample T1, a sub-sample of Composite 1 that was ground to 184µm prior to the test.

Table 4: Wilfley Table Results for Sample T1 ([2] - page 7)

Sample Composite 1					
Product	Mass		Assay (%)		Distribution (%)
	grams	%	Fe	SiO_2	Fe
Table Concentrate	**477.1**	**17.7**	**62.89**	**8.2**	**80.2**
Table Middlings 1	161.9	6.0	9.01		3.9
Table Middlings 2	**761.5**	**28.2**	**0.73**		**1.5**
Table Middlings 1+2	923.4	34.2	2.18		5.4
Table Tails	1299.9	48.1	4.14		14.4
Total Table Tails	**2223.3**	**82.3**	**3.33**		**19.8**
Calculated Feed	**2700.4**	**100.0**	**13.85**		**100.0**

Wilfley Table tests showed a good upgrade and recovery potential for sample T1; however, the absence of comparable Wilfley Table results on original (non-ground) Composite 1 material makes it impossible to determine if liberation is an issue or not, and hence whether grinding prior to the separation stage would be beneficial.

The determined characteristics of sample Composite 1 are reflective of standard iron-ore gravimetric circuit tails.

3 2015 RESULTS

Six (6) 45-gallons drums were received at COREM in February 2015. Each of the drums contained material collected from a site on the Lac Jeannine tailings dump (***Figure 6***).

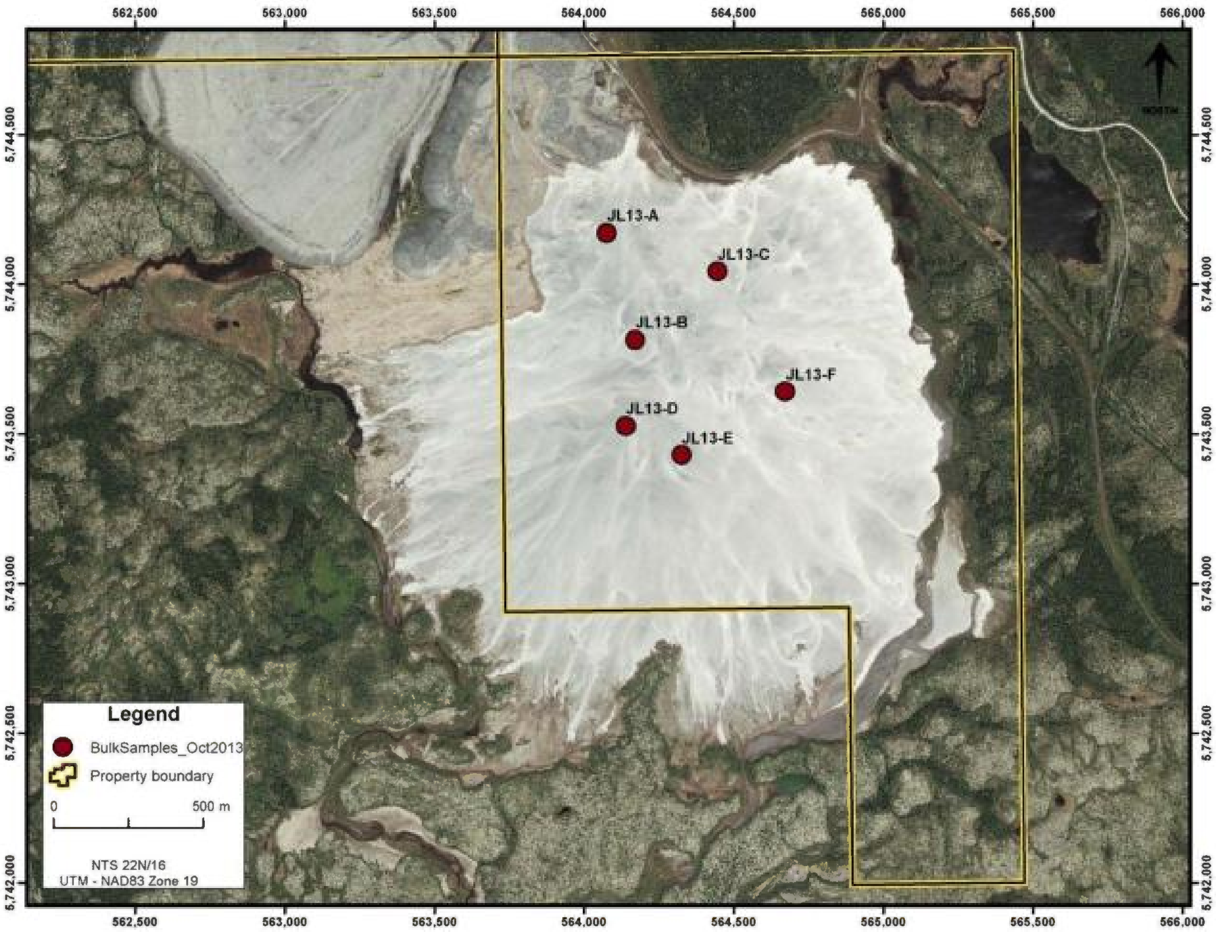


Figure 6: Sample sites of material comprising composite sample JLMet15-01

At each of the six sample sites, a 10-12 foot deep excavation was dug through the layered tailings material using a small (John Deere 85D) excavator. At each of the sites (except JL13-D and JL13-F), the tailings material was placed into five separate piles beside the excavation pit: each of the five piles representing a cumulative 2 foot depth interval in the 10 foot deep excavation. At sites JL13-D and JL13-F, the excavated was placed into one pile. The bulk sample from sites JL13-A and JL13-B was collected by hand-shovel from the five piles of sand. An equal number of shovels was collected from each of the five representative piles of sand and placed into a clean, plastic-lined, 45-gallon drum. At sites JL13-C to JL13-F (inclusive) the sample material was collected using the empty excavator bucket travelling vertically up the side wall of the pit wall and placed into a 45-gallon drum.

In addition to the bulk samples, at sites JL13-A, -B and -E, five point samples were collected, for a total of 15 point samples. Each point sample comprised approximately three shovels-full of material from each of the five individual tailings-sand piles. Thus, one point sample would represent the iron grade of the 2 foot wide interval of sand at that specific depth. The fifteen (15) point samples were sent to COREM and are currently in storage.

Upon reception at COREM the six (6) bulk samples were weighted, dried and homogenized into composite sample JLMet15-01.

After homogenization, a representative sub-sample of JLMet15-01 (approximately three kilograms of the material) was extracted for testing (particle size distribution, assay by size, and qualitative mineralogy).

3.1 MATERIAL CHARACTERIZATION

3.1.1 MATERIAL CHARACTERISTICS

This section presents the results obtained for sample JLMet15-01 and compares them to results reported in the 2007 Quinto study [1].

It is important to note that the characteristics identified as "Quinto 2007" were assumed by the project team at the time and were based on other iron ore operations in the area. No additional samples were gathered for the Quinto 2007 study.

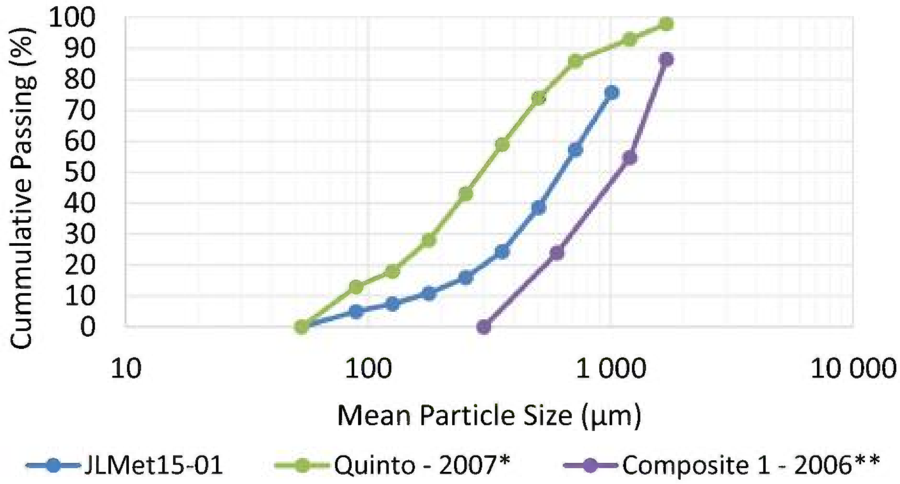
Table 5 presents the head iron grade of JLMet15-01 and the other historical samples.

Table 5: Head Assays of Lac Jeannine Tailings

Source	Iron Grade (% FeT)	Silica Grade (% SiO_2)
JLMet15-01	9.86	84.20
Composite 1	14.10	75.46
Quinto 2007 ([1] - page 3)	7.5	—

Based on historical production data [1] and discussions with other industry experts, the average iron grade average across the Lac Jeannine tailings is estimated at between 7.5 % and 11.0 % Fe. It is certain that the material throughout the tailings dump varies in grade; however, the scale at which the variability is present, and whether high-grade zones could be delineated and preferentially targeted for extraction, is indeterminate.

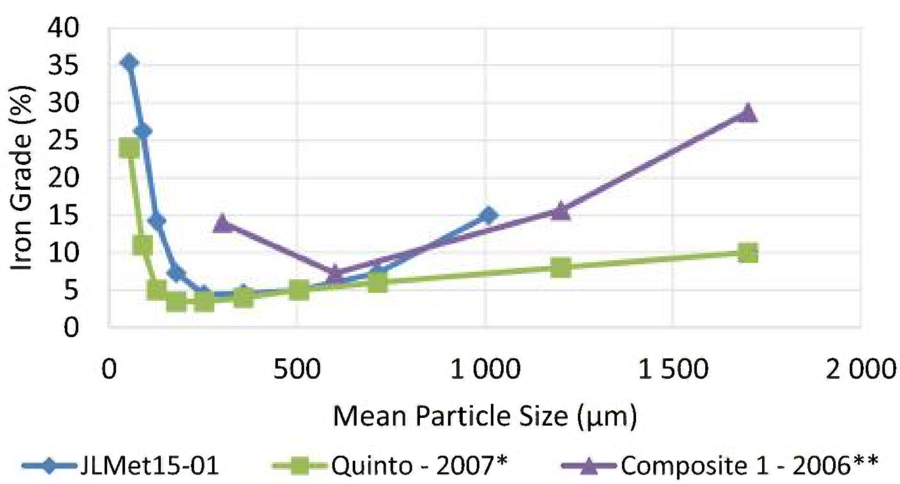
The PSD curves for all available tailings samples are presented in ***Figure 7***. The PSD curves for all the samples JLMet15-01 is quite different from the ones obtained during previous work and is assumed to be due to the heterogeneity of the tailing pond making it hard to collect a representative sample via "classic" sampling procedure.



* Data points for this curve are from Quinto ([1] - Page 21) and are "estimates of the Lac Jeannine average tailings characteristics" ([1] - Page 14). They are not supported by actual sample data.
** Data points for this curve are from PRA ([2] - Page 5).

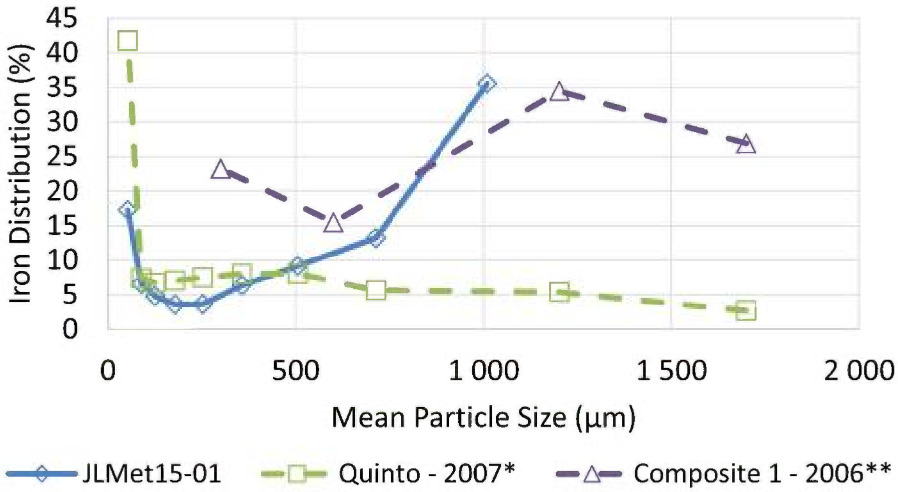
Figure 7: Particle Size Distribution (PSD) curves for Lac Jeannine tailings

Figure 8 and ***Figure 9*** present the iron grade of the different size fractions, and the distribution of the iron units across the size fractions respectively.



* Data points for this curve are from Quinto ([1] - Page 21) and are "estimates of the Lac Jeannine average tailings characteristics" ([1] - Page 14). They are not supported by actual sample data.
** Data points for this curve are from PRA ([2] - Page 5).

Figure 8: Assay by size - Lac Jeannine tailings



* Data points for this curve are from Quinto ([1] - Page 21) and are "estimates of the Lac Jeannine average tailings characteristics" ([1] - Page 14). They are not supported by actual sample data.

** Data points for this curve are from PRA ([2] - Page 5).

Figure 9: Iron Distribution across size range

Figure 9 shows that iron is mainly distributed in the fine (-212 µm) and coarse (+600 µm) fractions of the material. This is consistent with tailings data from other iron processing operations, such as ArcelorMittal's Mount Wright Mine and Cliffs Natural Resources' Bloom Lake Mine (closed), that employ spirals for gravimetric separation, like the former Lac Jeannine operation.

Bazin [3] states that spiral separators are known to be less efficient at recovering iron oxide particles with diameters at the extremes of the particle size distributions, signifying that the iron distribution curve obtained for sample JLMet15-01 is normal.

It is known that the hydraulic deposition process used to deposit the tailing material across the pond will result in a natural segregation of the particles, dependent on their size and specific gravity; it is normal to observe a gradient of grade and size, as a function of the distance from the discharge point. The discharge point at the Lac Jeannine tailings dump changed during the life-span operations, imparting an additional variable to the dispersion of the material characteristics across the tailing pond.

To establish that iron-grades are not uncharacteristically elevated at certain levels in the tailings pile, it is recommended to carry out vertical drilling through the entire tailings pile, using a system that preserves a complete core-section that can then be analyzed for material characteristics and grade.

3.1.2 QUALITATIVE MINERALOGY

A qualitative mineralogy study (T-1807) was performed at COREM on the JLMet15-01 sample, and is included as ***Appendix C***. The study confirms that hematite and quartz are the two main mineral species present in the Lac Jeannine tailings material.

Table 6 presents a summary of the qualitative mineralogy performed on JLMet15-01. The fraction finer than 212 microns was identified as "well liberated", but represents only a small portion, by mass, of the sample material, whereas the fraction coarser than 600 microns was identified as having "low to medium liberation", but represents the majority, by mass, of the tested material.

Table 6: Qualitative Mineralogy Summary

Size Fraction	Fe_2O_3 (%)	FeT(Total) (%)	SiO_2 (%)	Al_2O_3 (%)	Weight (%)	Iron Oxide Liberation	
+850	21.4	15.0	77.2	0.6	24.2	40%	60%
-850/+600	10.4	7.3	88.4	0.6	18.4	20%	40%
-600 / +425	7.1	5.0	92.0	0.6	18.8	20%	40%
-425 / +300	6.5	4.5	91.1	1.2	14.2	30%	50%
-300 / +212	6.3	4.4	92.4	0.8	8.4	50%	70%
-212 / +150	10.4	7.3	86.4	1.4	5.0	70%	90%
-150 / +106	20.4	14.3	76.1	1.4	3.4	>	90%
-106 / +75	37.5	26.2	58.8	1.2	2.6	>	90%
-75	50.6	35.4	46.0	1.1	5.0	>	90%

The mineralogical study also reveals that most of the non-liberated iron oxide particles are present in the form of fine inclusions in quartz particles. Liberation of this fraction of the iron would require an economically prohibitive amount of additional grinding.

The data in ***Table 6*** were used to determine the "recoverable iron distribution" (***Figure 10***), which is defined as the repartition of the liberated iron particles across the size distribution range. For example, ***Figure 10*** shows that 28% of the recoverable iron particles are contained in the +850 microns size fraction.

Based on the results presented in ***Table 6*** and ***Figure 10***, the reprocessing of the Lac Jeannine tails should focus on the -212 micron and +600 micron fractions, as they account for 89% of the recoverable iron contained in the tailing material, although they only constitute 58% of the total mass of the material.

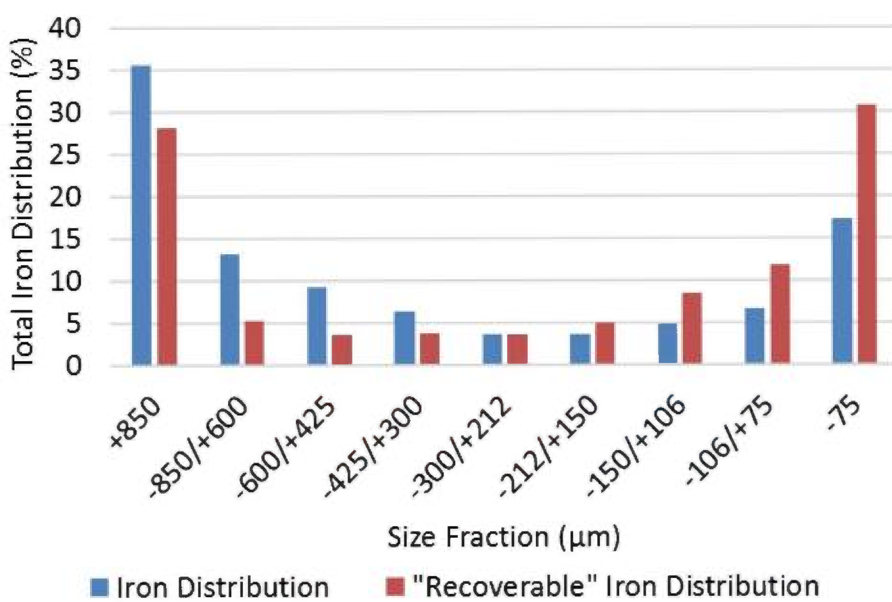


Figure 10: Recoverable iron distribution

3.2 PILOT-SCALE TESTING

Based on the results disclosed herein, there are no fundamental obstacles to producing an economic grade (+65%) iron oxide concentrate from the Lac Jeannine tailings using conventional processing and beneficiation methods. The main factors impacting the viability of the project at this stage are the economic considerations.

Following discussions with representatives of Mineral Technologies, Australia (http://mineraltechnologies.com.au/) and Cartier Iron, it was deemed unnecessary to proceed with additional pilot-scale testing of the material at this time. Instead, Mineral Technologies was given the go-ahead to produce a preliminary CAPEX and OPEX estimate for a Lac Jeannine tailings-reprocessing operation.

4 CONCLUSIONS & RECOMMENDATIONS

The historic and recent analytical results indicate that the total iron (FeT) content of the Lac Jeannine tailings is between 7.5% and 11%, with most of the valuable iron units concentrated into the fine (-212 micron) and coarse (+600 micron) fractions. The bulk of the tailings (+212 to -600 microns) comprise quartz (silica) particles.

Following discussions with representatives of Mineral Technologies, it was concluded that the reprocessing of just the -212 micron fraction was likely the most economically viable option, as reprocessing of the +600 micron fraction, in addition to the -212 fraction, would require a more complex process flow sheet, and therefore additional processing equipment.

Efficient reprocessing of the -212 micron fraction could be achieved using magnetic separation alone; no regrinding of this fraction would be required due to its high level of liberation (>85%).

Capital cost for a modular plant was approximated by Mineral Technologies to be between $10M and $17M dollars (CAD).

Based on the assays-by-size results at COREM and the design criteria outlined in ***Table 7***, payback for such a plant, processing tailing material with an average grade of 9% FeT, would be between 10.5 months to 1.5 years, based on the conceptual mass-balance presented in ***Table 8*** and the conceptual design criteria showed in ***Table 7***.

Table 7: Conceptual Processing Plant Design Criteria

Item	Value	Units
Mass Balance		
Feed Tonnage	1500	t/h
Feed Total Iron Grade	9	%Fe
WY to Screen Oversize	0.33	%
Hydrocyclone Weight Split to Underflow	84.08	%
Hydrocyclone Iron distribution to Overflow	32.14	%Fe
Magnetic separation Iron Recovery	69.08	%
Final Concentrate Iron Grade	63	%Fe
Economics		
Number of days per year	365	Days
Number of months operating per year	6	Months
Hours operating per day	24	Hours
Utilization	90	%
Concentrate Selling Price	60	$/t

Table 8: Conceptual Mass Balance

Item	Dry Tonnage (t/h)	Total Iron Grade (%Fe)	Global Iron Recovery (%)	Global Weight Recovery (%)	Unit Iron Recovery (%)	Unit Weight Recovery (%)
Feed Dry Hopper						
Dry Hopper Feed	1500.0	9.0	100.0	100.0	100.0	100.0
Vibrating Screen						
Vibrating Screen Oversize	5.0	9.0	0.3	0.3	0.3	0.3
Vibrating Screen Undersize	1495.0	9.0	99.7	99.7	99.7	99.7
Cyclone						
Cyclone Overflow (-212μm)	238.0	18.2	32.0	15.9	32.1	15.9
Cyclone Underflow	1257.0	7.3	67.6	83.8	67.9	84.1
Magnetic Separation						
Magnetic Fraction - Final Concentrate	47.4	63.0	22.1	3.2	69.1	19.9
Non-Magnetic Fraction	190.6	7.0	9.9	12.7	30.9	80.1

Figure 11 presents the sensitivity of annual revenue to the tailings FeT grade. ***Figure 11*** was developed using a fixed iron recovery and assumes that the proportion of the iron particles contained in the -212 micron fraction is constant, which is considered conservative.

From ***Figure 11***, feeding the reprocessing plant at a grade of 14% FeT would decrease the payback time to between 7 months and 1 year.

Figure 11: Tailing iron grade versus conceptual annual revenue

It is recommended to plan a drilling campaign of the Lac Jeannine tailings.

The aim of this drilling campaign will be to map the material characteristics, including grade and particle size distribution, across the site in order to:

1. identify any potential iron-rich zones;
2. develop an exploitation strategy;
3. develop the appropriate flow sheet for processing.

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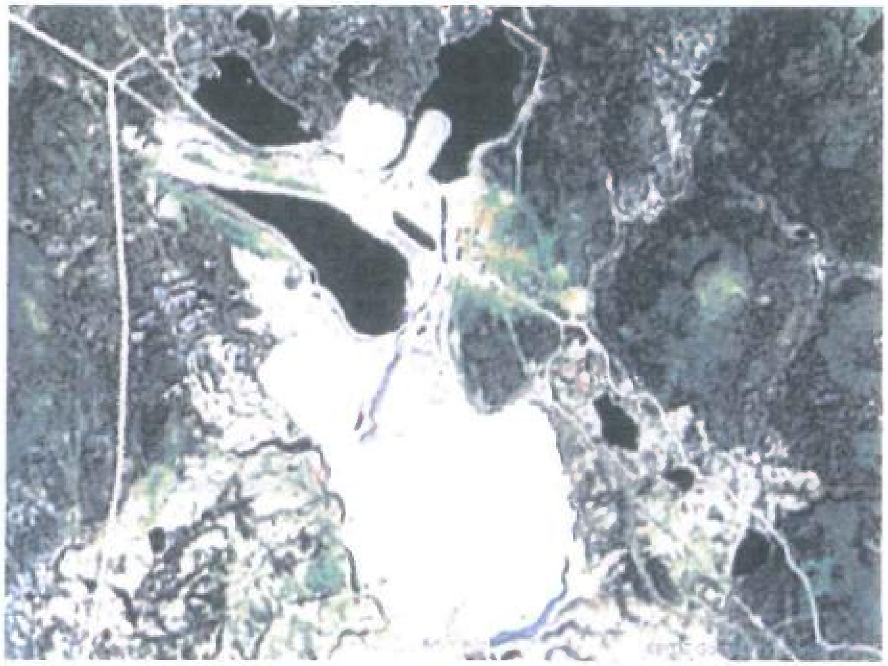
2. Process Research Associates Ltd., 2006 (*now Inspectorate Exploration and Mining Services Ltd., Metallurgical Division*). Summary of Metallurgical testing of Samples from Quinto Technology Inc., October 2006 - Project No. 0607009.
3. Bazin C. (2014), Simulation of an Iron Ore Concentration Circuit Using Mineral Size Recovery Curves of Industrial Spirals; Canadian Mineral Processors (CMP) 2014 Proceedings

APPENDIX A: QUINTO 2007 REPORT

QUINTO MINING CORPORATION



Opportunity Study

Beneficiation of the Lac Jeannine Tailings – Release 1

Original

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July 2007

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1. EXECUTIVE SUMMARY

BUMIGEME Inc. and Soutex have conducted the metallurgical assessment of the opportunity study concerning the tailings reprocessing of the following properties: Lac Jeannine and part of Fire Lake.

Total tailings are evaluated at 180 Mt grading 7.5% Fe. Of these, 127 Mt could be recovered for processing in the Lac Jeannine tailings dump. Most of the 26 Mt of additional tailings that was pumped in the old Lac Jeannine open pit before the closure of the Fire Lake mine could become available if the pit is unwatered.

The nature of the deposit is heterogeneous as segregation in size and chemical composition took place during the tailings dumping operation. The sample shipped to PRA reflects a zone in the dump where coarse iron rich particles settled. The gravity separation method on an already enriched zone will usually give better results than what would be expected from a low grade deposit such as the Lac Jeannine tailings. The test work performed by PRA show a certain upgrading potential for the iron rich material such as the one from the collected sample. Further material characterization is needed to validate the real content of the tailings dump in terms of grade, size distribution and iron bearing particles liberation. This work would then serve as a basis for further assessment and metallurgical test work.

A possible process which would eliminate the need for regrinding the tailings to lower capital expense is introduced. However iron recovery in the 40-50% range is expected.

Exploiting the iron rich zone only is not considered a valid method as the available tonnage of such zone is likely to be low. By defining the iron rich zone better and obtaining a good tonnage estimate, the processing of such material could be used in an operating strategy for possible faster payback. The processing of the lower grade zone would then have to be characterized to evaluate longer term potential. Process flowsheets could eventually be prepared to optimize the treatment of both types of material.

No environmental issue from the past operation is regarded as having a possible impact on the reprocessing project. However, a thorough characterization of the site prior to any decision to go into production would be advised. Tailings reprocessing would fall under the actual mining regulations thus needing approval through the Certificate of Authorization (CofA) request process. A state of the art designed area for tailings deposition would need to be built. Environmental monitoring of water effluents and restoration plan for affected areas would also need to be addressed in CofA request. Unwatering of the former Lac Jeannine open pit would need special environmental assessment such as validating if fishes are present in the pit prior to obtaining a green light.

In short, the reprocessing of the Lac Jeannine tailings is possible but is deemed technically hazardous.

2. CONCLUSIONS

2.1 RESERVE ESTIMATION AND CHARACTERIZATION

- Tailings tonnage in the tailings dump is estimated at 154 Mt
  - Average grade: 7.5% Fe
  - 127 Mt available for mining and milling purposes.
- Tailings tonnage in the former Lac Jeanine open pit is estimated at 26.6 Mt
  - Average grade: 7.5% Fe
  - Most material available for mining and milling purposes following pit unwatering.
- Selective exploitation of Fe rich zones doesn't appear promising due to relatively low tonnage that can be expected although:
  - Sampling procedure given would help define the Fe enriched zone to define operating strategies;
  - Evaluate overall reserve potential in the case Fe rich zone is first exploited.

2.2 MINERAL PROCESSING ASPECTS AND METALLURGICAL TESTS REVIEW

- Tests performed on sample named Composite 1 show that:
  - Coarser or richer material segregation likely occurred during the tailings deposition;
  - Magnetic separation does not appear a promising technology for Lac Jeannine tailings;
  - The Wilfley tables used give better results than what is to be expected from industrial gravity methods (hydraulic classifiers, spirals, etc.);
  - A beneficiation potential may exist with the deposit and tests need to be performed on representative samples to confirm the extent of the possibilities.
- Based on the expertise gained in the Quebec North Shore-Labrador iron ore operations it can be said that:
  - Most of the iron lost to Humphrey spirals tailings is in the finer (-75 um) fraction;
  - Efficient iron recovery from the fine fraction is a technical challenge;
  - Suggested flowsheet in its simplest form would allow for a less than 50% iron recovery;

- Expected concentrate grade would be in the 62-63% Fe range to maintain an acceptable recovery level using a very simple flowsheet;
- A more complex flowsheet could result in a standard concentrate grade (65% Fe and more) but in depth testwork is required;
- Very few potential customers;
- Possible presence of contaminants.

2.3 ENVIRONMENTAL ASSESMENT

- Tailings from tailings reprocessing would require a new tailings pond.
- Effluent from the new tailings pond would be submitted to current provincial and federal regulations:
  - Water quality assessment over a very long term (mine closure and beyond);
  - Annual contribution to the closure plan trust;
  - Land restoration works at mine closure.
- Unwatering of the former Lac Jeanine open pit will require environmental evaluation as to whether or not fish is present and the presence of contaminants in the water to be released to the environment.

3. RECOMMENDATIONS

3.1 RESERVE ESTIMATION AND CHARACTERIZATION TESTWORK

- Conduct a sampling campaign of the main tailings dump content using the procedure given in appendix 3.
- Perform proposed characterization work as given in appendix 3:
  - Size distribution
  - Grade distribution
  - Grade by size fraction
  - Liberation by size fraction through heavy liquid testing
- Calculate overall tonnage and iron content.
- Map iron and size distribution in the tailings dump.

3.2 UPGRADING POTENTIAL EVALUATION

- Based on characterization works, decision is to be made as whether or not the potential is still there:
  - A positive response should lead to preliminary metallurgical flowsheets and corresponding test work.

4. INTRODUCTION

4.1 SCOPE OF WORK

BUMIGEME Inc. (BUMIGEME) has asked Soutex Corporation (Soutex) to provide technical assistance for an opportunity study related to the reprocessing of the tailings from the Lac Jeannine milling facility. Quinto Mining Corporation is the current owner of the claims where the tailings dump is located and is the final study beneficiary.

Florent Baril of BUMIGEME acted as Project Manager and was responsible for the coordination of the study. Daniel Roy, senior metallurgist, an employee of Soutex served as the Qualified Person responsible for preparing the technical report. Gilles Ouellet, senior metallurgist, an employee of Soutex served as technical expert on metallurgical processing and reserve estimation with the help Pierre Roy, ing., P Eng (Ont) and André Lemay, senior metallurgist also employees of Soutex. Besides working on the metallurgical aspects of the project Pierre Roy conducted a review of possible environmental issues related to the project aforementioned. No employee of BUMIGEME or Soutex visited either the mine site or the tailings dump for this project.

4.1.1 DISCLAIMER

BUMIGEME/Soutex's assessment of the project was completed based on information mainly provided by the following persons or corporations:

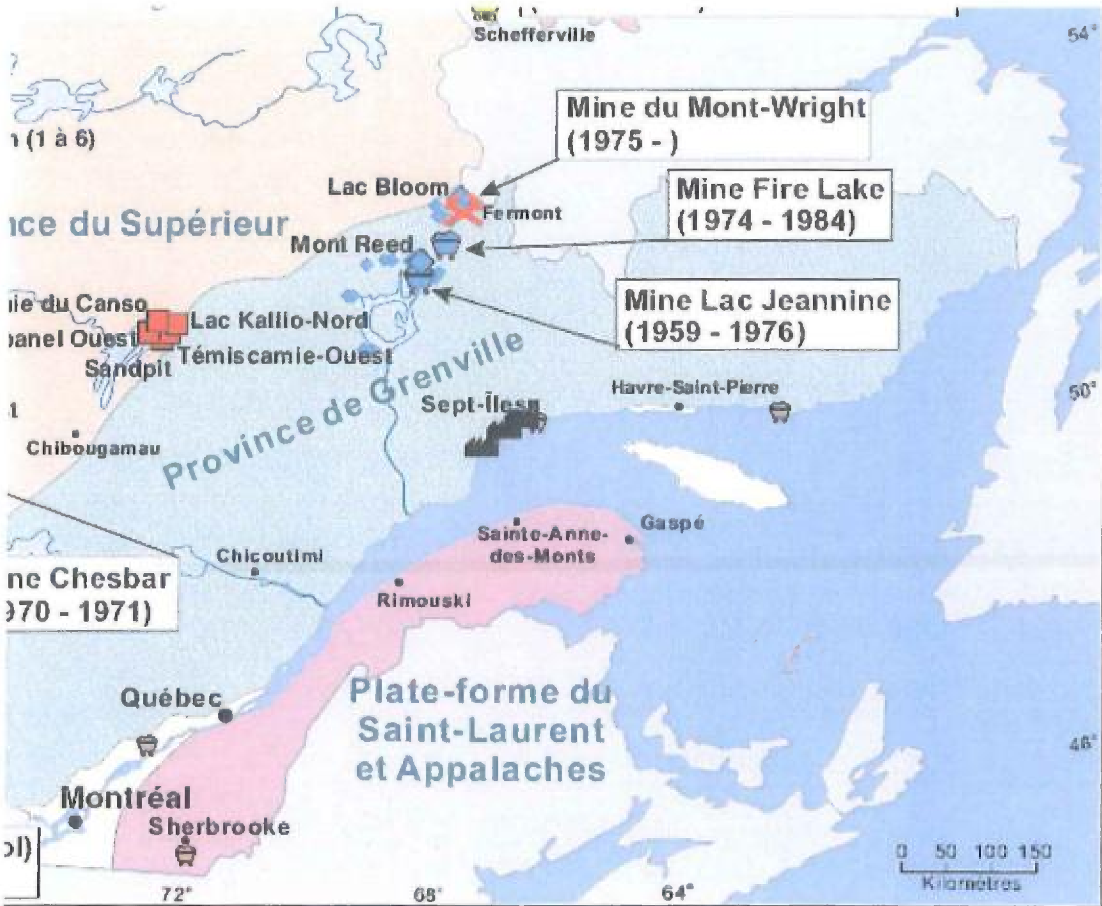
- Metallurgical testwork on a sample from the tailings dump : Mr. Michel Robert, vice president of Quinto Mining Corporation;
- Tailings tonnage estimates, past production data : Ministère des Ressources naturelles et de la Faune du Québec;
- Previous iron ore milling experience from BUMIGEME/Soutex personnel.

The estimates are based on the best publicly available information that could be obtained. All design criteria and data sources are presented in section 9 while references are given in section 10.

4.2 PROPERTY DESCRIPTION AND LOCATION

The Lac Jeannine tailings dump is located near the closed Lac Jeannine mine (Figure 1). Both Lac Jeannine and Fire Lake mines were part of the Mount Wright and Mount Reed iron ore deposit on Quebec North Shore close to Labrador.

Figure 1 : General Location of the Lac Jeannine and Fire Lake Mines [13]



5. TAILINGS RESOURCE ESTIMATION

5.1 INTRODUCTION

To better estimate the tailings reprocessing economical potential of the Lac Jeannine tailings dump, it is paramount to obtain the best possible figure as to how much material there is to be processed. As important is having a good estimate of the amount of iron present. A first estimate is given using historical production data to have an idea of the total amount of tailings sent to the dumping area. A second estimation, based on volumetric methods, has been conducted to evaluate how many tons of tailings are available for reprocessing.

5.2 TAILINGS PHYSICAL CHARACTERISTICS

The size distribution of the iron units in the Lac Jeanine tailings dump is considered typical of Quebec North Shore-Labrador mining area iron ore milling operations. The iron content by size distribution is presented in Table 1.

Table 1 :
Estimated size and Iron Distribution of Lac Jeannine Tailings

Size fraction (µm)	Retained fraction (%)	Assay (% Fe)	Fe distribution (%)
+1180	2	10	3
+850	5	8	5
+600	7	6	6
+425	12	5	8
+300	15	4	8
+212	16	4	7
+150	15	4	7
+106	10	5	7
+75	5	11	7
-75	13	24	42

The values presented in Table 1 can be explained by the way autogenous milling and screening circuit operates as well as by the spirals upgrading circuit response to the material feeding it. First, the above average grade of retained 850 µm is a compromise between liberation and screen opening for typical iron ore concentration circuit. Second, portion of passing 75 µm and -106 µm to +75 µm range particles is directly related to the spirals efficiency to concentrate the fine particles. These figures are in line with the predicted size distribution at the time of the CofA [1] request and also with what was presented as the Lac Jeannine concentrator process flowsheet [12] (see appendix 2). They represent what is to be found in the different tailings pounds of the past and current operations.

The Bond Ball mill Work Index (BWI_{BM}) for grinding calculation purposes was estimated to 15.2 kW-h/t. This value is for quartz and should be viewed as a conservative figure.

The solids bulk weight is estimated at 1.8 t/m3 for a compacted mixture of quartz and hematite.

Figure 2 shows the graphical representation of expected iron distribution in tailings.

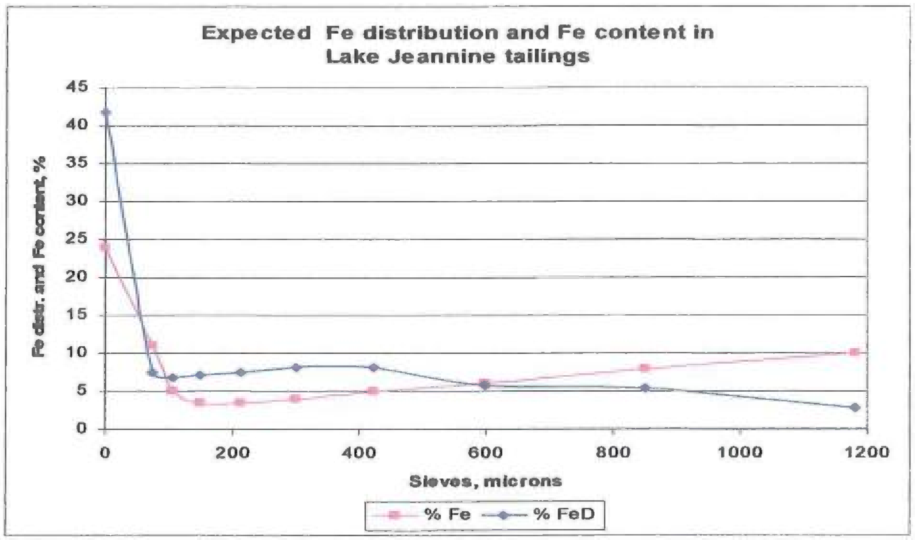


Figure 2 : Estimated Iron Distribution and Assay in the Tailings

5.3 HISTORICAL MILESTONES AND PRODUCTION REPORTED

The Lac Jeannine property is located in the Wabush Lake-Mount Reed area. The deposit was identified in 1952 by aeromagnetic survey. Other surveys and drilling campaigns followed. The exploration phase ended in 1956 [10]. After running a pilot plant in the late 50's, decision was made by Quebec Cartier Mining (QCM) to create an open pit operation including a milling facility and the creation of the city of Gagnon. The first concentrate was shipped in July 1961. The ore was coarse grained, quartz-specularite formation containing 31-33% Fe. The ore nature allowed a simple gravity concentration through a series of Humphrey spirals following a coarse grinding (98% passing 1.7 mm or 10 mesh).

The concentrator had a throughput capacity of 20 000 000 long tons per annum. The concentrate produced had a 66% Fe grade with 5% SiO_2. The tailings from the rougher spirals were classified through 36 inch cyclones. Cyclones overflow was then thickened to recover finer solids which were then blended with the coarser cyclone underflow and pumped to the tailings pond [12] (see appendix 2 for flowsheet).

Lac Jeannine mine ceased its operation in 1976 after over fifteen years of operation and close to 266 Mt of ore processed. In October 1976, Sidbec-Normine received permission from QCM to use the Lac Jeannine pit as tailings impoundment area for the Fire Lake ore processing. As time was required to prepare the pit for impoundment, some of the Fire Lake tailings were dumped over the Lac Jeannine tailings from 1977 to 1978 inclusively. The Fire Lake ore was processed at a lower throughput than the Lac Jeannine ore. Over the seven year operating period (1977-1984), 54Mt of ore was processed [5]. In the first two years of operation (1977 and 1978), over 7 000 000 tons of ore were extracted [15] and are calculated as having been processed in the current estimation.

5.4 TOTAL TAILINGS ESTIMATION

The Lac Jeannine milling plant processed close to 277 million tons of iron ore from 1961 to 1984. All tailings from the Lac Jeanine operation were deposited in the dumping area or dump. Ore extraction from the Lac Jeannine mine was over in late 1976 but works in the open pit appears to have continued until early 1978. During this two year period, the milling of the Fire Lake ore started in 1977 and the tailings produced were dumped over the existing tailings dump. Production rate of the Fire Lake mine was reduced well below the capacity of the processing plant because of pricing difficulties met by Sidbec Normines in selling the pellets produced at its Port-Cartier plant.

Lac Jeannine material and metallurgical balances for the operation during the mine life are given in Table 2.

Once the Lac Jeannine open pit was available for tailings impoundment, the new tailings line going from the mill to the pit was set into use. So while the amount of tailings from Lac Jeannine ore processing is well known, the amount of tailings from the Fire Lake ore processing is somewhat harder to determine. The amount of tailings deposited has been estimated to what could be expected to the first two years of operation of Fire Lake ore processing. This amount is considered conservative in all account and represents less than 10% of total estimated reserve. The values are presented in Table 3.

Table 2 : Metallurgical balance for Lac Jeannine operation

Description	Tonnage (t)	Assay (% Fe)	Recoveries	
			Weight (%)	Iron (%)
Feed	265 897 000	33	100	100
Concentrate	116 006 000	66	44	87
Tailings	149 891 000	7.5	56	13

Table 3 : Estimated metallurgical balance for Fire Lake 1976-1977 operation

Description	Tonnage (t)	Assay (% Fe)	Recoveries	
			Weight (%)	Iron (%)
Feed	7 436 000	35	100	100
Concentrate	3 476 000	66.1	47	88
Tailings	3 960 000	7.7	53	12

It can hen be estimated that close to 154,000,000 tonnes of tailings grading 7.5% Fe were deposited in the Lac Jeannine tailings dump. The amount of tailings impounded in the Lac Jeannine open pit is given in Table 4.

Table 4 : Estimated metallurgical balance for Fire Lake 1978-1984 operation

Description	Tonnage (t)	Assay (% Fe)	Recoveries	
			Weight (%)	Iron (%)
Feed	50 087 000	35	100	100
Concentrate	23 413 000	66.1	47	88
Tailings	26 674 000	7.7	53	12

5.5 RECOVERABLE TAILINGS ESTIMATION

Data from the original land topography [2] and satellite images (as the one used in Figure 3 from [6]) were used to estimate the tailings dump surface area and the volume of tailings that are available. The following assumptions were also made in order to estimate the volume that can be retrieved:

- The tailings that were deposited under the water level are not considered as recoverable. It would be economically impossible to mine those areas due to the high permeability of the tailing.
- The first 0.5 to 1.0 meter of material above the natural ground will have to be kept in place to avoid the presence of vegetal material in the process.
- The resulting form of tailings deposition is a cone with 4% slope.
- The tailings deposited in the old open pit can be mostly recovered in the bottom of the pit. However a complete unwatering of the pit will be required.

Based on the data, the estimated values of the volume in place are presented in Table 5.

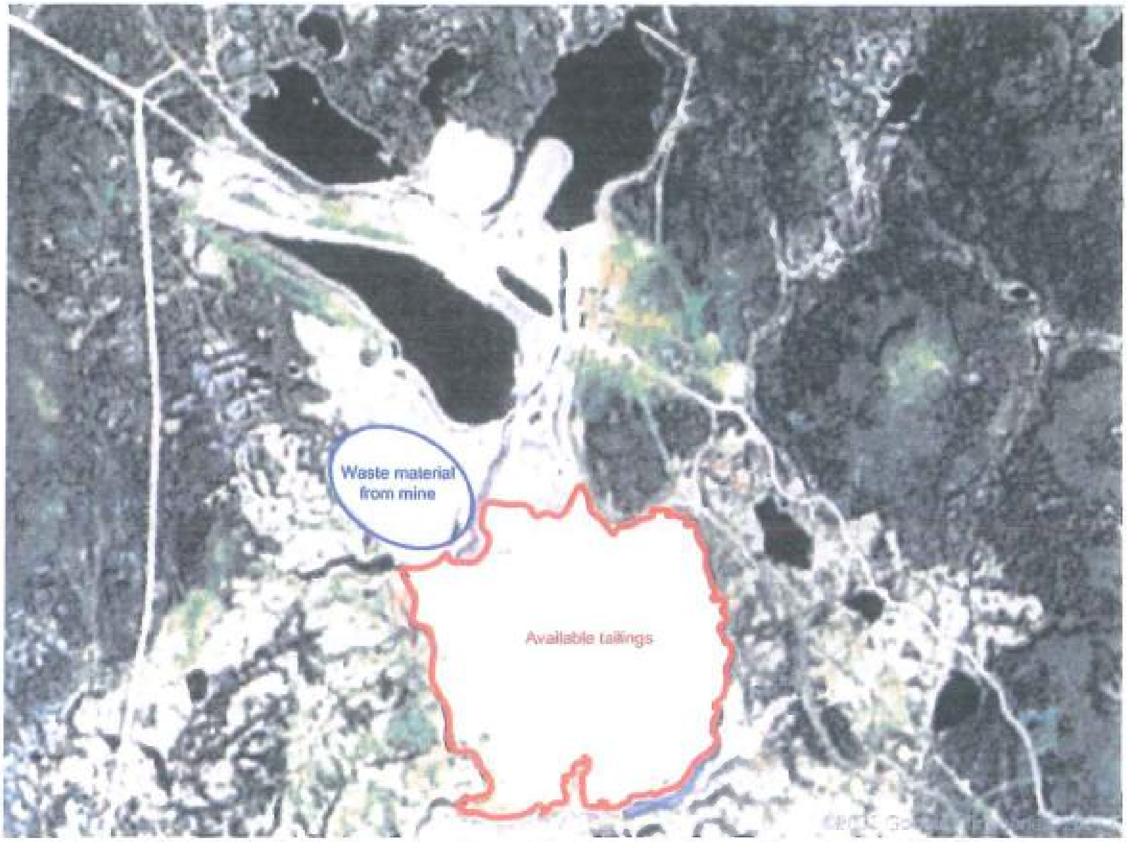


Figure 3 : Lac Jeannine Operation and Tailings Dump Satellite View

The evaluation shows that there is less tailings available based on the evaluation of the actual dump than reported. A part of the tailings is under the waste dump situated north of the tailings area and they are not included in the volume estimation. Also, the tailings situated under the water level of the lakes are also excluded. It is then normal to have such an evaluation difference. To take into account the trees that could have been buried in the tailings, a 1 m from ground level excavation limit is used, resulting in about 127 Mt available for processing.

Table 5 : Estimated Lac Jeannine tailings dump total and available tonnage

Description	Units	Value
Surface	m^2	3 252 000
Volume	m^3	74 079 000
Tailings bulk density	t/m^3	1.8
Tonnage available at a distance from ground level:		
At 0 m from bottom (ground level)	t	133 342 000
At 0,5m from ground level	t	130 415 000
At 1m from ground level	t	127 488 000

A better evaluation of the available tailings in the dump could be done with a surveying of the dump and measurement of the bulk density.

6. METALLURGICAL TEST WORK REVIEW

6.1 INTRODUCTION

The characteristics of composite sample taken at the Lac Jeannine tailings dump and shipped to PRA Laboratories in British Columbia were reviewed as well as the results from the preliminary metallurgical tests that were performed.

6.2 SAMPLE AND OVERALL TAILINGS DEPOSIT CHARACTERISTICS COMPARISON

The results from PRA chemical and size analysis on the sample taken from Lac Jeannine tailings dump, labeled Composite 1, indicate a 13% Fe grade with a rather coarse grind (P80=1 396 µm) for an iron ore processing plant tailings. Results from the PRA characterization work are presented in Table 6 where they are compared with BUMIGEME/Soutex estimates of the Lac Jeannine average tailings characteristics.

The discrepancy is large and originates most certainly from the mineral dressing process used as well as the tailings deposition methods used and the nature of the material itself.

Table 6 : Comparison between Characteristics of Composite 1 Sample and Global Tailings Dump Content Estimate

	Retained size fraction (%)		Assay per size fraction (% Fe)		Fe distribution per size fraction (%)	
Size fraction	Sample	Tailings	Sample	Tailings	Sample	Tailings
+1700 um	13.4	2	28.7	10	26.9	2.7
+850 um	31.7	5	15.6	8	34.5	5.4
+425 um	30.8	19	7.2	5.4	15.4	13.7
-425 um	23.9	74	14	7.9	23.2	78.3

6.2.1 MINERAL DRESSING PROCESS

The grinding process used at the Lac Jeannine concentrator produced a rather wide size distribution. The target was to have 98% of the ore sent to the spirals passing 1 700 µm (10 mesh) [12]. The material exiting the mill was screened. Some very fine particles were produced as well as coarser ones. Spirals themselves are better at recovering certain size fractions (-20 to +150 mesh) and leaving parts of the coarser and finer iron ore go through.

6.2.2 TAILINGS DEPOSITION AND TAILINGS DEPOSITION CHARACTERISTICS

Assuming that a standard tailings deposition was used at the Lac Jeannine tailings dump, it can be concluded that segregation inside the dump occurred. Deposition is done through pipe carrying pumped tailings. Once it leaves the pipe, the coarser and the denser (iron bearing) particles will settle faster and closer to the pipe exhaust while lighter material will flow at a greater distance.

Documents available [8] and tailings deposit observation tend to confirm that the method was pretty much standard. Then, the composite sample must have been taken close to tailings pipe exhaust. If such sampling had been performed downflow from exhaust location, grade and size would have been much lower. The very iron rich nature of the two coarse sizes in the sample indicates material that was not recovered by the spirals. The iron distribution indicates that over half of the iron is present in these two fractions while the standard iron distribution in such tailings would amount to less than 10% of all iron present. The sample received by PRA was used for quick upgrading evaluation purposes but its size distribution is very different from the standard size and grade distribution expected in the dump overall. Further work is required to evaluate the real content and its full potential.

6.3 TEST WORK REVIEW

The magnetic separation test [14] did not show encouraging results and will not be discussed any further.

The results obtained from the Wilfley table test [14] look promising. However, as the sample represents a richer and coarser material than the dump average content, they are overly optimistic in regards to what would be obtained. It must also be noted that the Wilfley table is an instrument that give the very best results with this kind of material as it is operated under supervision and its operation during test work is usually optimized.

Results obtained by more industrial type of equipments like Humphrey spiral, hydraulic classifiers and others are lower. Hence, the iron recovery of 80% at a 63% Fe grade is not considered realistic and tests results should not be used as a basis for economical assessment of the project.

7. MINERAL PROCESSING ASPECTS OF LAC JEANNINE TAILINGS REPROCESSING

7.1 IRON RECOVERY CHALLENGE

The estimated iron distribution shows that the passing 106 µm (150 mesh) fractions contains close to 50% of all iron in the tailings.

It is fortunate that best value iron is concentrated in the finer fraction. This can greatly reduce capital expenses as no grinding related equipments would be needed. However, to recover relatively fine iron is a challenge in itself. Only gravity separation would meet this and may have a chance of economical success. Some equipment available today is more prone to recover fine iron units. Still, the proofs to achieve pilot scale results are still to be made.

Possible concentration processes include in steps:

- Large size hydraulic classifiers for scalping instead of screens
- Fine spirals for concentration
- Jigs (Yang or Kelsey) for concentrate cleaning.

Reverse flotation, as it would require huge dewatering and filtration units notwithstanding huge amount of process water to deal with, is not considered practical for this application. Reverse flotation would also require huge amount of flotation reagents. These would imply higher operating costs and also prior to operation start up, additional environmental impact studies prior to obtaining the CofA. However, reverse flotation would probably represent one of the best upgrading methods to obtain a high iron grade concentrate (67%-69% Fe) or a high purity concentrate (over 69% Fe).

7.2 SCALPING THE FINE IRON

Large capacity hydraulic classifiers would represent a good equipment to efficiently recover the fine iron bearing particles. These particles, recovered at the classifiers overflow, would represent 45-48% of the iron with only 25% of total flow. This would reduce the tonnage of material to process.

7.3 FINE IRON CONCENTRATION

Two methods could be used for producing the iron concentrate:

1. Use spirals to produce a final tail and a pre concentrate (roughing stage). Jigs will produce a final concentrate (cleaning stage).
2. If spirals could not achieve sufficient recovery, a jigs only approach should be considered, in a two steps process more likely.

After dewatering the classifier overflow, a fine spiral could possibly recover about 85% iron units and produce a final tail. Overall recovery would then be in the range of 40% of total iron units entering the process. The pre concentrate would be cleaned by a Yang jig or a Kelsey jig. The tail from that step would be return to the spiral feed. The final grade would be around 62% Fe and about 7% SiO_2. The trace elements would be relatively high, being locked in the main grain. Such concentrate would be hard to sell as higher content material is readily available throughout the world and the penalties would make it a very low margin product.

8. ENVIRONMENTAL LIABILITIES

8.1 RESPONSIBILITY RELATED TO PREVIOUS OPERATION

Based on the current legislation, the promoter is not linked to previous environment conditions or damage that existed at the time of the Lac Jeannine mine operation. In fact, he should not be held accountable for anything that happened before he received permitting. However, the promoter will have to respect the Law 72 that request the new operator to prevent any migration of contamination already in place toward the environment.

Prior to site construction, the operator should then characterize the land to identify any contamination that is already in place. Failing to proceed with this work will cause any contamination found after the beginning of operation to be considered as resulting from the new operation unless it can be proven without any doubt that it is not the case. Such proof could be excruciatingly difficult to present so the proactive approach of identifying contaminants already in place is the best insurance policy.

Past operation under a different legislation does not discharge a new operator to comply with any of the actual environmental requirement. In particular:

- Any portion of land to be disturbed by the new operator will have to be restored according to the Quebec Mining Act, even if it was already disturbed by the previous operator.
- The water course that passes along the tailings dump will need to be protected against potential source of contamination resulting from the operation.
- All water coming from the site operation including storm water will have to be controlled prior to being discharged to the environment. The control includes flow measurement, sampling and environmental effect monitoring according to federal regulations.
- All water coming from the tailings treatment will also have to be controlled prior to discharge to the environment.
- The tailings that will be produced by the new operation will have to be stored in a tailings pond closed by dam construction.

8.2 NEW OPERATION PERMITTING

Before the beginning of the operation the promoter will have to obtain a permit or CofA from the Ministère du Développement durable, de l'Environnement et des Parcs du Québec. The CofA will include all information from the operation and will normally required the above element to be addressed

- Water balance of the mine operation.
- Tailings disposal from the new operation in a state of the art designed tailings pond. The site for this pond will have to be chosen to minimize environmental impacts.
- Water collection system for liquids seeping from the area of material reclaiming and for any water pumped from the Lac Jeannine open pit will be required. The system must include a polishing pond for collected water prior to discharging to the environment.
- The recovery of the tailings inside the old pit will be subject to an authorization of Environment Canada because the old pit can possibly be considered as a fish habitat.

After operations start up, the promoter will have to notify Environment Canada and begin monitoring all effluents from the site according to the MMER (Metal Mining Effluent Regulation).

8.3 MINING ACT

The Mining Act states that the promoter must prepare a restoration plan for all the area affected by the mining activities and waste material disposal. The plan must contain cost estimation for the works. The operator must also put a guarantee covering 70% of the cost in the form of a trust.

9. DESIGN CRITERIA AND DATA

Item / parameter	Units		Average value	Reference
Impoundment area general data				
Cone deposition slope	%		4	Estimate
Tailngs impoundment - Available at 1m above ground	Mt		127.5	Estimate
Solids' physical characteristics				
Ore grade (Lac Jeanine tailings dump)	%Fe		7.5	Calculation
Ore work index	kW-h/t		15.2	Estimate
Particle size P80	µm		513	Estimate
Bulk density	t/m3		1.8	Calculation
Lac Jeannine mine - Mineral processing data				
Throughput (fresh feed)	Mt		265.9	[5]
Ore grade	%Fe		33	[5]
Fe recovery	%		87	Calculation
Concentrate grade				
	%Fe		66	[5]
	%Si		5	[12]
Fire Lake mine - Mineral processing data (1976-1977)				
Ore grade	%Fe		35	[15]
Throughput	Mt		7.4	[15]
Fe recovery	%		88	Calculation
Concentrate grade	%Fe		66.1	[5]
Fire Lake mine - Mineral processing data (1978-1984)				
Ore grade	%Fe		35	[15]
Throughput	Mt		50.1	[15]
Fe recovery	%		88	Calculation
Concentrate grade	%Fe		66.1	[5]

Item / parameter	Units		Average value	Reference
Lac Jeanine and Fire Lake tailings size by size composition				
Size distribution				
+1700 um	% retenu		2	Experience
+850 um	% retenu		5	Experience
+600 um	% retenu		7	Experience
+425 um	% retenu		12	Experience
+300 um	% retenu		15	Experience
+212 um	% retenu		16	Experience
+150 um	% retenu		15	Experience
+106 um	% retenu		10	Experience
+75 um	% retenu		5	Experience
-75 um	% retenu		13	Experience
Chemical analysis per size fraction				
+1700 um	%Fe		10	Experience
+850 um	%Fe		8	Experience
+600 um	%Fe		6	Experience
+425 um	%Fe		5	Experience
+300 um	%Fe		4	Experience
+212 um	%Fe		3.5	Experience
+150 um	%Fe		3.5	Experience
+106 um	%Fe		5	Experience
+75 um	%Fe		11	Experience
-75 um	%Fe		24	Experience
Iron distribution per size fraction				
+1700 um	%		3	Experience
+850 um	%		5	Experience
+600 um	%		6	Experience
+425 um	%		8	Experience
+300 um	%		8	Experience
+212 um	%		7	Experience
+150 um	%		7	Experience
+106 um	%		7	Experience
+75 um	%		7	Experience
-75 um	%		42	Experience
"Composite 1" test sample size by size composition				
Size distribution				
+1700 um	% retenu		13.4	[3]
+850 um	% retenu		31.7	[3]
+425 um	% retenu		30.8	[3]
-425 um	% retenu		23.9	[3]
P80	um		1396	Calculation
Chemical analysis per size fraction				
+1700 um	%Fe		28.7	[3]
+850 um	%Fe		15.6	[3]
+425 um	%Fe		7.2	[3]
-425 um	%Fe		14,0	[3]
Iron distribution per size fraction				
+1700 um	%		26.9	[3]
+850 um	%		34.5	[3]
+425 um	%		15.4	[3]
-425 um	%		23.2	[3]

10. REFERENCES

Item	Company	Date	Title
1	CMQC	oct-60	Approval request for 6 year and 20 year areas for tailings deposition of Lac Jeannine operation
2	Dept. Of Mines	1959	Carte topographique 1959 Lac Barbel Sheet 22N/16
3	PRA	oct-06	Comp 1 assay
4	MRNF	oct-96	Géologie Québec - Commentaires - Feuillet 22N/16
5	MRNF	2004	Gros plan sur la Côte-Nord - Activité minière
6	Google	2007	Image satellite région de Gagnon
7	MRNF	févr-93	Lac Jeannine
8	CMQC	sept-60	Lac Jeannine Concentrator - Location Plan - Tailings disposal area
9	CMQC	oct-76	Projet de remblai du puits de la mine du Lac Jeannine avec les rejets de concentration
10	MRNF	1977	Rapport géologique 78, Région de Gagnon
11	MRNF	août-84	Restauration des résidus de CMQC
12	SME	juin-05	SME Mineral Processing Handbook
13	MRNF	juin-05	Subdivisions géologiques et localisation des principaux gisements de fer
14	PRA	oct-06	Table T1 test
15	MRNF	avr-07	Compilation de production annuelle - Fire Lake - Lac Jeannine

APPENDIX A
PRA LABORATORY TESTS RESULTS

MAGNETIC SEPARATION TEST BALANCE

Client: Quinto-Esbec
Test: MS 1
Sample: Composite 1

Date: 12-oct-06
Project: 0607009

Objective: Davis Tube at ~7500Gauss

Magnetic Separation Balance

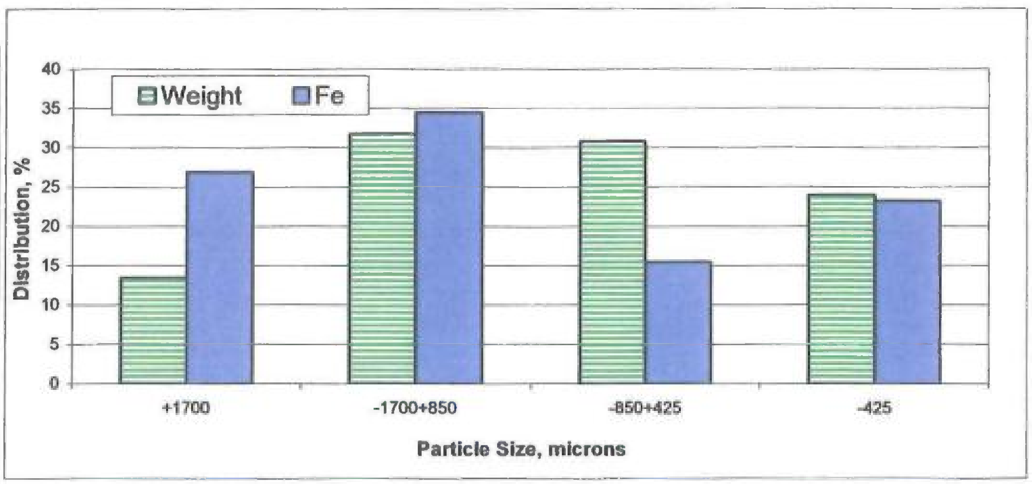
Product	Weight (g)	Weight (%)	Assay Fe (%)	Distribution Fe (%)
Magnetic Concentrate	1,22	0,7	64,80	2,9
Non-magnetic Materials	184,0	99,3	14,64	97,1
Calculated Feed	**185,2**	**100,0**	**14,97**	**100,0**
Measured Feed			13,85	

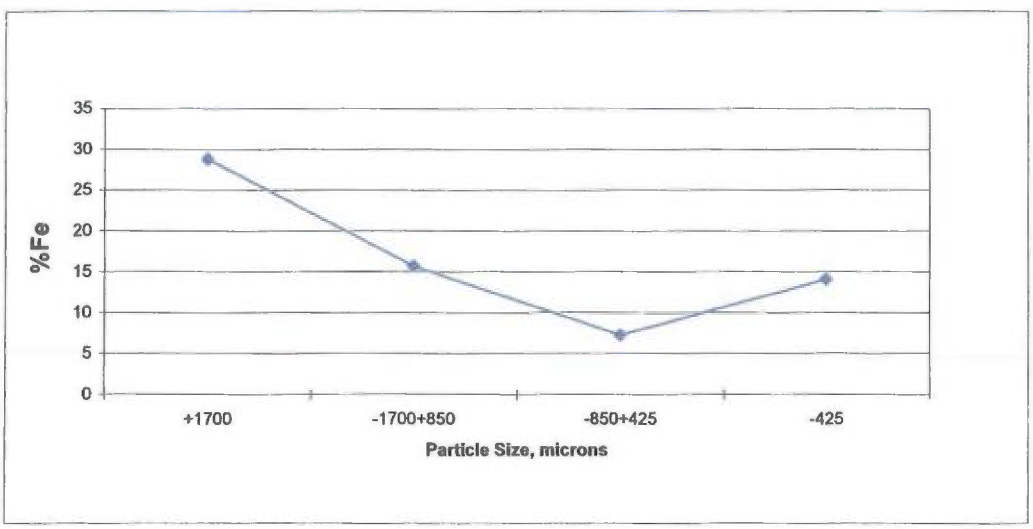
SIZE-ASSAY ANALYSIS REPORT

Client: Quinto-Esbec
Test: SA1
Sample: Composite 1

Date: 12-oct-06
Project: 0607009

Size Fraction		Weight		Assay (%)	Distribution (%)
Tyler Mesh	Microns	g	%	Fe	Fe
+ 10	+1700	267,8	13,5	28,72	26,9
- 10 + 20	-1700+850	630,1	31,7	15,65	34,5
- 20 + 35	-850+425	611,5	30,8	7,23	15,4
-35	-425	475,3	23,9	13,98	23,2
Total		**1984,7**	**100,0**	**14,42**	**100,0**
Measured				13,85	





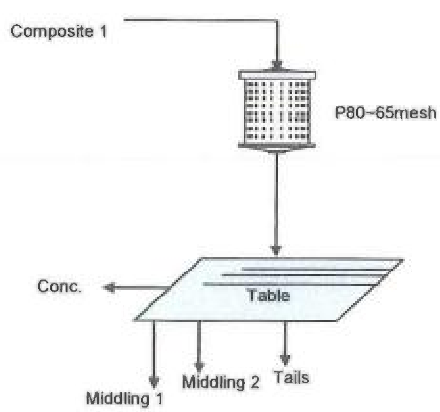
GRAVITY CONCENTRATION - TABLE TEST METALLURGICAL BALANCE

Client: Quinto Technology-Esbec
Test: T1
Sample: Composite 1 ground to P80~65mesh

Date: 27-oct-06
Project: 0607009

Objective: To recover hematite using gravity concentration on Wilfley shaking table

Product	Weight		Assay		Distribution
			Fe	SiO_2	Fe
	g	%	%	%	%
Table Concentrate	477,1	17,7	62,89	8,23	80,2
Middlings					
Table Middlings 1	161,9	6,0	9,01		3,9
Table Middlings 2	761,5	28,2	0,73		1,5
Table Middlings 1 + 2	**923,4**	**34,2**	**2,18**		**5,4**
Total Table Concentrate	**1 400,5**	**51,9**	**22,86**		**85,6**
Table Tails	1 299,9	48,1	4,14		14,4
Total Head	**2 700,4**	**100,0**	**13,85**		**100,0**
Measured Head			13,85	75,46	



APPENDIX B
FLOWSHEET OF HUMPHREYS SPIRAL SECTION

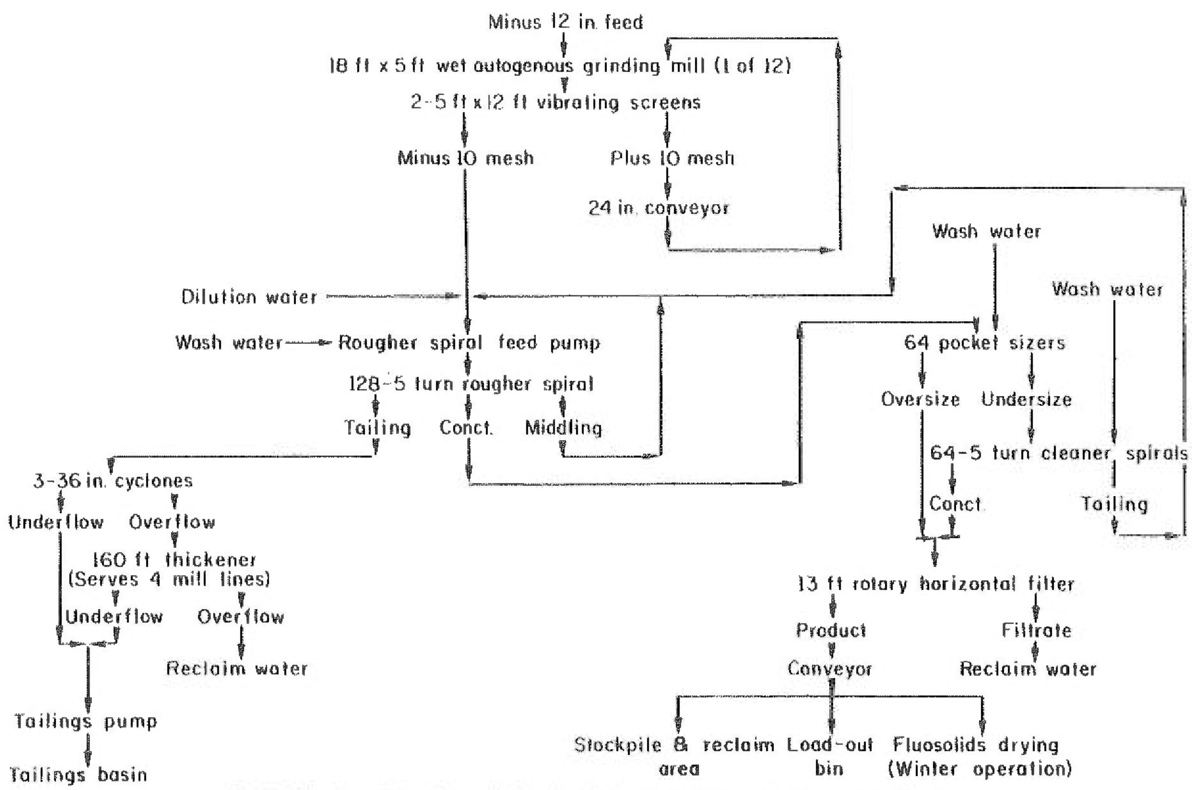


FIG. 9. Flowsheet of Humphreys spiral section, Quebec Cartier Mining Co., Gagnon, P.Q., Canada.

APPENDIX C
PROPOSED LAC JEANNINE TAILINGS DUMP CHARACTERIZATION TESTWORK

IRON AND SIZE DISTRIBUTION MAPPING

A preliminary sampling campaign of the Lac Jeannine tailings dump should be performed in order to know to an acceptable extent the following points.

- The average iron content of the tailings dump
- The average size distribution of the tailings
- The amount of segregation both in iron content and in size that exists in the dump

The sampling campaign results would be in the form of maps detailing iron and size distribution. The tonnage of the different zones or material types are to be computed based on the findings.

To optimize samplings efforts the following method is proposed using a small sample drilling equipment:

3. Trace two lines that run down the tailings dump (see Figure 4);
4. Starting at the top of the dump, take a drill core every 150 meters along each of the line to obtain 11 to12 cores per line;
5. Each core should be identified and placed in individual core boxes or bags;
6. Each core should be shipped to a laboratory for iron, silica and selected elements assay, size analysis and iron content by size fraction.

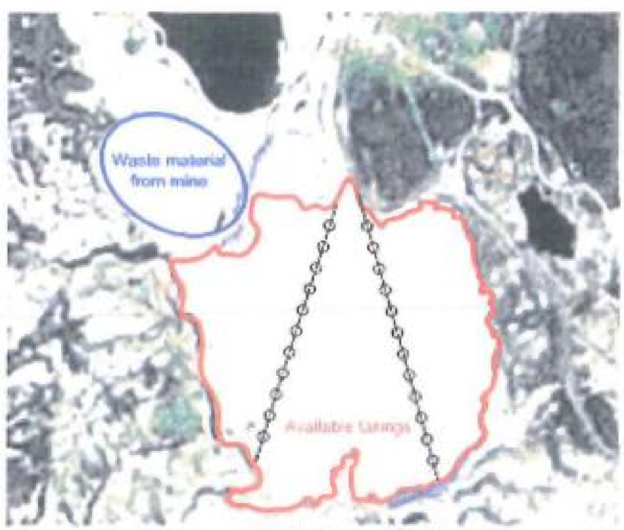


Figure 4: Suggested Survey Points for Tailings Dump Content Assessment

Upon reception of results from the laboratory, a mapping of the zone should be performed to obtain a good picture of the tonnage available at certain characteristics (like coarse-high grade or medium coarse-low grade). Overall tailings content must also be calculated.

The tests that should be performed at the chemical and metallurgical laboratory include:

- Size distribution from 2mm to passing 75µm ;
- Iron assay ;
- Minor element and silica assays ;
- Heavy liquid testing by size fraction.

These data will then be used for process development testwork.

APPENDIX D
DATA FROM MINISTÈRE DES RESSOURCES NATURELLES ET DE LA FAUNE DU QUÉBEC USED IN THE STUDY

Nom de la mine : FIRE LAKE
Nom de l'exploitant : SIDBEC NORMINES
Canton : BERGERON
Substance exploitée : Fe
Service regional : SEPT-ILES
Fiche de gîte : 23B/6-9

	PRODUCT.ANNUELLE		PRODUC.CUMULATIVE		RES./Prouv.+Prob./		TAILLE/Prod.+Res./	
Annee	Tonnage	Fe%	Tonnage	Fe%	Tonnage	Fe%	Tonnage	Fe%
1976	1729746	35	1729746	35				
1977	5706420		7436166					
1978	3547064		10983230					
1979	8920265		19903495					
1980	11623000		31526495					
1981	9471000		40997495					
1982	2467000		43464495					
1983	6117000		49581495					
1984	7942000		57523495		341000000	33,35	386706279	33,55

Note : à cause de la rentabilité, la mine est fermée sans que le gisement soit epuisé.

Nom de la mine : LAC JEANNINE
Nom de l'exploitant : QUEBEC CARTIER
Canton : CANON
Substance exploitée: Fe
Service regional : SEPT-ILES
Fiche de gîte : 22N/16-3

	PROD.ANNUELLE		PROD.CUMULATIVE	
Année	Tonnage	Fe%	Tonnage	Fe%
1961	17519399	31	17519399	31
1962	12967886		30487285	
1963	3689227		34176512	
1964	22275465		56451977	
1965	22093700		78545677	
1966	20016066		98561743	
1967	20672879		119234622	
1968	21132800		140367422	
1969	20035520		160402942	
1970	22802088		183205030	
1971	22040854		205245884	
1972	21011848		226257732	
1973	20689824		246947556	
1974	18007310		264954866	
1975	17454964		282409830	
1976	9801893		292211723	

APPENDIX B: PRA 2006 REPORT

Metallurgical Division

Summary of Metallurgical testing of Samples from Quito Technology Inc.

October 2006

Attached is a set of data from a testing program conducted by Process Research Associates in October 2006. No report was issued at that time.

Prepared by: Metallurgical Division
Inspectorate Exploration and Mining Services Ltd.
11620 Horseshoe Way,
Richmond, BC V7A 4V5 Canada

Project No.: 0607009

Date: November 18, 2013

SAMPLE RECEIVING LOG SHEET

Receiving Date:	12-Sep-06	**Project No:**	0607009
Carrier:	Eagle Global Logistics	**Client:**	Quinto Technologies-Exploration
Receiver:	JM	**Page:**	1 of 1

Count	Sample Label	Container Type	Sample Type (C, R, P, Sl, S)	Wet /Dry	Top Size	Weight (grams)
1	193201	Pail	P	Dry	10 mesh	5,363.0
2	193202	Pail	P	Dry	8 mesh	3,386.0
3	193203	Pail	P	Dry	20 mesh	2,010.0
4	193204	Pail	P	Dry	8 mesh	5,161.0
5	193205	Pail	P	Dry	10 mesh	5,164.0
6	193206	Pail	P	Dry	16 mesh	5,501.0
7	193207	Pail	P	Dry	14 mesh	3,275.0
8	193208	Pail	P	Dry	8 mesh	3,156.0
9						
Note :						**33,016.0**

Core, **R**ock, **P**ulp, **Sl**urry, **S**olution

Head Assays

COREM ASSAY REPORT

Client: Quinto-Esbec **Date:** 31-Oct-06
Sample: Composite 1 **Project:** 0607009

Elements	Units	Sample ID Composite 1	Assay Method
Fe	%	4.53	ISO 9035:1989

Note: Composite 1 are 193201 and 193203 to 193208 samples.

WHOLE ROCK ASSAY REPORT

Client: Quinto-Esbec **Date:** 03-Oct-06
Sample: Composite 1 **Project:** 0607009

Compounds	Unit	Sample ID Composite 1	Detection Limits Min.	 Max.	Analytical Method
Al2O3	%	1.49	0.01	100	WRock
BaO	%	0.01	0.01	100	WRock
CaO	%	0.36	0.01	100	WRock
Fe2O3	%	20.16	0.01	100	WRock
K2O	%	0.46	0.01	100	WRock
MgO	%	0.29	0.01	100	WRock
MnO	%	0.03	0.01	100	WRock
Na2O	%	0.22	0.01	100	WRock
P2O5	%	0.07	0.01	100	WRock
SiO2	%	75.46	0.01	100	WRock
TiO2	%	0.03	0.01	100	WRock
LOI	%	1.18	0.01	100	2000 F
Total	%	99.78	0.01	105	WRock

Note: Composite 1 are 193201 and 193203 to 193208 samples.

HEAD ASSAY REPORT

Client: Quinto-Esbec **Date:** 03-Oct-06
Sample: Composite 1 **Project:** 0607009

Elements	Units	Sample ID Composite 1	Detection Limits Min.	Detection Limits Max.	Analytical Method
Fe	%	13.60	0.01	100	FusWet
Al	ppm	3839	100	50000	ICPM
Sb	ppm	<5	5	2000	ICPM
As	ppm	<5	5	10000	ICPM
Ba	ppm	38	2	10000	ICPM
Bi	ppm	<2	2	2000	ICPM
Cd	ppm	<0.2	0.2	2000	ICPM
Ca	ppm	2257	100	100000	ICPM
Cr	ppm	184	1	10000	ICPM
Co	ppm	3	1	10000	ICPM
Cu	ppm	7	1	20000	ICPM
Fe	**ppm**	**46612**	**100**	**50000**	**ICPM**
La	ppm	12	2	10000	ICPM
Pb	ppm	<2	2	10000	ICPM
Mg	ppm	1651	100	100000	ICPM
Mn	ppm	181	1	10000	ICPM
Hg	ppm	<3	3	10000	ICPM
Mo	ppm	4	1	1000	ICPM
Ni	ppm	<1	1	10000	ICPM
P	ppm	242	100	50000	ICPM
K	ppm	2292	100	100000	ICPM
Sc	ppm	<1	1	10000	ICPM
Ag	ppm	<0.5	0.5	500	ICPM
Na	ppm	340	100	100000	ICPM
Sr	ppm	7	1	10000	ICPM
Tl	ppm	<2	2	1000	ICPM
Ti	ppm	<100	100	100000	ICPM
W	ppm	<5	5	1000	ICPM
V	ppm	9	1	10000	ICPM
Zn	ppm	3	1	10000	ICPM
Zr	ppm	9	1	10000	ICPM

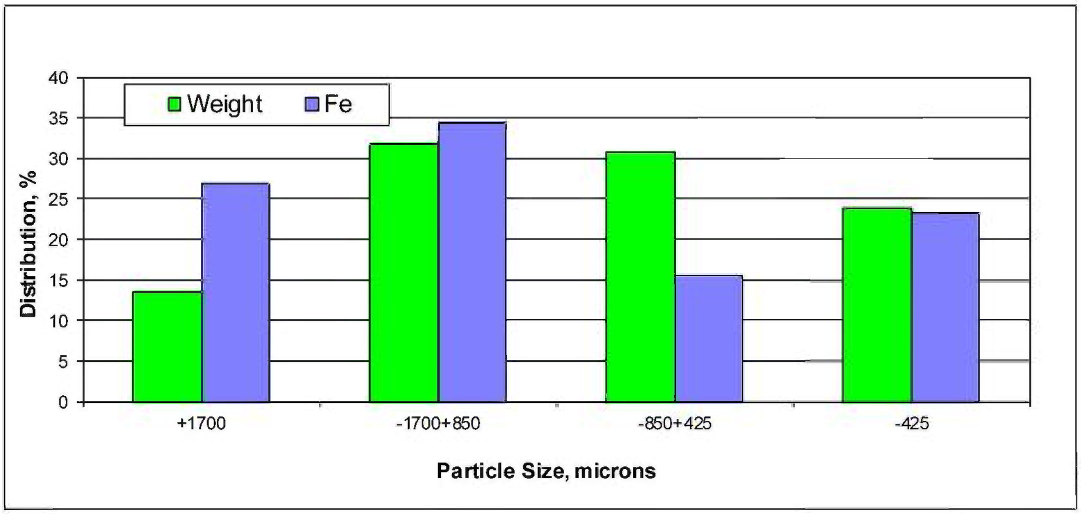
Note: Composite 1 are 193201 and 193203 to 193208 samples.

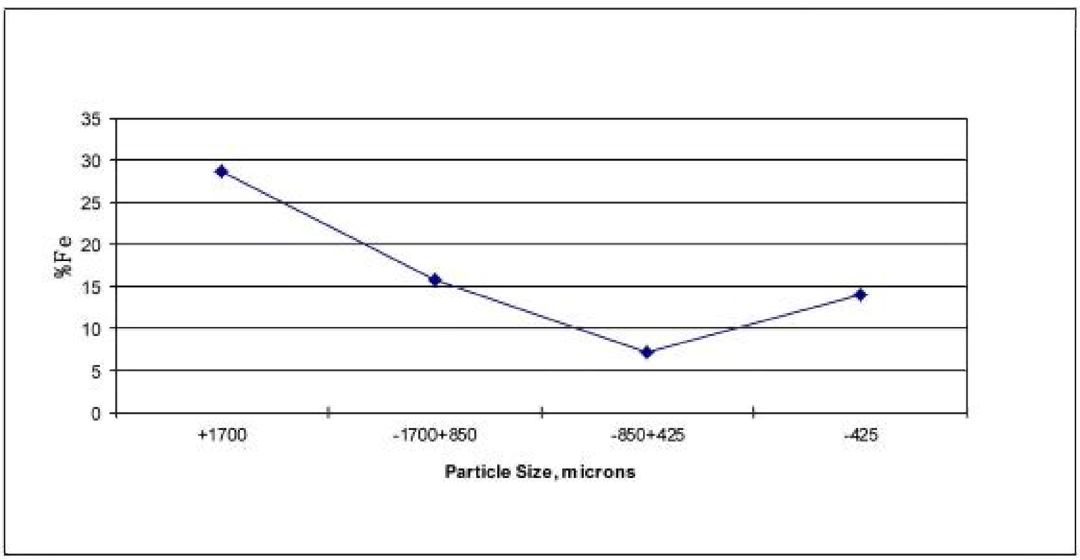
SIZE-ASSAY ANALYSIS REPORT

Client: Quinto-Esbec
Test: SA1
Sample: Composite 1

Date: 12-Oct-06
Project: 0607009

Size Fraction		Weight		Assay (%)	Distribution (%)
Tyler Mesh	Microns	g	%	Fe	Fe
+ 10	+1700	267.8	13.5	28.72	26.9
- 10 + 20	-1700+850	630.1	31.7	15.65	34.5
- 20 + 35	-850+425	611.5	30.8	7.23	15.4
-35	-425	475.3	23.9	13.98	23.2
Total		**1984.7**	**100.0**	**14.42**	**100.0**
Measured				13.85	





MAGNETIC SEPARATION TEST BALANCE

Client: Quinto-Esbec
Test: MS 1
Sample: Composite 1

Date: 12-Oct-06
Project: 0607009

Objective: Davis Tube at ~7500Gauss

Magnetic Separation Balance

Product	Weight		Assay Fe	Distribution Fe
	(g)	(%)	(%)	(%)
Magnetic Concentrate	1.22	0.7	64.80	2.9
Non-magnetic Materials	184.0	99.3	14.64	97.1
Calculated Feed	**185.2**	**100.0**	**14.97**	**100.0**
Measured Feed			13.85	

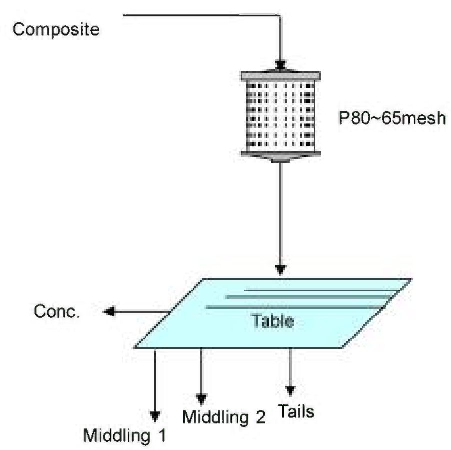
GRAVITY CONCENTRATION - TABLE TEST METALLURGICAL BALANCE

Client: Quinto Technology-Esbec
Test: T1
Sample: Composite 1 ground to P80~65mesh

Date: 27-Oct-06
Project: 0607009

Objective: To recover hematite using gravity concentration on Wilfley shaking table

Product	Weight		Assay		Distribution
			Fe	SiO_2	Fe
	g	%	%	%	%
Table Concentrate	477.1	17.7	62.89	8.23	80.2
Middlings					
Table Middlings 1	161.9	6.0	9.01		3.9
Table Middlings 2	761.5	28.2	0.73		1.5
Table Middlings 1 + 2	**923.4**	**34.2**	**2.18**		**5.4**
Total Table Concentrate	**1,400.5**	**51.9**	**22.86**		**85.6**
Table Tails	1,299.9	48.1	4.14		14.4
Total Head	**2,700.4**	**100.0**	**13.85**		**100.0**
Measured Head			13.85	75.46	



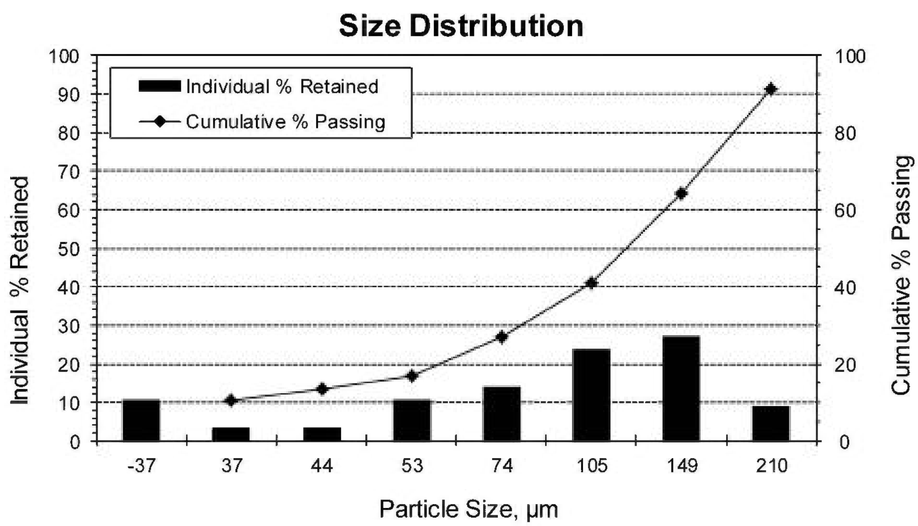
SIZE ANALYSIS REPORT

Client: Quinto Technology-Esbec
Sample: T1
Grind: 1.0kg for 15 minutes at 65% solids in stainless mill #1

Date: 27-Oct-06
Project: 0607009

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	8.7	91.3
100	149	26.9	64.4
150	105	23.7	40.8
200	74	13.7	27.0
270	53	10.3	16.7
325	44	3.3	13.4
400	37	3.1	10.3
Undersize	- 37	10.3	-
TOTAL:		100.0	

80 % Passing Size (µm) = 184



WHOLE ROCK ASSAY REPORT

Client: Quinto-Esbec
Sample: 193202 Sample

Date: 03-Oct-06
Project: 0607009

Compounds	Unit	Sample ID		Detection Limits		Analytical
		193202 Head	RE: 193202 Head	Min.	Max.	Method
Al2O3	%	1.06	0.92	0.01	100	WRock
BaO	%	<0.01	<0.01	0.01	100	WRock
CaO	%	0.15	0.22	0.01	100	WRock
Fe2O3	%	79.46	79.51	0.01	100	WRock
K2O	%	<0.01	<0.01	0.01	100	WRock
MgO	%	<0.01	<0.01	0.01	100	WRock
MnO	%	0.02	0.02	0.01	100	WRock
Na2O	%	0.29	0.17	0.01	100	WRock
P2O5	%	0.02	0.02	0.01	100	WRock
SiO2	%	15.1	16.73	0.01	100	WRock
TiO2	%	0.07	0.07	0.01	100	WRock
LOI	%	1.91	1.91	0.01	100	2000 F
Total	%	98.1	99.57	0.01	105	WRock

HEAD ASSAY REPORT

Client: Quinto-Esbec
Sample: 193202 Sample

Date: 03-Oct-06
Project: 0607009

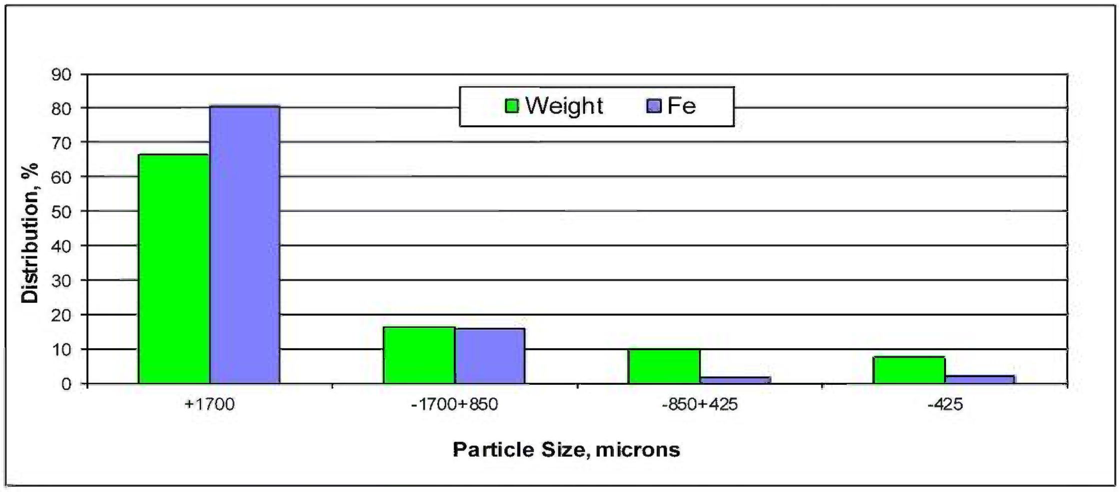
Elements	Units	Sample ID 193202 Head	Sample ID RE: 193202 Head	Detection Limits Min.	Detection Limits Max.	Analytical Method
Fe	%	61.78	61.78	0.01	100	FusWet
Al	ppm	1088	1106	100	50000	ICPM
Sb	ppm	<5	<5	5	2000	ICPM
As	ppm	<5	<5	5	10000	ICPM
Ba	ppm	25	26	2	10000	ICPM
Bi	ppm	<2	<2	2	2000	ICPM
Cd	ppm	<0.2	<0.2	0.2	2000	ICPM
Ca	ppm	598	609	100	100000	ICPM
Cr	ppm	152	166	1	10000	ICPM
Co	ppm	6	7	1	10000	ICPM
Cu	ppm	21	20	1	20000	ICPM
Fe	ppm	286571	292460	100	50000	ICPM
La	ppm	2	3	2	10000	ICPM
Pb	ppm	<2	<2	2	10000	ICPM
Mg	ppm	286	290	100	100000	ICPM
Mn	ppm	123	123	1	10000	ICPM
Hg	ppm	<3	<3	3	10000	ICPM
Mo	ppm	13	12	1	1000	ICPM
Ni	ppm	<1	<1	1	10000	ICPM
P	ppm	<100	<100	100	50000	ICPM
K	ppm	256	268	100	100000	ICPM
Sc	ppm	<1	<1	1	10000	ICPM
Ag	ppm	<0.5	<0.5	0.5	500	ICPM
Na	ppm	158	166	100	100000	ICPM
Sr	ppm	3	3	1	10000	ICPM
Tl	ppm	<2	<2	2	1000	ICPM
Ti	ppm	114	118	100	100000	ICPM
W	ppm	<5	<5	5	1000	ICPM
V	ppm	34	36	1	10000	ICPM
Zn	ppm	4	3	1	10000	ICPM
Zr	ppm	14	15	1	10000	ICPM

SIZE-ASSAY ANALYSIS REPORT

Client: Quinto-Esbec
Test: SA2
Sample: 193202 Sample

Date: 12-Oct-06
Project: 0607009

Size Fraction		Weight		Assay (%)	Distribution (%)
Tyler Mesh	Microns	g	%	Fe	Fe
+ 10	+1700	2011.7	66.6	66.83	80.6
- 10 + 20	-1700+850	485.1	16.1	54.75	15.9
- 20 + 35	-850+425	297.5	9.9	8.91	1.6
-35	-425	224.7	7.4	14.07	1.9
Total		**3019.0**	**100.0**	**55.25**	**100.0**
Measured				58.68	



MAGNETIC SEPARATION TEST BALANCE

Client: Quinto-Esbec
Test: MS 2
Sample: 193202 Sample

Date: 12-Oct-06
Project: 0607009

Objective: Davis Tube at ~7500Gauss

Magnetic Separation Balance

Product	Weight		Assay Fe	Distribution Fe
	(g)	(%)	(%)	(%)
Magnetic Concentrate	1.11	0.6	68.47	0.7
Non-magnetic Materials	197.1	99.4	53.55	99.3
Calculated Feed	**198.2**	**100.0**	**53.63**	**100.0**
Measured Feed			58.68	

APPENDIX C: T1807-LAC JEANINE-TAILS-MINERALOGY FINAL

SIZE BY SIZE CHEMICAL ANALYSES

PROJECT	T-1807
Sample	Head sample

Fractions				Analyses (%)															
µm	Mesh	Mean particle diameter (µm)	% Weight	Fe_T	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO	P_2O_5	Cr_2O_3	V_2O_5	ZrO_2	ZnO	LOI
850	20	1010.0	24.2	15.0	77.2	0.60	21.4	0.31	0.48	0.04	0.15	0.02	0.03	0.02	0.04	0.01	0.02	0.01	0.17
600	28	714.1	18.4	7.3	88.4	0.60	10.4	0.25	0.39	0.06	0.15	0.01	0.03	0.02	0.04	0.01	0.02	0.01	0.08
425	35	505.0	18.8	5.0	92.0	0.60	7.1	0.22	0.33	0.07	0.17	0.02	0.02	0.02	0.05	0.01	0.02	0.01	0.04
300	48	357.1	14.2	4.5	91.1	1.20	6.5	0.44	0.55	0.14	0.34	0.01	0.03	0.06	0.03	0.01	0.02	0.01	0.33
212	65	252.2	8.4	4.4	92.4	0.80	6.3	0.29	0.38	0.09	0.24	0.02	0.03	0.03	0.05	0.01	0.02	0.01	0.08
150	100	178.3	5.0	7.3	86.4	1.40	10.4	0.50	0.84	0.14	0.38	0.03	0.05	0.15	0.03	0.01	0.02	0.01	0.46
106	150	126.1	3.4	14.3	76.1	1.40	20.4	0.56	1.15	0.15	0.34	0.03	0.06	0.27	0.05	0.01	0.02	0.01	0.47
75	200	89.2	2.6	26.2	58.8	1.20	37.5	0.49	1.18	0.12	0.24	0.07	0.07	0.27	0.05	0.01	0.02	0.01	0.43
-75	-200	53.0	5.0	35.4	46.0	1.10	50.6	0.52	1.31	0.14	0.20	0.10	0.08	0.25	0.03	0.01	0.02	0.02	0.85
Calculated head			100.0	10.2	83.7	0.81	14.6	0.33	0.54	0.08	0.21	0.02	0.03	0.06	0.04	0.01	0.02	0.01	0.21
Analyzed head			100.0	9.9	84.2	0.80	14.1	0.28	0.45	0.06	0.23	0.02	0.03	0.05	0.04	0.01	0.02	0.01	0.18

Fractions				Distributions (%)															
µm	Mesh	Mean particle diameter (µm)	% Weight	Fe_T	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO	P_2O_5	Cr_2O_3	V_2O_5	ZrO_2	ZnO	LOI
850	20	1010.0	24.2	35.5	22.3	17.9	35.5	22.6	21.6	11.6	17.2	21.2	21.6	8.2	23.7	24.2	24.2	23.1	--
600	28	714.1	18.4	13.2	19.5	13.7	13.2	13.9	13.4	13.2	13.1	8.1	16.4	6.2	18.0	18.4	18.4	17.6	--
425	35	505.0	18.8	9.2	20.7	13.9	9.2	12.5	11.6	15.8	15.1	16.5	11.2	6.3	23.0	18.8	18.8	17.9	--
300	48	357.1	14.2	6.4	15.5	21.1	6.4	18.9	14.6	23.9	22.9	6.2	12.7	14.4	10.4	14.2	14.2	13.6	--
212	65	252.2	8.4	3.6	9.3	8.3	3.6	7.3	5.9	9.1	9.5	7.4	7.5	4.2	10.3	8.4	8.4	8.0	--
150	100	178.3	5.0	3.6	5.2	8.6	3.6	7.5	7.8	8.4	9.0	6.6	7.4	12.6	3.7	5.0	5.0	4.8	--
106	150	126.1	3.4	4.8	3.1	5.9	4.8	5.7	7.3	6.1	5.5	4.5	6.1	15.5	4.2	3.4	3.4	3.2	--
75	200	89.2	2.6	6.6	1.8	3.8	6.6	3.8	5.6	3.7	2.9	7.9	5.3	11.6	3.1	2.6	2.6	2.4	--
-75	-200	53.0	5.0	17.2	2.7	6.7	17.2	7.8	12.1	8.3	4.7	21.7	11.8	20.9	3.6	5.0	5.0	9.5	--
Total			100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	--

Sample: Lac Jeanine Tails

Fraction	% Fe_2O_3	%Fetotal	%SiO_2	%Al_2O_3	% Weight	Main Mineral identification*												
						**Hematite	Iron hydroxide	Magnetite (Satmagan)	Quartz	Brown mica Fe	White mica Al	Amphibole	Carbonates	Chlorite	Aluminosilicates	Garnet	Fe-Ti oxides	Feldspars
+850 µm	21.4	15.0	77.2	0.6	24.2	Major	trace	trace	Major	trace	trace	trace	trace	n.d.	n.d.	n.d.	n.d.	trace
-850+600 µm	10.4	7.3	88.4	0.6	18.4	minor	trace	trace	Major	trace	trace	trace	trace	n.d.	n.d.	n.d.	n.d.	trace
-600+425 µm	7.1	5.0	92.0	0.6	18.8	minor	trace	trace	Major	trace	trace	trace	trace	n.d.	n.d.	n.d.	n.d.	trace
-425+300 µm	6.5	4.5	91.1	1.2	14.2	minor	trace	trace	Major	trace	trace	trace	trace	n.d.	n.d.	n.d.	n.d.	trace
-300+212 µm	6.3	4.4	92.4	0.8	8.4	minor	trace	trace	Major	trace	trace	trace	trace	trace	trace	n.d.	n.d.	trace
-212+150 µm	10.4	7.3	86.4	1.4	5.0	minor	trace	trace	Major	trace	trace-minor	trace	trace	trace	trace	n.d.	n.d.	trace
-150+106 µm	20.4	14.3	76.1	1.4	3.4	Major	trace	trace	Major	trace	trace-minor	trace	trace	trace	trace	n.d.	n.d.	trace
-106+75 µm	37.5	26.2	58.8	1.2	2.6	Major	trace	trace	Major	trace	trace-minor	trace	trace	trace	trace	n.d.	trace	trace
-75 µm	50.6	35.4	46.0	1.1	5.0	Major	trace	trace	Major	trace	trace-minor	trace	trace	trace	trace	n.d.	trace	trace

n.a. = not available; n.d. = non detected; trace < ≅1-2%; * It is recommanded to perform optical microscopy for more details.; ** The hematite particles occured as granular and specular hematite

Fraction	% Fe_2O_3	%Fetotal	%SiO2	%Al2O3	% Weight	*Iron oxides Liberation
+850 µm	21.4	15.0	77.2	0.6	24.2	40-60%
-850+600 µm	10.4	7.3	88.4	0.6	18.4	20-40%
-600+425 µm	7.1	5.0	92.0	0.6	18.8	20-40%
-425+300 µm	6.5	4.5	91.1	1.2	14.2	30-50%
-300+212 µm	6.3	4.4	92.4	0.8	8.4	50-70%
-212+150 µm	10.4	7.3	86.4	1.4	5.0	70-90%
-150+106 µm	20.4	14.3	76.1	1.4	3.4	**>90%
-106+75 µm	37.5	26.2	58.8	1.2	2.6	**>90%
-75 µm	50.6	35.4	46.0	1.1	5.0	**>90%

*Iron oxides (hematite+magnetite) liberation >90% surface

**low quantity of material, maybe low representativity

Image 1. Image by stereomicroscope of the size fraction +850 µm. Some free coarse particles of iron oxides are present as well as fine inclusions of iron oxides in quartz particles.

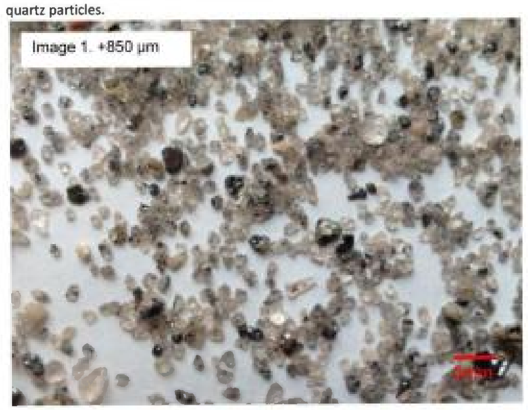


Image 2. Image by stereomicroscope of the size fraction -850+600 µm; the iron oxides are mainly in inclusions in quartz particles.

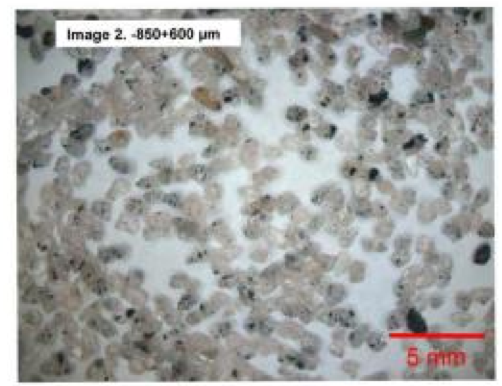


Image 3. Image by stereomicroscope of the size fraction -212+150 µm; Low proportion of iron oxides but they are mainly free.

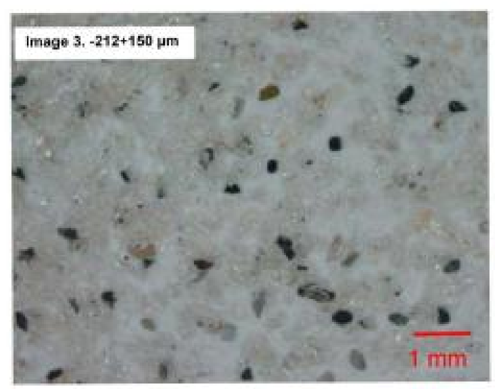
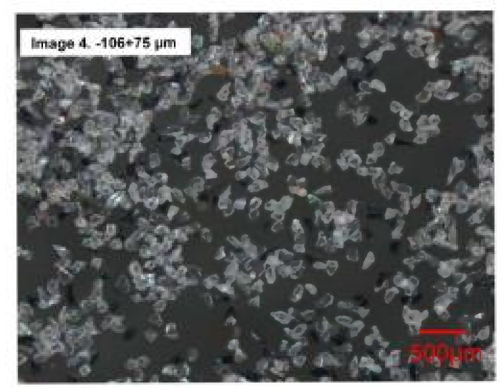
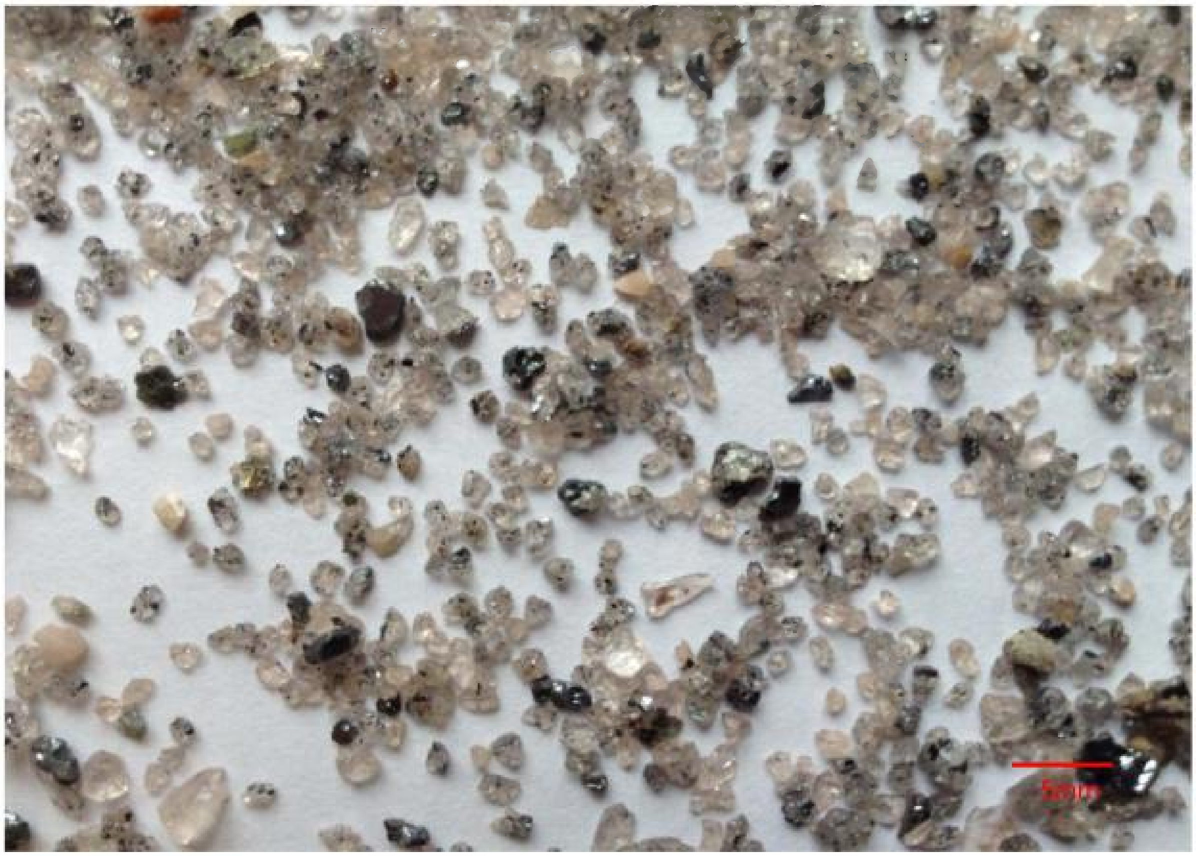
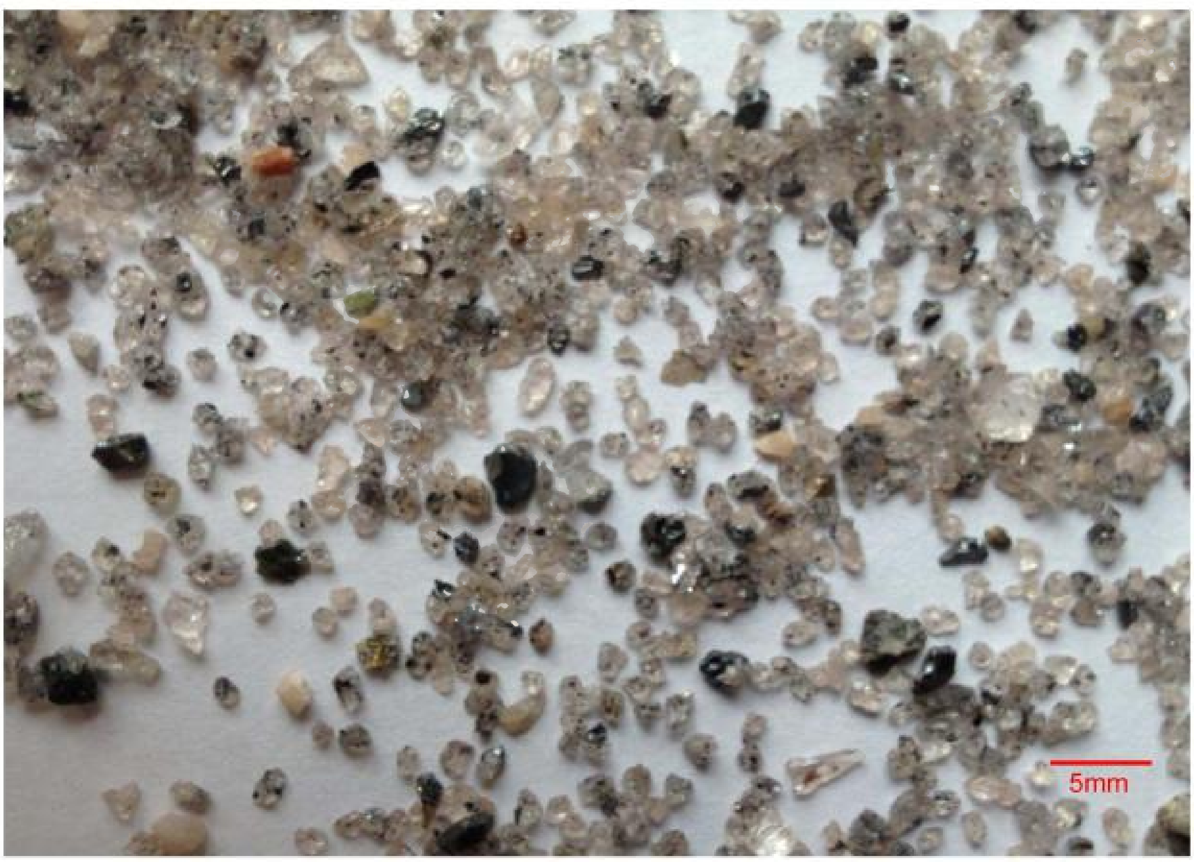


Image 4. Image by stereomicroscope of the size fraction -106+75 µm; Low proportion of iron oxides but they are mainly free.

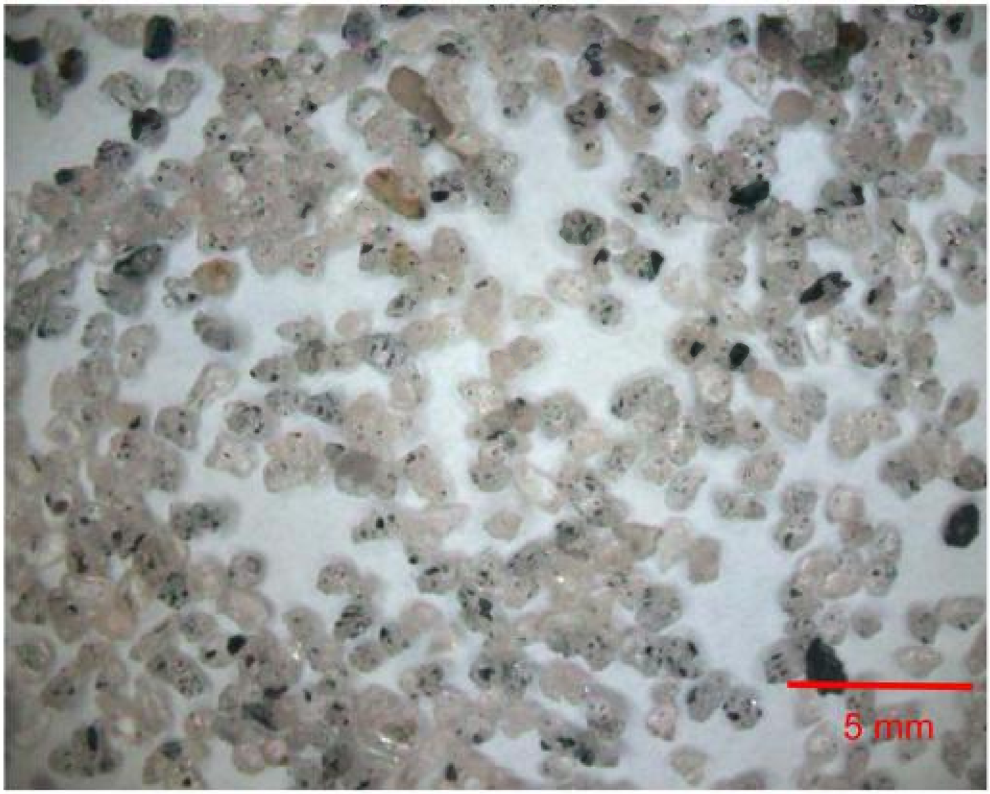


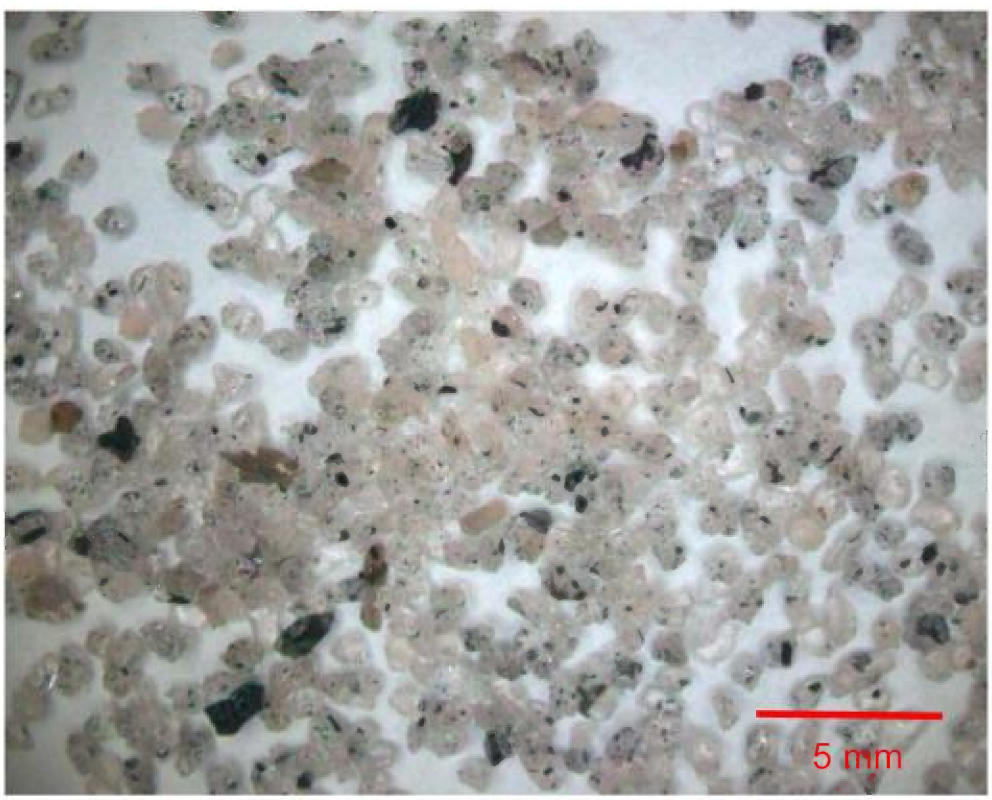
Images of size fraction +850 µm



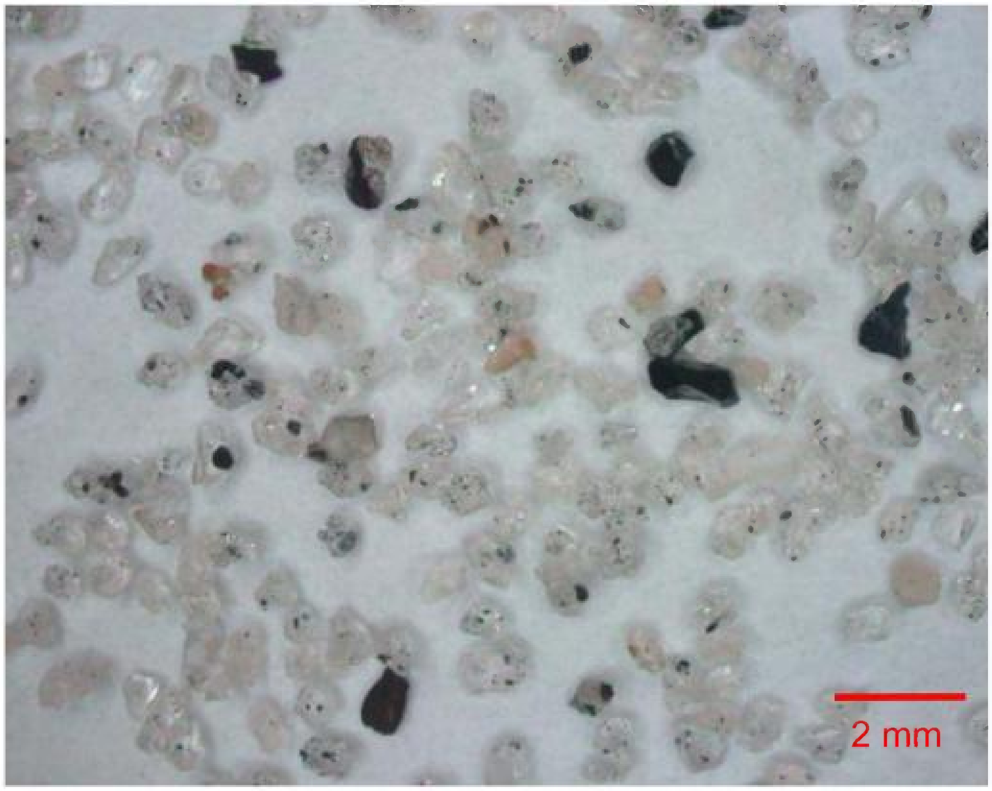


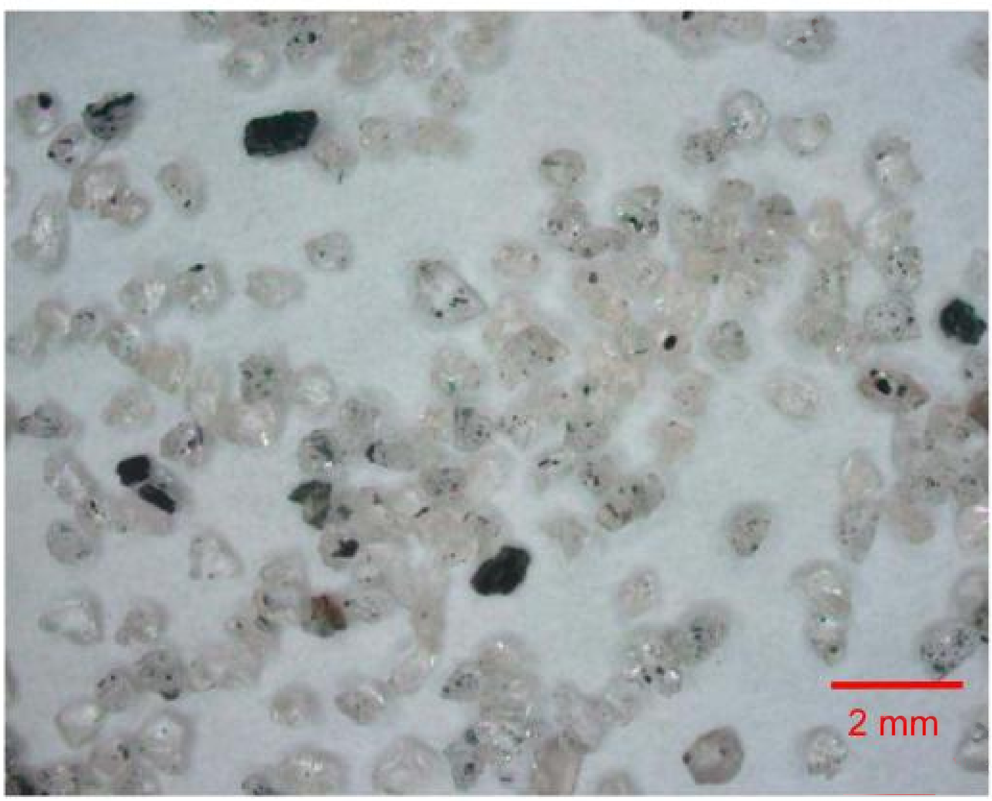
Images of size fraction -850+600 μm (stereomicroscope)



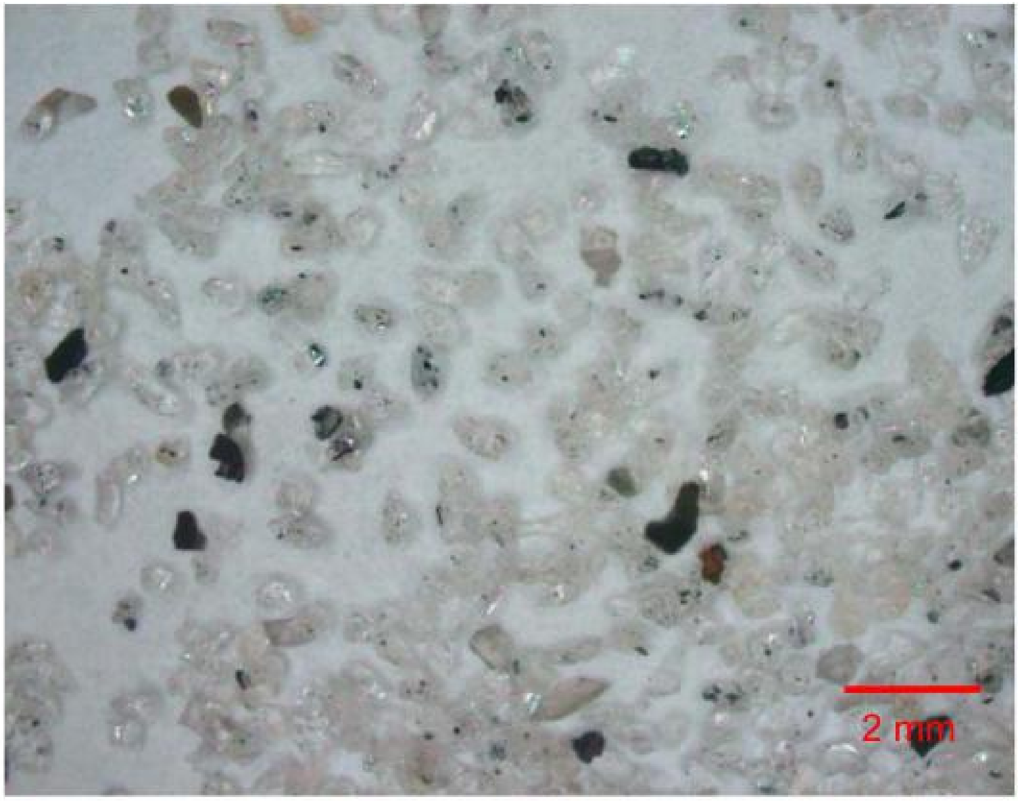


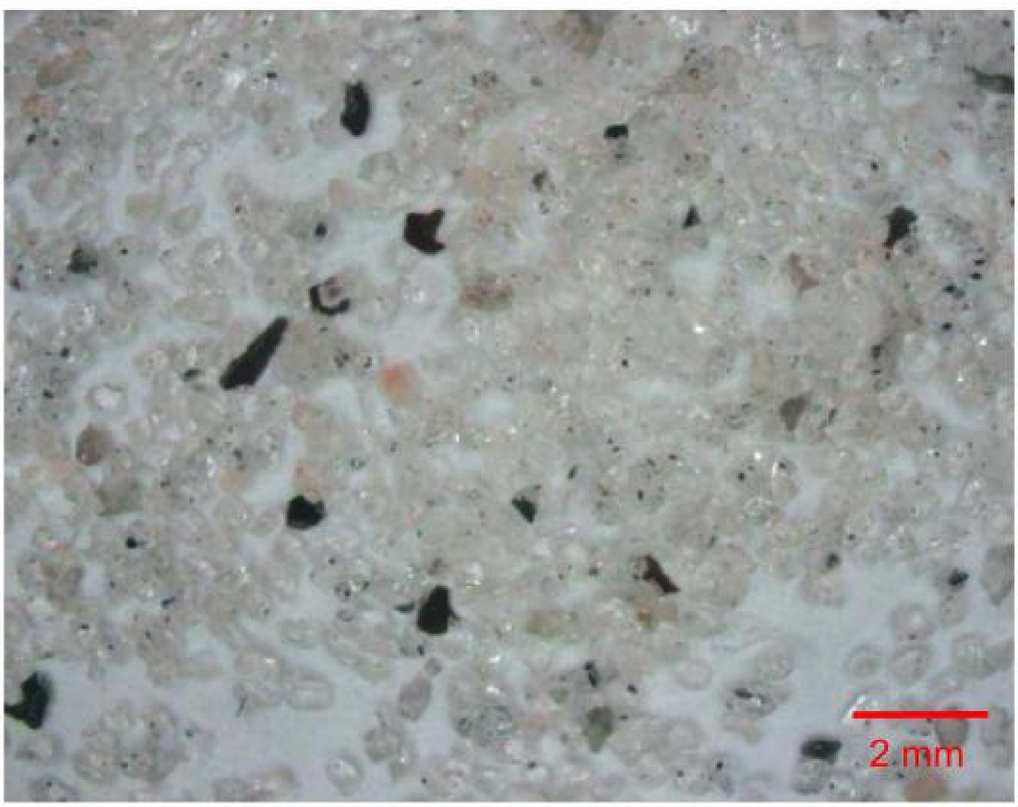
Images of size fraction -600+425 µm (stereomicroscope)



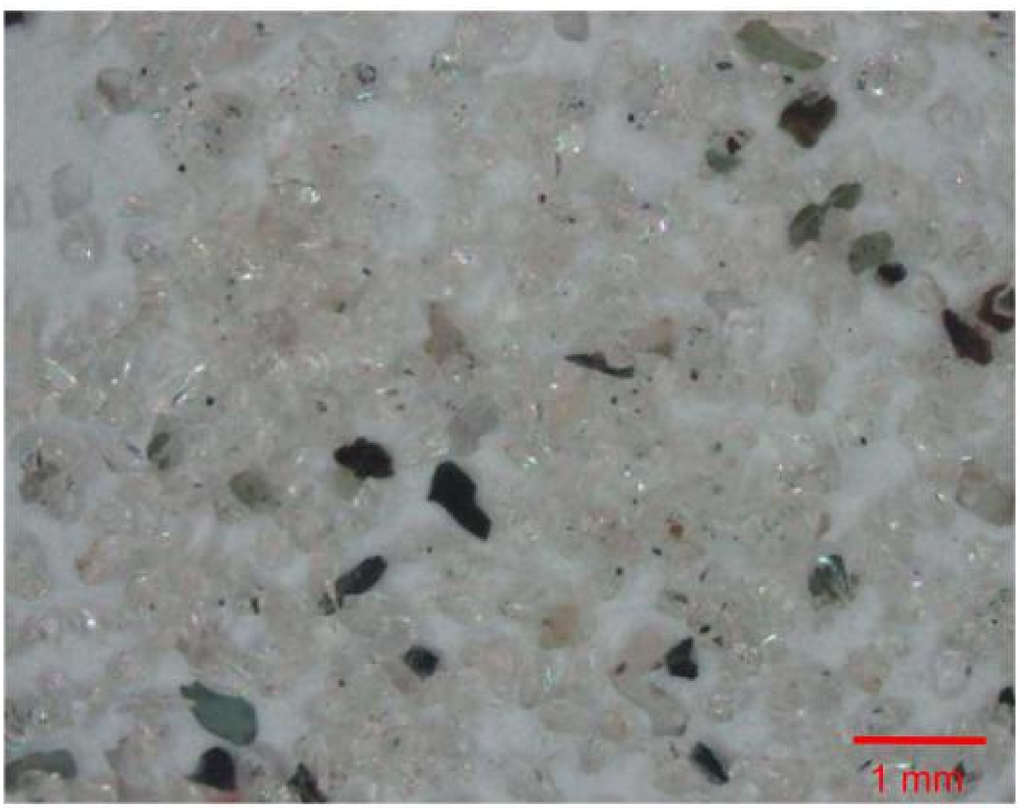


Images of size fraction -425+300 µm (stereomicroscope)

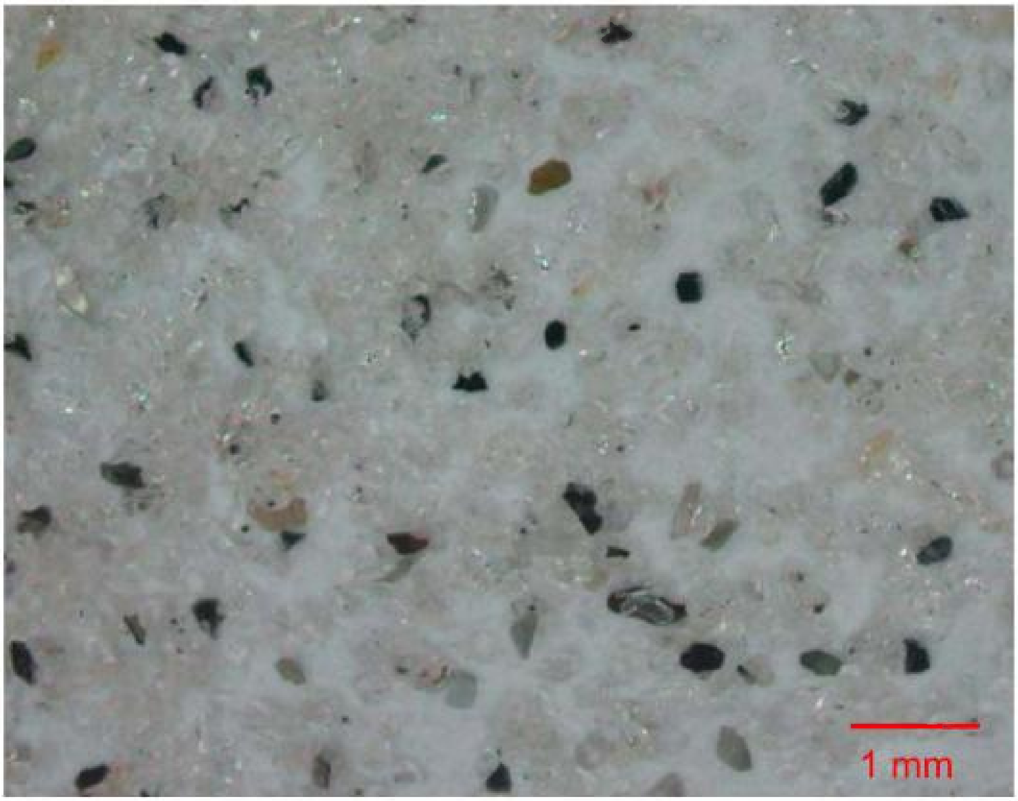


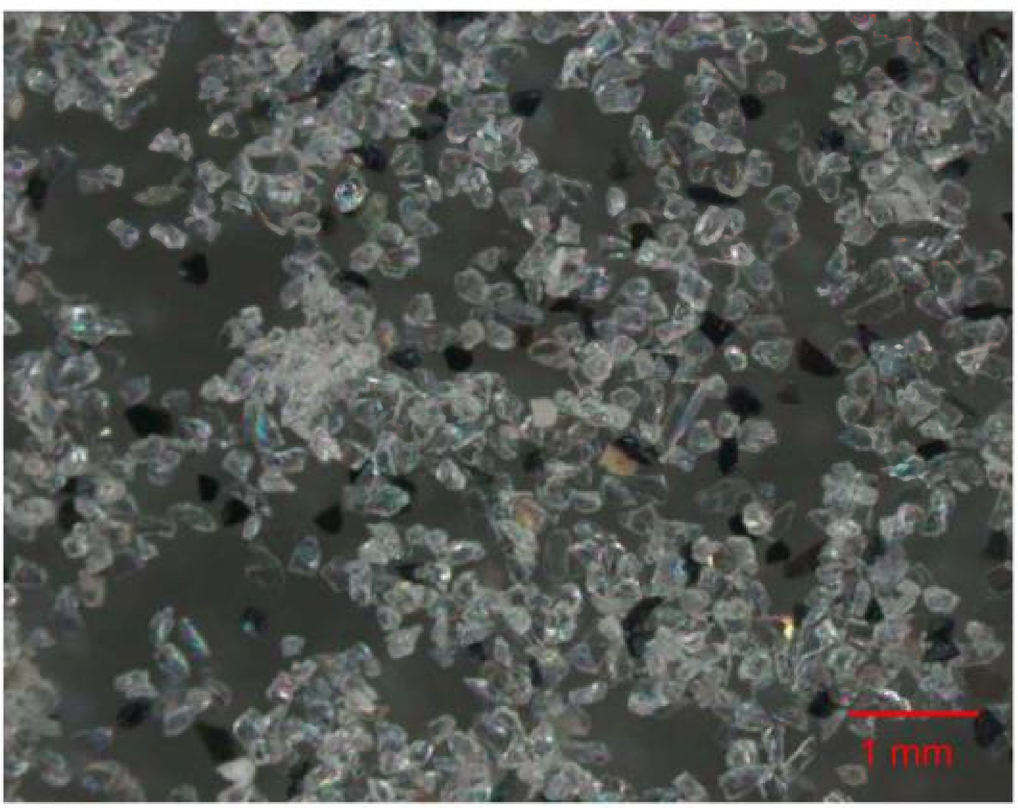


Images of size fraction -300+212 µm (stereomicroscope)

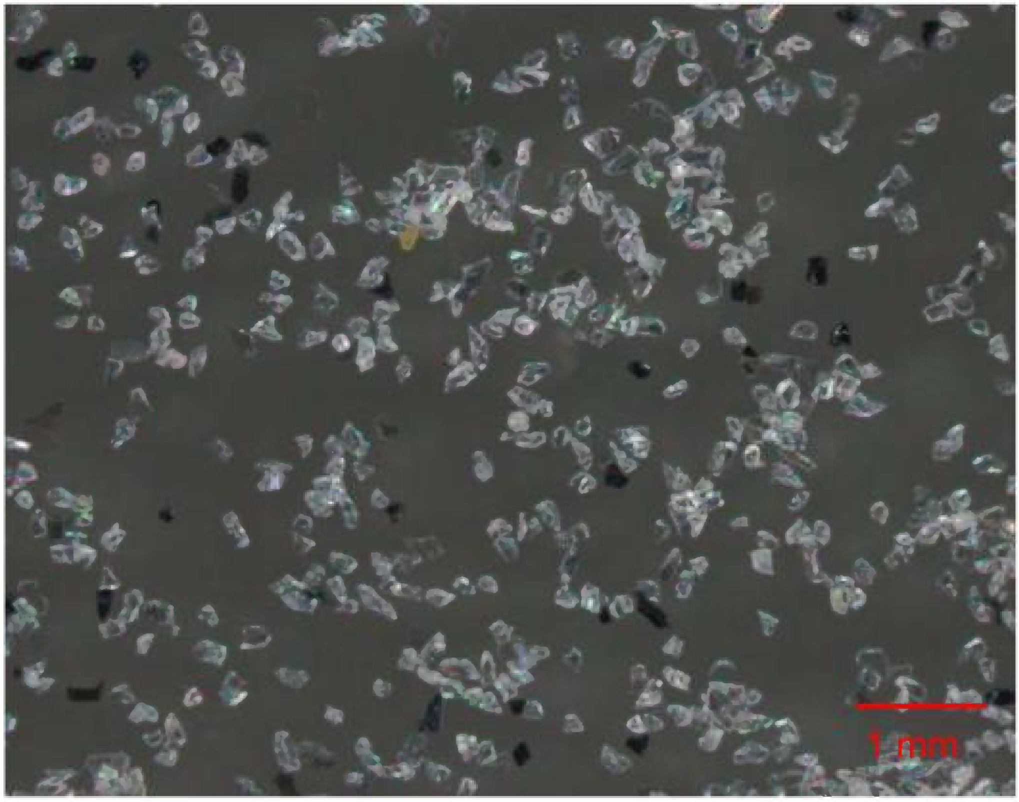


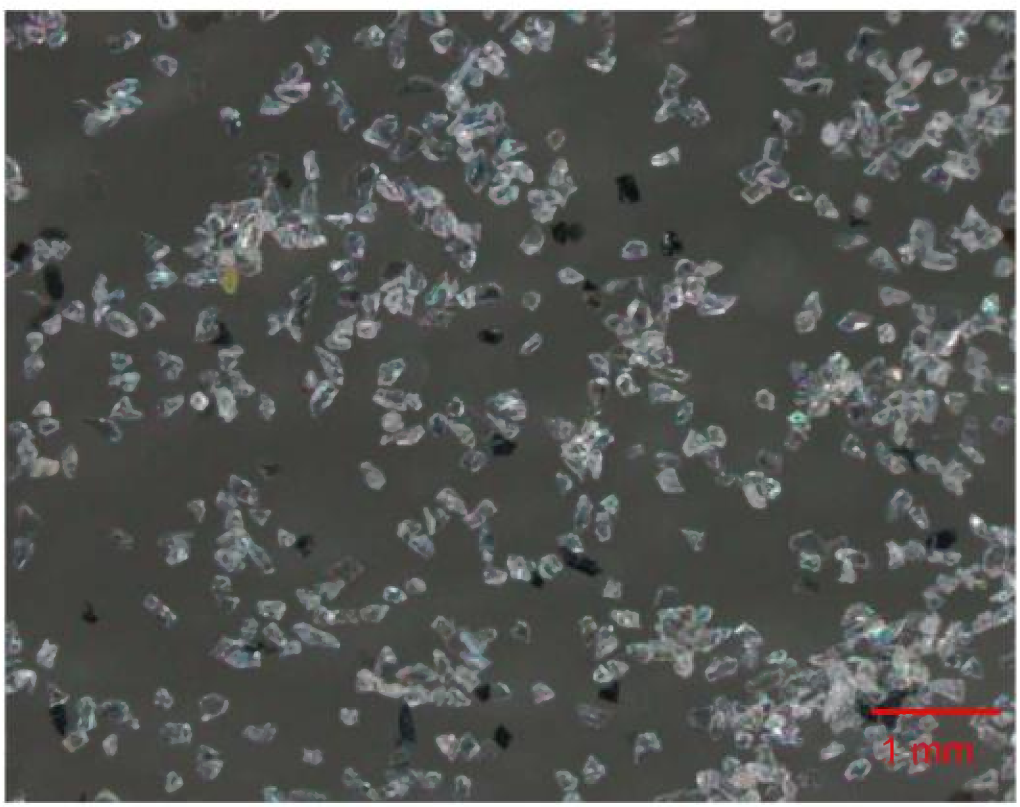
Images of size fraction -212+150 µm (stereomicroscope)



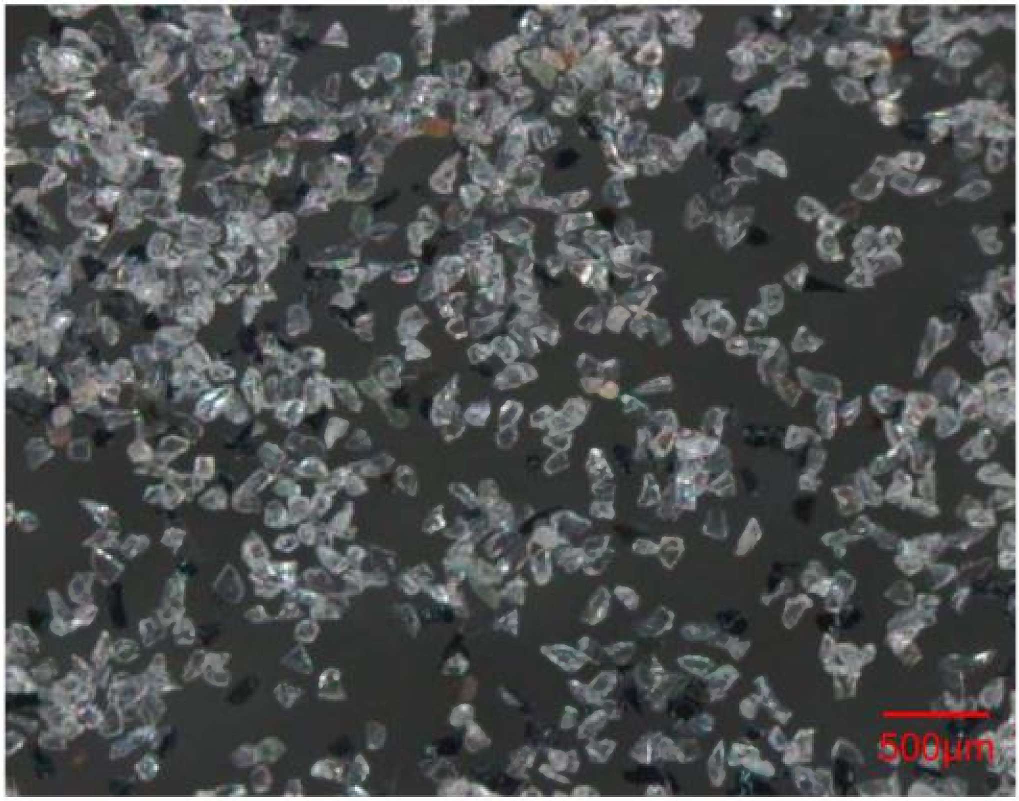


Images of size fraction -150+106 µm (stereomicroscope)





Images of size fraction -106+75 µm (stereomicroscope)



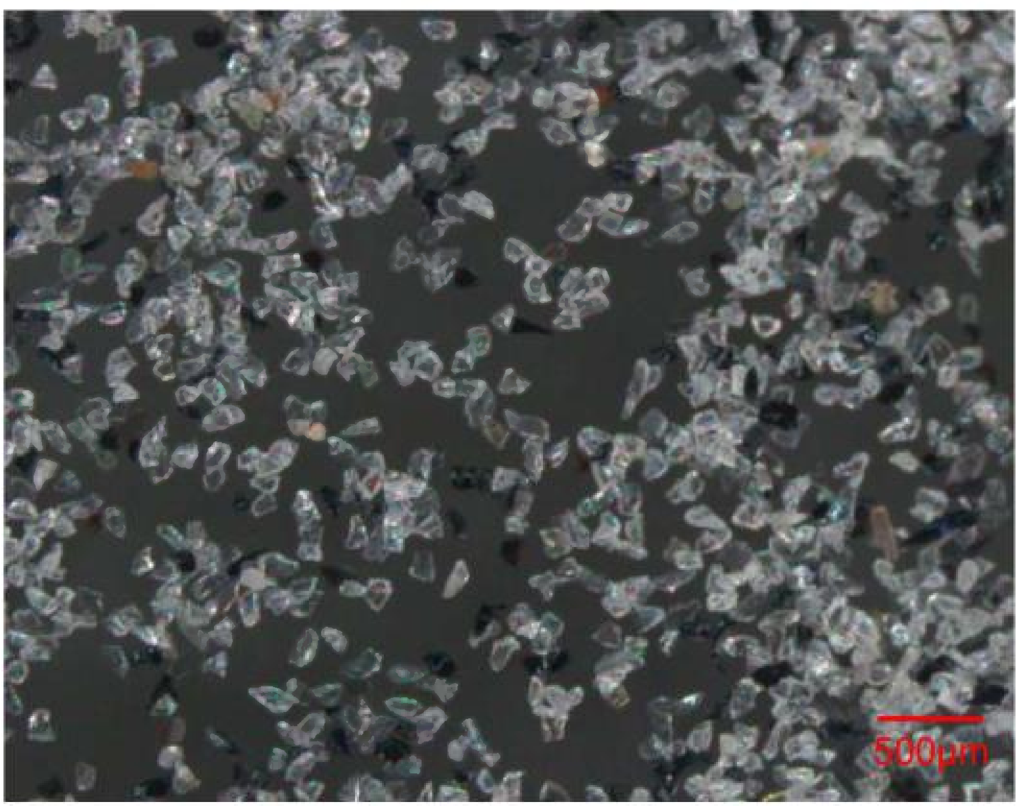


Image of size fraction -75 µm (stereomicroscope)