Mattawa Canada Garnet Deposit

NC State University MRL Proposal # 71832

8/07/07

By

Robert Carland

Dr. William Miller
Dr. Jeffery Reid

For 2 . 35722

Barton Mines

Executive Summary

The ore sample submitted by Jeff Kinblom for claims in Canada that Barton hold on the deposit called "Mattawa" were processed to generate enough # 80 Grade water jet product to do comparative testing with Barton's existing products. The ore sample was very high in heavy minerals (>2.96 sp) and had several forms of garnet present. The ore sample had 34% by weight of garnet but only 54% was almandine, 29% pyrope, and 18% grossular. From a mineralogy standpoint this spread of garnet coupled with the diopside and hornblende comprised 75% of the ore. The ore was rather difficult to process using sizing, gravity, and low and high strength magnetic fields due to the common specific gravity of the diopside-hornblende-pyrope-grossular minerals. The almandine form of garnet has a high specific gravity around 4.3 which allows it to be easily gravity separated. Because of this, the final product could not be purified beyond 80% garnet grade with the above method. It is believed by the author that if Barton seeks a grade higher than 80%; froth flotation needs to be employed to make the higher grade efficiently. The approach used within was to screen the rock fractions into three size ranges so that gravity as well as magnetic separation would be more effective. This logic was fostered from previous work with garnet ores with lower specific gravity garnet minerals present. The process worked rather well for the removal of the feldspar, biotite and diopside, but to a much lesser extent for the hornblende due to its specific gravity and magnetic properties. The diopside was removed during the magnetic separation. In the final product, the contaminant is mostly hornblende at a 20% level. Mr. Kinblom was contacted and advised on the purity level and further froth flotation work was declined.

The recovery of the above process was not relevant in terms of processing efficiency. The lab work's main emphasis was on sample generation with an attempt to understand the difficulty of processing the ore. There is no doubt to capture the lighter grades of garnet more efficiently thus achieving a reasonable recovery, froth flotation should be considered. Once again, as in a previous study for Barton, Hutton Bay, the high grade of garnet in the ore is not a sole predictor of economic viability. The author believes that a mineralogy study of the garnet and the accompanying minerals in the rock can be a good screen for the ease of processing. This may save Barton both time and money in their efforts to locate easily processed ore deposits.

**Mattawa Garnet Ore Processing**

Process evaluation of the Mattawa garnet ore has been completed. The unit operations involved in the process included size reduction, gravity concentration and magnetic separation to produce a final product of garnet concentrate. Size reduction was necessary for liberation and proper size gradation of the product concentrate. Both gravity concentration and magnetic separation were for removal of heavy and highly magnetic impurities from the garnet. The procedure for the unit operations are described below:

**Size Reduction**

Approximately 600 lb of raw ore material was shipped to our facility as rocks, 6 – 8 inches in size, in cardboard boxes on a pallet. The as-received ore material was crushed in a 6 x 12" jaw crusher to produce a suitable feed to the roll crusher. The jaw crusher's discharge opening was set to a product of about ½" that could be fed straight to the roll crusher. To avoid production of excessive fines, the subsequent size reduction steps involved stage crushing. The jaw crusher product was screened on an 80-mesh screen to remove undersize fraction before feeding to the roll crusher. All the crushed material from the jaw crusher was staged crushed in the roll crusher to produce approximately 1/8 inch product and excess minus 80-mesh fines. The roll crusher product was screened into three size fractions, plus 14-mesh, 14 x 30-mesh and 38 x 80-mesh. The 30 x 80-mesh fraction was considered as the desired size for subsequent concentration process whereas the other size fractions were subjected to further size reduction using a cone crusher to generate the final 30 x 80-mesh product. The weight distribution of the size fractions after roll crushing was 72 lb of plus 14-mesh; 215 lb of 14 x 30-mesh; 205 lb of 30 x 80-mesh and 92 lb of minus 80-mesh. After the size reduction, the product was screened into three final size fractions, 30 x 50-mesh, 50 x 80 mesh and 80 x 100-mesh, for the subsequent gravity concentration and magnetic separation steps. All the minus 80-mesh fines were kept separate and stored. The weight distribution after size reduction was 44.2 lb of 30 x 50-mesh fraction; 104 lb of 50 x 80-mesh fraction; 95 lb of 80 x 100-mesh fraction and 279 lb of minus 80-mesh

Table 1. Mass Balance of Feed Material for Processing

| Size Fraction | After Roll Crusher lb | Size Fraction | After All Size Reduction lb |
|---|---|---|---|
| + 14 Mesh | 72 | - 30 + 50 Mesh | 44.2 |
| - 14 + 30 Mesh | 215 | - 50 + 80 Mesh | 104.0 |
| - 30 + 80 Mesh | 205 | - 80 + 100 Mesh | 95.0 |
| - 80 Mesh | 92 | - 80 Mesh | 279.0 |
| | | - 100 Mesh | 36.0 |
| Total | 584 | Total | 558.2 |

**Heavy-Liquid Separation (Sink-Float Analysis)**

Initial amount of heavy minerals in the ore feed was determined by heavy liquid separation using tetrabromoethane (TBE) with a specific gravity of 2.94. Three samples from three size fractions of the feed were used for the heavy liquid separation. These were 14 x 200 mesh, 50 x 80 mesh and 80 x 270 mesh size fractions. The results of the sink float analysis are tabulated in Table 2.

Table 2. Results of Heavy Liquid Separation (Sink-Float Analysis)

| | 50 x 80 Mesh | | 80 x 270 Mesh | | 14 x 200 Mesh | |
|---|---|---|---|---|---|---|
| | Weight | | Weight | | Weight | |
| | g | % | g | % | g | % |
| H-L Floats | 67.49 | 25.3 | 79.30 | 27.3 | 93.26 | 21.7 |
| H-L Sinks | 199.52 | 74.7 | 211.17 | 72.7 | 337.48 | 78.3 |
| Total | 267.01 | 100.0 | 290.47 | 100.0 | 430.74 | 100.0 |

The results of the sink-float analysis showed that there were about 75% heavy minerals (with specific gravity greater than 2.94) in the ore. However, visual examination indicated that not all the heavy minerals were garnet. The float and sink samples from the test with 14 x 200 mesh fraction were subjected to a mineralogical count to determine the garnet concentration in the sink and float fractions. According to the mineralogical count, the head feed contained 34% garnet, 20.5% diopside, 13.4% hornblende, 14% biotite and 18.1% plagioclase as the major minerals. Table 3 and Table 4 show the mineralogical balances in the head feed (14 x 200 mesh)

Table 3. Mineralogical Balance of the Ore Feed (14 x 200 Mesh)

| | Heavy Liquid Sink | | | | Heavy Liquid Float | | | |
|---|---|---|---|---|---|---|---|---|
| | Grain | Specific | Equiv. weight | | Grain | Specific | Equiv. weight | |
| Minerals | Count | Gravity | Count | % | Count | gravity | Count | % |
| Garnet | 603.0 | 3.6 | 2,170.8 | 43.4 | 0 | 3.6 | 0.0 | 0.0 |
| Diopside | 316.0 | 3.6 | 1,137.6 | 22.8 | 81.0 | 3.6 | 291.6 | 12.4 |
| Hornblende | 238.0 | 3.6 | 856.8 | 17.1 | 0 | 3.6 | 0 | 0.0 |
| HeavyMinerals | 1,157.0 | | 4,165.2 | 83.4 | 81.0 | | 291.6 | 12.4 |
| Biotite | 305.0 | 2.6 | 793.0 | 15.9 | 64.0 | 2.6 | 166.4 | 7.1 |
| Plagioclase | 15.0 | 2.6 | 39.0 | 0.8 | 727.0 | 2.6 | 1,890.2 | 80.5 |
| Light Minerals | 320.0 | | 832.0 | 16.6 | 791.0 | | 2,056.6 | 87.6 |
| Total | 1,477.0 | | 4,997.2 | | 872.0 | | 2,348.2 | |

Table 4. Mineralogical Balance of Ore Feed (14 x 200 Mesh)

| | | Wt. % | | | | |
|---|---|---|---|---|---|---|
| | Wt. % | Garnet | Diopside | Hornblende | Biotite | Plagioclase |
| Sink | 78.3 | 43.4 | 22.8 | 17.1 | 15.9 | 0.8 |
| Float | 21.7 | 0.0 | 12.4 | 0.0 | 7.1 | 80.5 |
| Total | 100.0 | 34.0 | 20.5 | 13.4 | 14.0 | 18.1 |

**Gravity Concentration by Shaking Table**

Three size fractions generated after size reduction, 30 x 50-mesh, 50 x 80-mesh and 80 x 100-mesh were advanced to gravity separation process by shaking table. Each size fraction was run separately with a feed rate of about 60 lb/hr at 25% solids pulp density. The shaking table was set at full tilt at about 200 strokes per minute. The results of the shaking table concentration are tabulated in Table 5. Effective concentration of heavy minerals from light minerals was achieved for all the three size fractions tested.

Table 5. Mass Balance of Shaking Table Products

| | 30 x 50 mesh | | 50 x 80 mesh | | 80 x 100 mesh | |
|---|---|---|---|---|---|---|
| Products | Wt. g | Wt. % | Wt. g | Wt. % | Wt. g | Wt. % |
| Initial | 20,084.0 | 41.0 | 47,216.0 | | 43,130.0 | |
| Concentrate | 8,099.0 | 41.0 | 14,314.0 | 30.2 | 5,549.0 | 13.0 |
| Middlings | 7,140.0 | 36.1 | 17,884.0 | 37.7 | 9,071.5 | 21.3 |
| Tailings | 4,530.4 | 22.9 | 15,217.0 | 32.1 | 27,928.8 | 65.7 |
| Total | 19,769.4 | 100.0 | 47,405.0 | 100.0 | 42,549.3 | 100.0 |

The table concentrates and some middlings were advanced to magnetic separation to remove additional impurities.

**Magnetic Separation**

Magnetic separation procedure involved the use of high intensity, high-gradient permanent, rare earth (RE) magnetic separation equipment to remove the highly non-magnetic materials from the heavy minerals concentrate. Next the magnetic fraction from the RE separation was run over a low intensity permanent drum magnetic separator to remove heavy ferromagnetic material from the concentrate.

**High Intensity (Rare Earth), High-gradient Permanent Magnetic Separation**

The shaking table concentrate from each size fraction was subjected to magnetic separation with the rare earth (RE) Roche model # R144-101 magnetic separator. Four products, two non-magnetic and two magnetic products were generated and their weight distributions are tabulated in Table 6.

Table 6. Weight Distribution (grams) of Products from Rare Earth Magnetic Separator

| Size fraction | High Non-Magnetic Minerals | Low Non-Magnetic Minerals | Low Magnetic Minerals | High magnetic Minerals |
|---|---|---|---|---|
| 30 x 50 Mesh | 630.0 | 2,119.0 | 3,670.0 | 975.0 |
| 50 x 80 Mesh | 2,056.0 | 985.0 | 12,717.0 | 345.3 |
| 80 x 100 Mesh | 153.0 | 73.0 | 12,864.0 | 916.0 |

**Low Intensity Permanent Magnetic Separation**

Finally, the low magnetic minerals from above were treated separately with a low intensity magnetic separation to remove any residual heavy highly magnetic mineral impurities. This separation use Eriez model 24x14 DFA 10 dry low intensity permanent drum magnetic separator that yielded two products, non-magnetic heavy mineral concentrate and magnetic heavy minerals. The non-magnetic heavy mineral was considered as the final garnet concentrate. The weight distribution of the low intensity magnetic separation products is tabulated in Table 7.

Table 7. Weight Distribution (grams) of products from Low Intensity Drum Separator

| Size Fraction | Non-Magnetic Concentrate | Magnetic Mineral Impurities |
|---|---|---|
| 30 x 50 Mesh | 3,670.0 | 0.0 |
| 50 x 80 Mesh | 12,337.0 | 380.0 |
| 80 x 100 Mesh | 11,973.0 | 891.0 |

Mineralogical count of this final concentrate indicated about 80% garnet and about 20% other heavy minerals. Approximately 15,500 grams (34 lb) of final garnet concentrate (composite of the three size fractions) was produced which was labeled as Mattawa Garnet Concentrate, 80-grade and shipped to the sponsor. Particle size analysis of the concentrate is presented in Table 8 together with the particle size analysis of Barton's 80 grade garnet for comparison purposes.

Table 8. Particle Size Analysis of Processed Mattawa Garnet Concentrate

| SCREEN SCALE ratio 1.414 | | Mattawa Garnet Concentrate 80-Grade | | | | Barton 80-Grade | | | |
|---|---|---|---|---|---|---|---|---|---|
| Opening | | Weight between | % Wt. between | Cum % Retained | Cum % Passing | Weight between | % Wt. between | Cum % Retained | Cum % Passing |
| Mesh | micromete | sieves | Sieves | on Sieves | Sieves | sieves | sieves | on sieves | sieves |
| 30 | 600 | 0.10 | 0.0 | 0.0 | 100.0 | | 0.0 | 0.0 | 100.0 |
| 35 | 500 | 0.00 | 0.0 | 0.0 | 100.0 | | 0.0 | 0.0 | 100.0 |
| 40 | 425 | 0.00 | 0.0 | 0.0 | 100.0 | | 0.0 | 0.0 | 100.0 |
| 45 | 355 | 11.00 | 3.8 | 3.8 | 96.2 | | 2.0 | 2.0 | 98.0 |
| 50 | 300 | 26.30 | 9.0 | 12.8 | 87.2 | | 19.0 | 21.0 | 79.0 |
| 60 | 250 | 46.70 | 15.9 | 28.7 | 71.3 | | 30.0 | 51.0 | 49.0 |
| 70 | 212 | 123.60 | 42.1 | 70.8 | 29.2 | | 27.0 | 78.0 | 22.0 |
| 80 | 180 | 75.90 | 25.9 | 96.7 | 3.3 | | 15.0 | 93.0 | 7.0 |
| 100 | 150 | 7.10 | 2.4 | 99.1 | 0.9 | | 5.0 | 98.0 | 2.0 |
| Pan | -150 | 2.60 | 0.9 | | | | 2.0 | 100.0 | |
| Total | | 293.30 | 100.0 | | | | 100.0 | | |

# A PRELIMINARY MINERAL EXAMINATION

# OF

# SAMPLE 7112 FROM MATAWA, ONTARIO, CANADA

Prepared for:

Mr. Robert Carland
Director,
Minerals Research Laboratory
180 Coxe Ave., Asheville, North Carolina 28801

Submitted by:

Jeffrey C. Reid, Ph.D., P.G., CPG
President,
ForensicGeology, Inc.
8401 Summerspring Lane
Raleigh, North Carolina 27615

Date: 28 July 2007

**Summary**:

This report transmits preliminary mineralogical results of two samples (sink and float) of the 14x200 fraction of Minerals Research Lab (MRL) sample 7112 from Mattawa, Ontario, Canada. Garnet is the primary mineral of interest.

**Initiation**:

Mr. Robert Carland requested this study. Mr. Carland is Director of the Minerals Research Laboratory (MRL), 180 Coxe Avenue, Asheville, North Carolina 28801. The samples were shipped from the MRL on 28 June 2007 accompanied by a transmittal letter from Dr. Robert Mensah-Biney of MRL. Other size fractions were included in the sample shipment, but were not examined as part of the requested scope of work.

**Purpose of study**:

The purposes of this study were to:

1. Provide a mineral grain count for each of the sink and float subsamples of the 14x200 fraction of MRL sample 7112 from Mattawa, Ontario, Canada, and

2. Provide additional mineralogy.

**Scope of study**:

The scope of study is a binocular examination of sink and float fraction subsamples from the 14x200 fraction of MRL sample 7112, Mattawa, Ontario, Canada. This report constitutes the deliverable including grain counts and photoimage documentation.

**Previous work**:

The author is not aware of previous mineralogical work on this deposit and does not know the geographic location. This does not preclude the existence of previous material. The author had access the report by Miller dated 13 June 2007 (see References).

**Procedures**:

1. The two samples were weighed upon receipt:

| *Sample* | *Sink (weight in grams)* |
|---|---|
| 7112 – sink (14x200) | ~110.2 |
| 7112 – float (14x200) | ~36.4 |

2. Preliminary reconnaissance sample examination:

The samples were examined for general mineralogy using stereozoom binocular microscopes.

Small amounts of the sink and float samples were examined using a petrographic microscope in air without index of refraction oils. Grain size was not reduced for reconnaissance petrographic examination.

Reconnaissance mineral examination notes were made and supplemented with about 50 high resolution digital images taken using the stereozoom microscope.

3. Sample splitting prior to grain counting and imaging:

Samples were split using a Sepor Microsplitter (Jones-type riffle splitter) composed of 14, 1/8"-wide slots and high-backed receiving aluminum pans. Samples were split down to several grams for grain counting using three- to four splits. The Sepor Microsplitter was cleaned between samples that were split.

4. Grain counting:

Samples were examined using a Meiji trinocular stereozoom microscope equipped with super widefield eyepieces, a parfocalizing camera adapter and T-mount ring mated with a Nikon D80 (10.2 megapixel) digital camera. A dual-arm fiber optic light source provided adjustable lighting (position and intensity). A shutter cable-release was used to minimize camera vibration.

Table 1 provides standard field of view for all images included in this report. The stereozoom and camera field of view were calibrated using a 10mm micrometer with 10 divisions per millimeter. All grain count images were done using a 3.0 instrument setting (see Table 1 for all counted images, Table 2). Lower magnification was not as effective in grain counting these samples.

**Table 1** – Stereozoom binocular microscope calibrated field of view and camera view field.

| *Stereozoom setting* | *Viewable (long field)* | *Camera (long field)* |
|---|---|---|
| 3.0 | ~8 mm | ~4 mm |

Grains from the sink samples were distributed on a white background using a microspatula. Grains from the float fraction were distributed on a dark background. The viewed layer was one grain thick to maximize observation and imaging. The grains were returned to the split container following imaging. This process was repeated three or four

times for each sample. Care was taken not to shake the split to potentially concentrate heavier minerals.

Images were captured as .jpeg images and were processed using Adobe Photoshop CS 2, version 9.0.1. Final images were saved as Photoshop PDF files and printed at full page size (~8.5 x 11 inches) for grain counting. Grain counting was done on translucent, 216mm x 279 engineering graph paper taped over the printed images. Each grain counted was marked with a cross on the overlay transparent paper and tabulated on a tally sheet. The high resolution Adobe images used to make the prints were displayed on a computer screen to help verify grain identity on the transparent overlay.

**Results**:

Grain count results are tabulated in Table 2 (raw counts and mineral percent totals). A total of 1,477 points were counted for the sink fraction and a total of 872 points were counted for the float fraction.

**Discussion**:

The following discusses aspects of the minerals:

*Garnet* – The garnets are brown orange red and typically have a conchoidal fracture. They are also clear and do not appear to have many inclusions. Larger grains are more deeply colored than smaller grains. When viewed with a petrographic microscope the garnets in this fraction are isotropic and do not appear sheared. Only a few garnets in the float fraction appear not liberated from the feldspar.

*Pyroxene (diopside)* – Diopside is medium green and blocky with pyroxene cleavage angles. Smaller grains are translucent and greener. Thicker grains are more deeply colored. The diopside in the float fraction tends to have a 'nugget' effect and appears as larger grains resulting to some variation in the grain count.

*Hornblende* – Hornblende forms stubby black crystals with an amphibole cleavage. Smaller crystals are translucent brown to black.

*Biotite* – Biotite has perfect cleavage and tends to occur in 'books.' Thinner 'books' or flakes are reddish brown.

*Feldspar* – The plagioclase feldspar is white to colorless, and clear to translucent. Plagioclase twinning is distinct in many grains. Crystals may be stubby or elongated – especially the translucent crystals. Some grains are stained by iron oxide resulting in a reddish cast.

**Reference cited:**

Miller, J. W., 13 June 2007 (Memorandum), "Chemical analysis of Mattawa garnet ore, Methods, Results, and Minerals."

**Appendix**:

1. Table 2 – Grain count results.

2. Paper grain count overlays taped to original images (image labels taped to the back of each image). Tally sheets included.

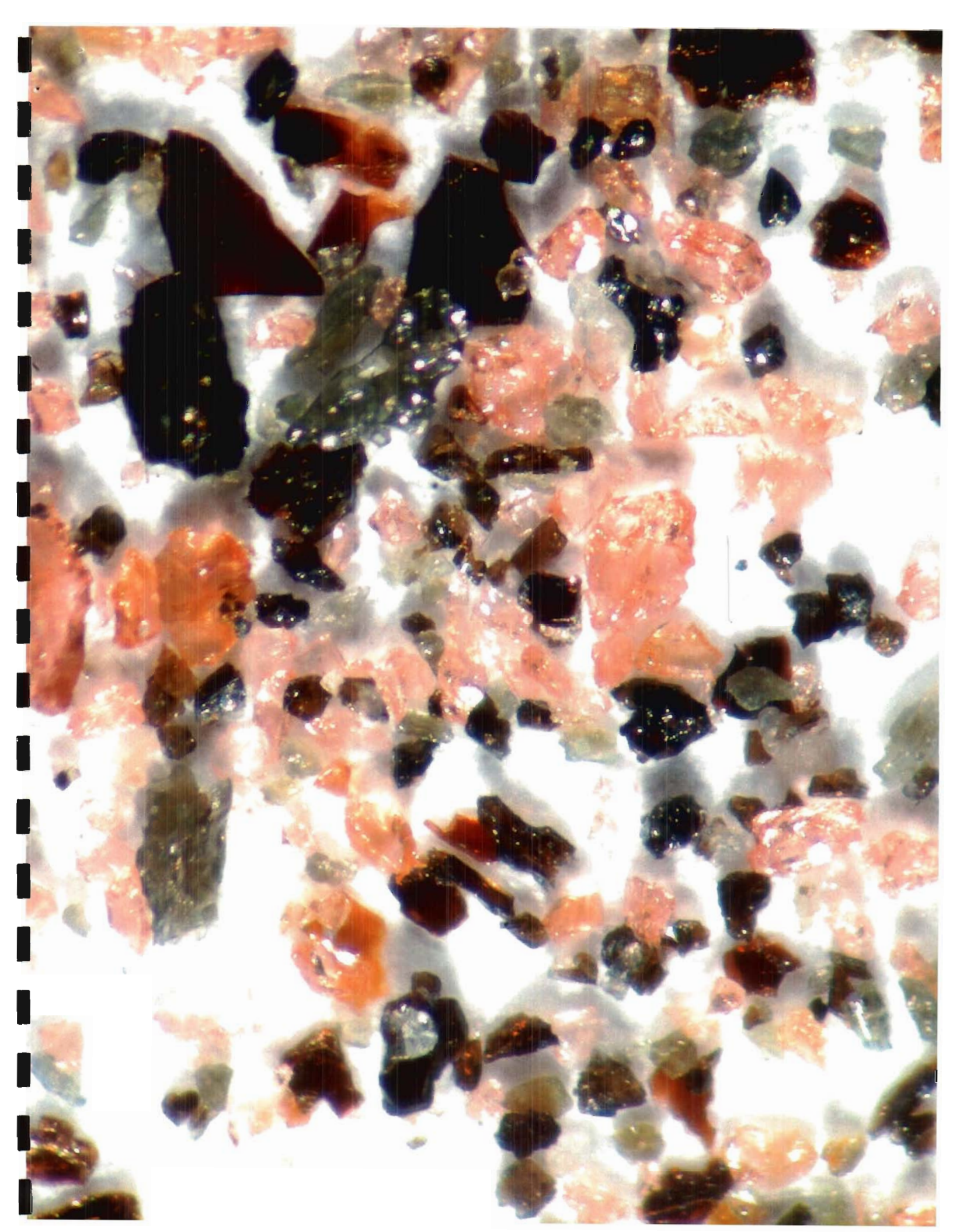
Sink fraction

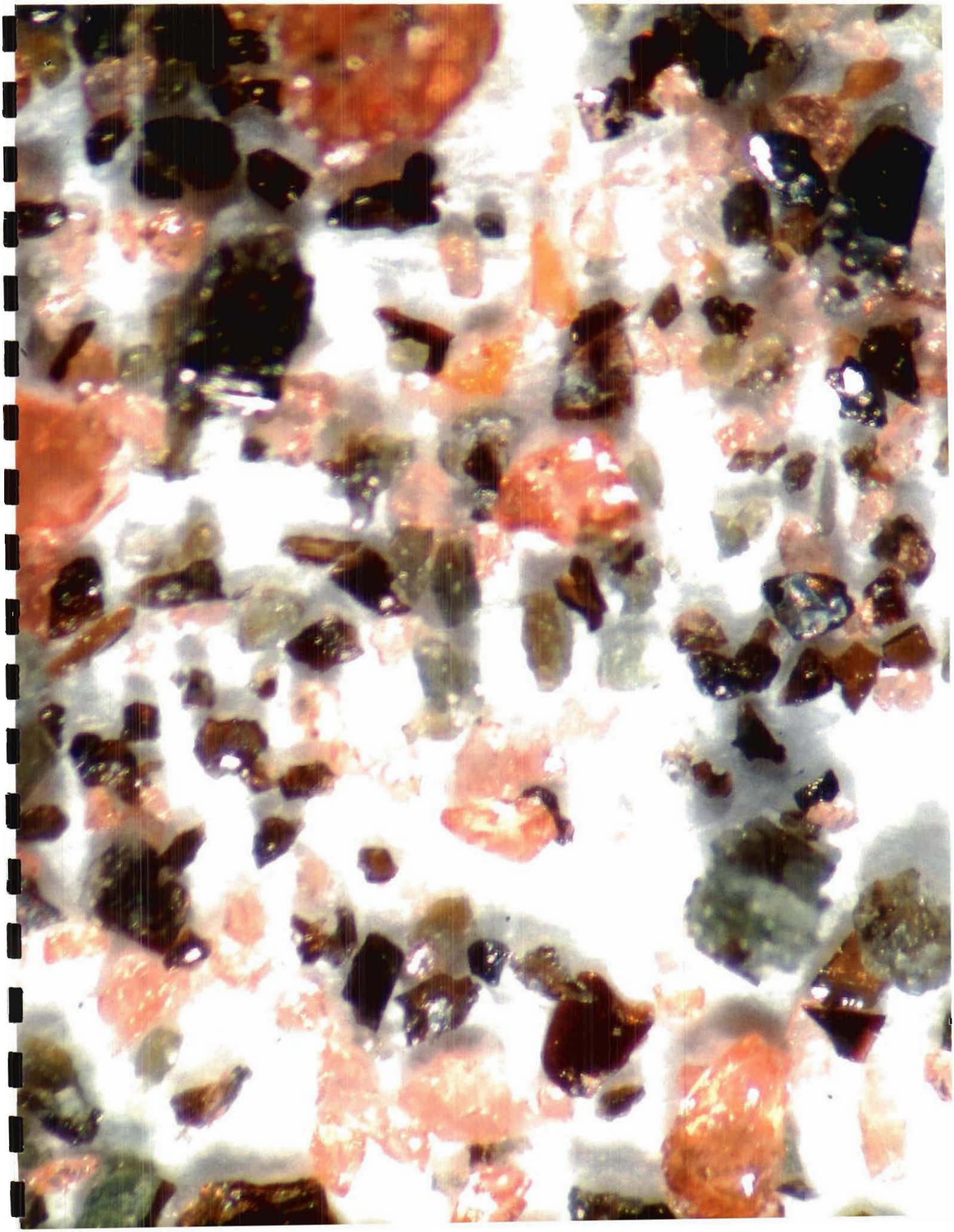
- 7112_sink_3a1
- 7112_sink_3b1

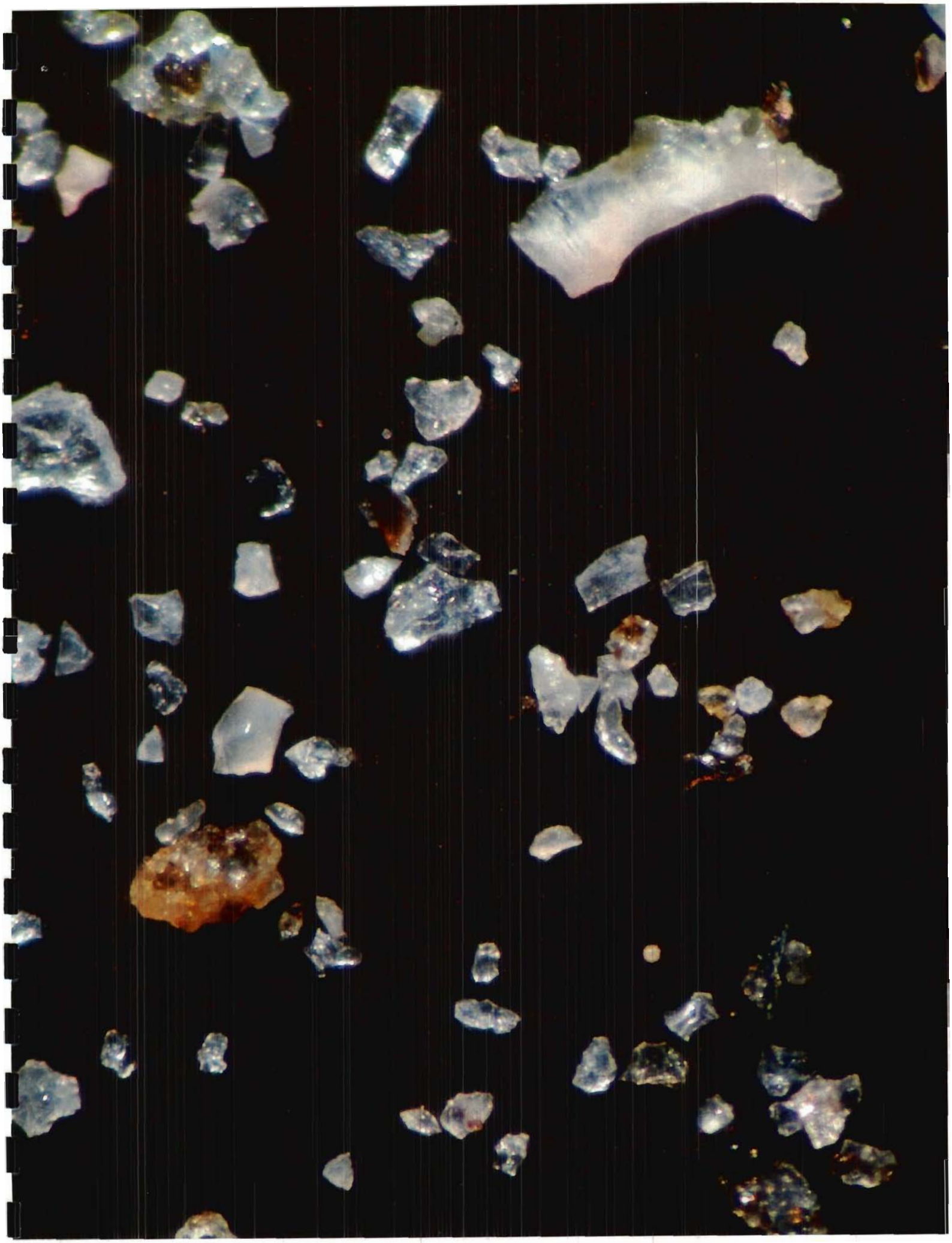
Float fraction

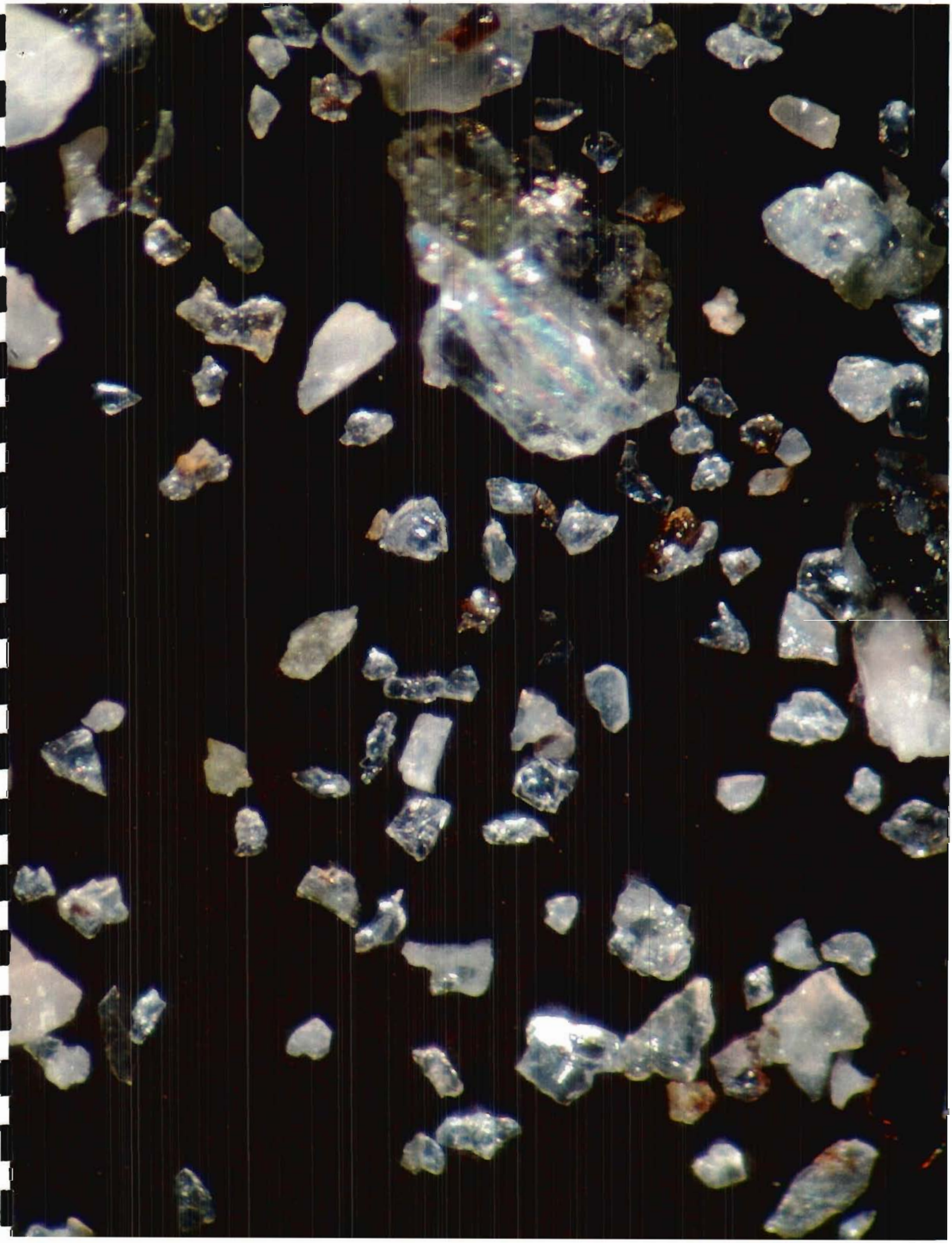
- 7112_float_3a1
- 7112_float_3c1
- 7112_float_3e1

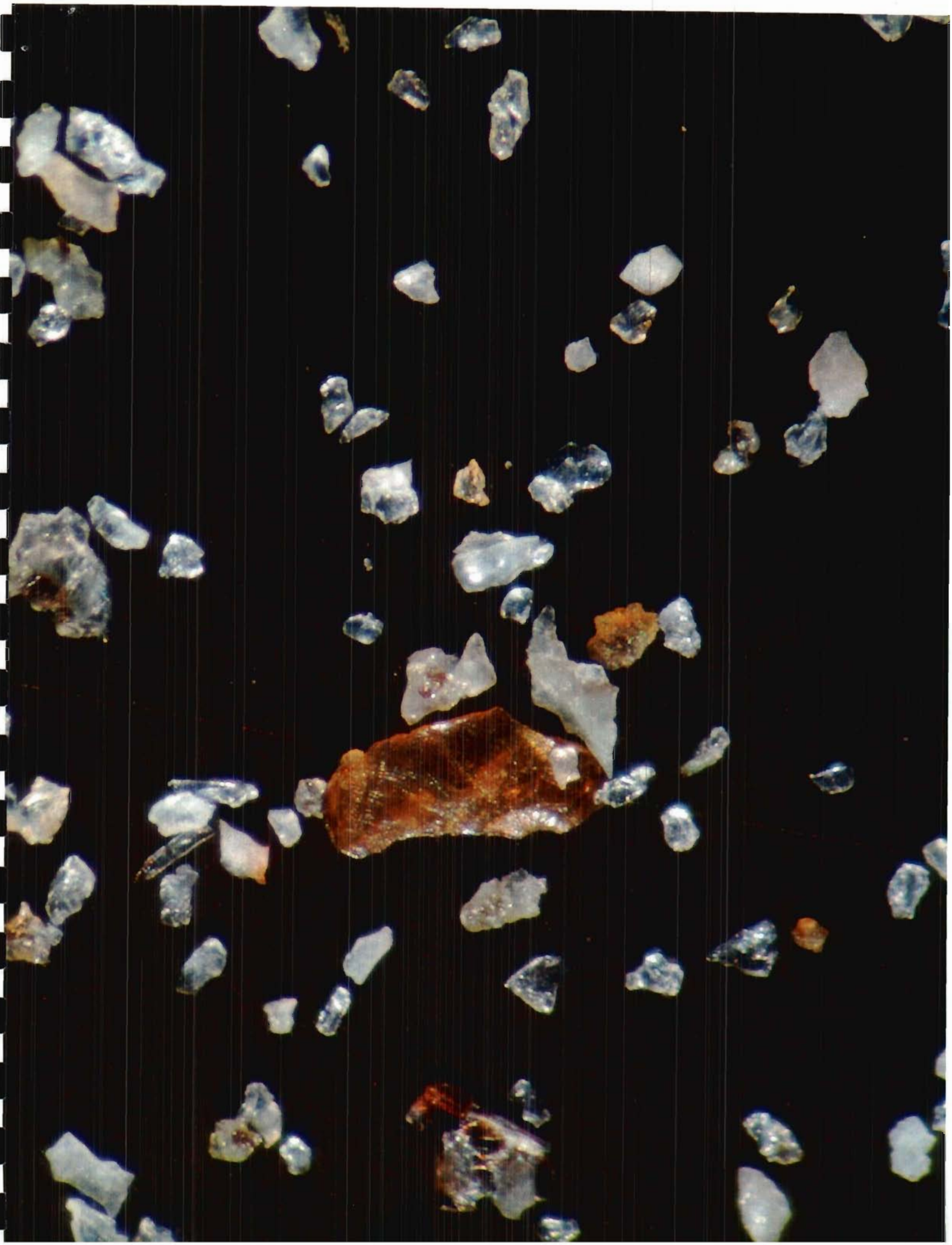
| *Table 2 - Sample 7112 grain count summary - Mattawa, Ontario, Canada* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| ***Mineral*** | ***7112 Sink*** | ***7112 Sink*** | ***Total*** | ***Percent*** | | ***Float*** | ***Float*** | ***Float*** | ***Total*** | ***Percent*** |
| | ***3a1*** | ***3b1*** | | | | ***3a1*** | ***3c1*** | ***3e1*** | | |
| Garnet | 308 | 295 | 603 | 40.83 | | | | | | |
| Diopside | 201 | 115 | 316 | 21.39 | | 2 | 74 | 5 | 81 | 9.29 |
| Hornblende | 141 | 97 | 238 | 16.11 | | | | | | |
| Biotite | 151 | 154 | 305 | 20.65 | | 13 | 38 | 13 | 64 | 7.34 |
| Plagioclase | 5 | 10 | 15 | 1.02 | | 220 | 276 | 231 | 727 | 83.37 |
| | | | ======= | ======= | | | | | ======= | ======= |
| Total grains counted=========> | | | 1477 | 100 | | | | | 872 | 100 |











*J. William Miller, Jr., Ph.D., P.G.* *Consulting Geologist*

604 Sweet Hollow Road
Burnsville, NC 28714-5712

jwmiller@unca.edu
828-232-5182 voice
828-251-6041 fax

**M e m o r a n d u m**

To: **Robert Carland, Director**
**North Carolina State University Minerals Research Laboratory**
**180 Coxe Avenue**
**Asheville, North Carolina 28801**

From: **J.W. Miller**

Date: **13 June 2007**

Re: **Chemical analyses of Mattawa garnet ore**

## Methods

Six samples from the Mattawa garnet deposit were characterized by plain light microscopy, polarizing light microscopy, powder X-ray diffraction (XRD), and scanning electron microscope/energy dispersive spectrometry (SEM/EDS). Samples analyzed included the following:

| Sample | size fraction |
|---|---|
| 7112-sink | 14x200 |
| 7112-float | 14x200 |
| 7112-sink | 50x80 |
| 7112-float | 50x880 |
| 7112-sink | -80+270 |
| 7112-float | -80+270 |

All percentages in this report are in weight percent unless otherwise noted.

### Mineral Identification

Minerals initially were identified with a dissecting microscope and polarizing microscope (grains in index oil). Individual minerals were separated by hand and identified with a Philips PW 3040 powder X-ray diffractometer and an FEI Quanta 400 scanning electron microscope with an Oxford Inca 450 energy dispersive spectrometer. Identification of individual minerals was accomplished for the coarsest samples (7112-14x200 fraction) while mineral identifications for other splits were confirmed with the dissecting microscope and XRD.

## Results

### XRD Results

Powder XRD scans easily identify mineral structural groups but only extended, careful scans pinpoint the specific mineral variety without confirming chemical analyses. For this project, the clinoamphibole mineral, hornblende, was identified in XRD scans as hornblende, pargasite, actinolite, tremolite, etc., and compositions from the SEM/EDS analysis pinpointed the mineral variety as hornblende. The same is true for the other mineral groups, such as garnet, clinopyroxene, and biotite. Copies of XRD scans follow this report.

| Sample | XRD number | size fraction | mineral fraction* | minerals detected |
|---|---|---|---|---|
| 7112-sink | 7112sc | 14x200 | (all) | almandine, hornblende, diopside, biotite ("phlogopite"), albite |
| 7112-sink | 7112scb | 14x200 | biotite | biotite, diopside |
| 7112-sink | 7112sca | 14x200 | garnet | almandine, diopside, albite |
| 7112-sink | 7112scg | 14x200 | green | diopside, almandine, biotite |
| 7112-sink | 7112scp | 14x200 | black | almandine, hornblende, diopside, biotite ("phlogopite") |
| 7112-sink | 7112scx | 14x200 | black aggregate | almandine, amphibole ("pargasite"), diopside, biotite ("phlogopite") |
| 7112-float | 7112fc | 14x200 | (all) | albite, amphibole ("tremolite"), diopside |
| 7112-float | 7112fcfq | 14x200 | white, colorless | albite |
| 7112-sink | 7112sm | 50x80 | (all) | almandine, diopside, amphibole ("magnesioriebeckite"), biotite ("annite") |
| 7112-float | 7112fm | 50x80 | (all) | albite, amphibole ("actinolite") |
| 7112-sink | 7112sf | -80+270 | (all) | almandine, amphibole ("actinolite"), albite |
| 7112-float | 7112ff | -80+270 | (all) | albite |

**Minerals**

Relative percentages of minerals (detailed in a separate report) within each sample differed according to separation processing, but all mineral species identified for the deposit were found in each sample (Table 1). Minerals present included garnet (pyralspite), clinopyroxene (diopside), clinoamphibole (hornblende), and plagioclase (albite) (Figs. 1,2). Mineral groups were identified/corroborated with XRD and mineral varieties were determined by compositions revealed by SEM/EDS. Individual SEM/EDS scans follow this report, where sample numbers correspond to different mineral grains, with one analysis per grain (e.g. MG-gar-6 of Table 1 is labeled on the SEM/EDS report as *Mattawa garnet* (top-left side), *Spectrum* 6 (top-right side).

***Garnet*** *($A_3B_2(SiO_4)_3$, where A=$Fe^{2+}$, Mg, Ca, and B=Al, $Fe^{3+}$)*

Mattawa garnets are brownish orange-red in plain light (Fig. 1) with typical conchoidal fracture (Figs. 1, 2). They are best characterized as "pyralspite" garnets with a dominant almandine composition (Table 1, Fig. 3). The approximate average atomic percentage of the components is

54% almandine ($Fe_3Al_2(SiO_4)_3$)
29% pyrope ($Mg_3Al_2(SiO_4)_3$)
18% grossular ($Ca_3Al_2(SiO_4)_3$) or andradite ($Ca_3Fe_2(SiO_4)_3$).

The composition may be written also as $(Fe_{1.6}Mg_{0.9}Ca_{0.5})(Al,Fe)_2(SiO_4)_3$, with iron content ranging evenly from 21-26 weight percent.

***Clinopyroxene/diopside*** *($CaMgS_2O_6$)*

In plain light, the clinopyroxene appeared medium-green with typical 87°x93°cleavage angles. Powder X-ray diffraction and SEM/EDS identified the clinopyroxene as diopside, with a minor augite *($(Ca,Na)(Mg,Fe,Al)(Si,Al)_2O_6$)* component.

***Clinoamphibole/hornblende*** *($(Ca,Na)_{2-3}(Mg,Fe,Al)_5Si_6(Si,Al)_2O_{22}(OH)_2$)*

Hornblende was black in plain light with typical 56°x124° cleavage angles. The black color, massive form, XRD results, and composition (significant magnesium, and iron; small amount of sodium compared to calcium) confirmed the identification.

***Biotite*** *($K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$)*

Biotite appeared as typical dark brown grains with one direction of perfect cleavage.

***Plagioclase/albite*** *($NaAlSi_3O_8$ - $CaAl_2Si_2O_8$)*
Plagioclase was ranged from transparent and colorless to translucent and white or orange (probably iron oxide stain). Twin striations were obvious, and the composition was within the albite (sodium end-member) range.

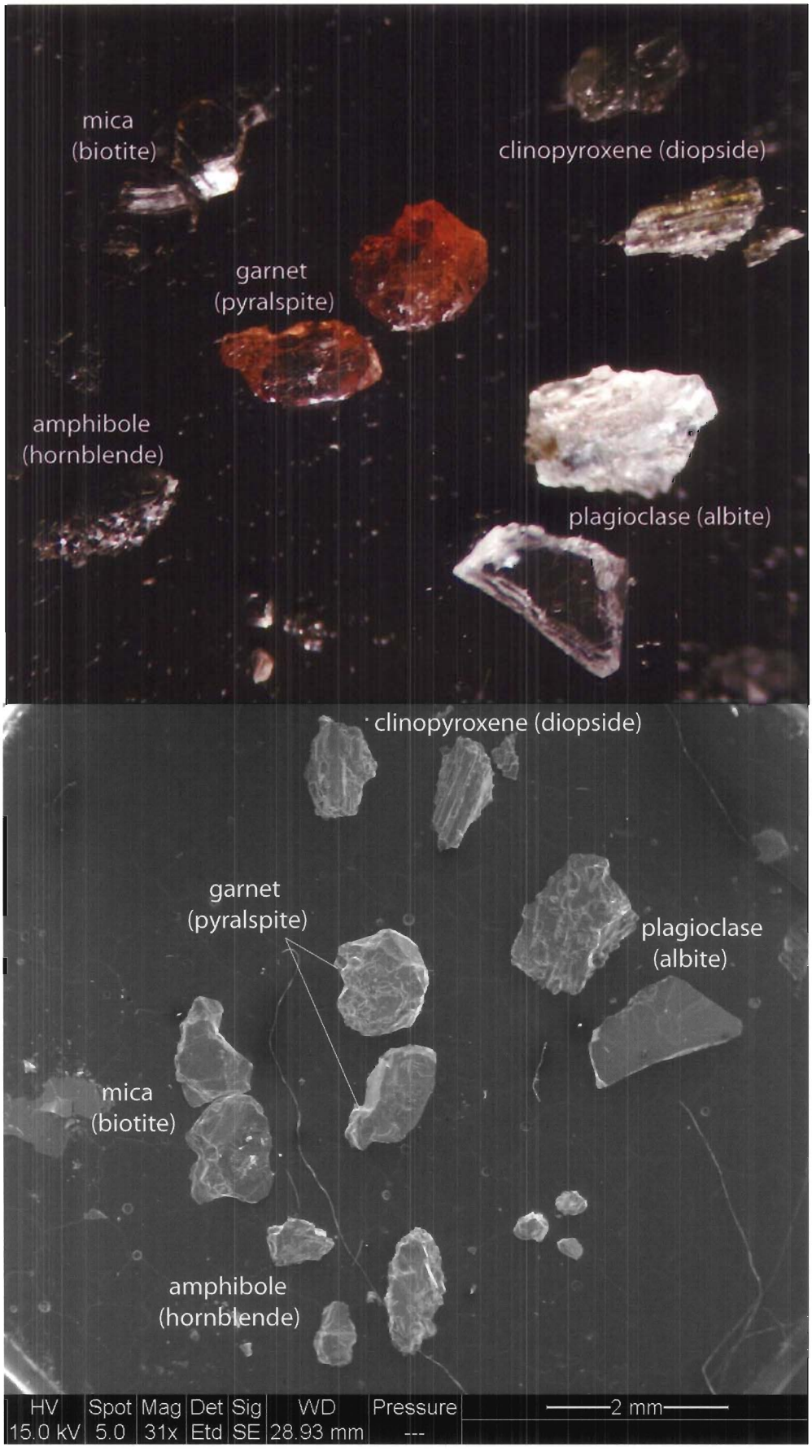



Figure 1. Top picture is in plane light, and bottom picture is SEM photo. Note that the bottom picture is oriented approximately 60° clockwise from the top picture.

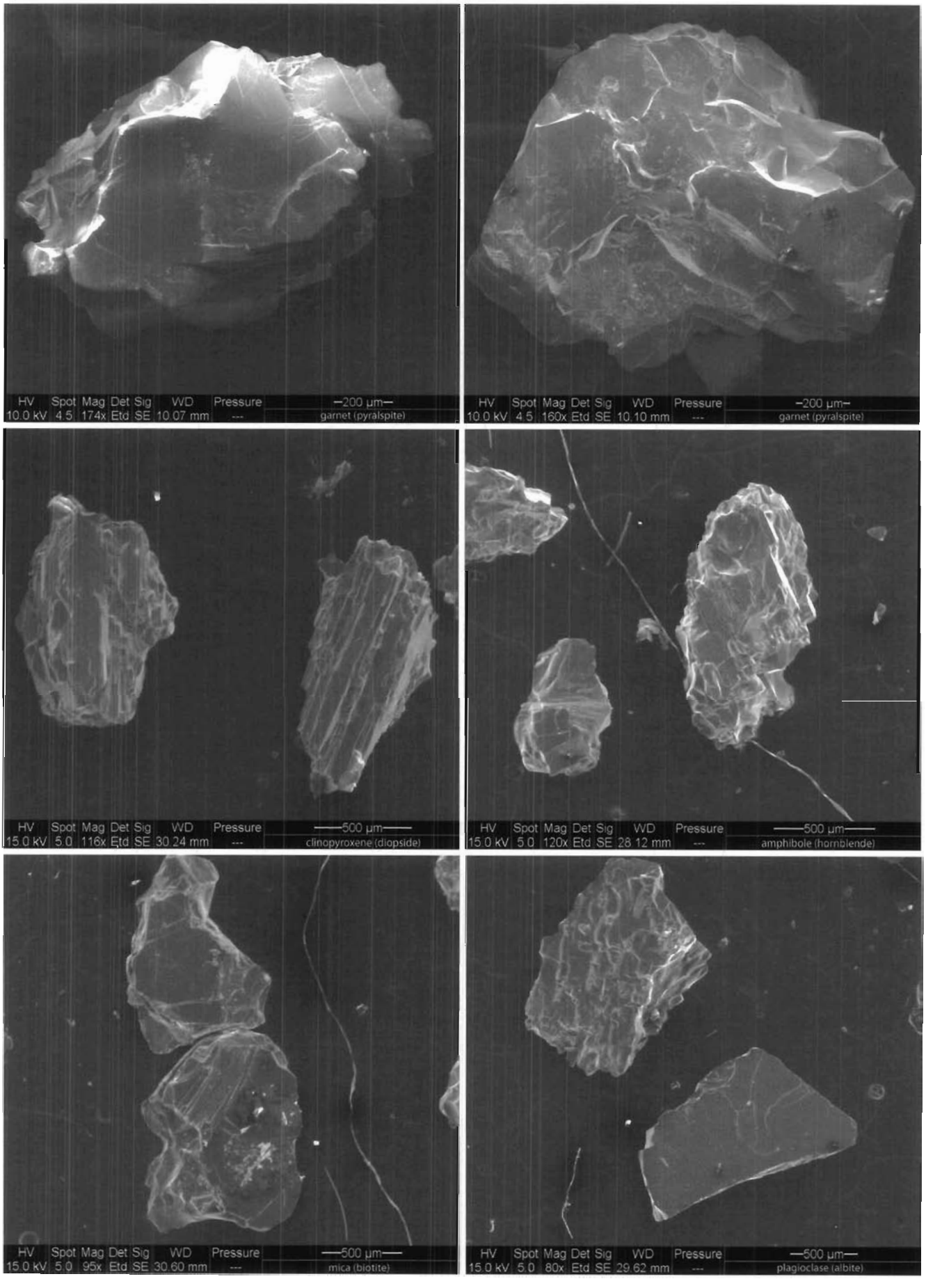



Figure 2. SEM photos of Mattawa minerals. Top two photos are different garnets than those shown in Figure 1, and the other minerals are magnified images from Figure 1.

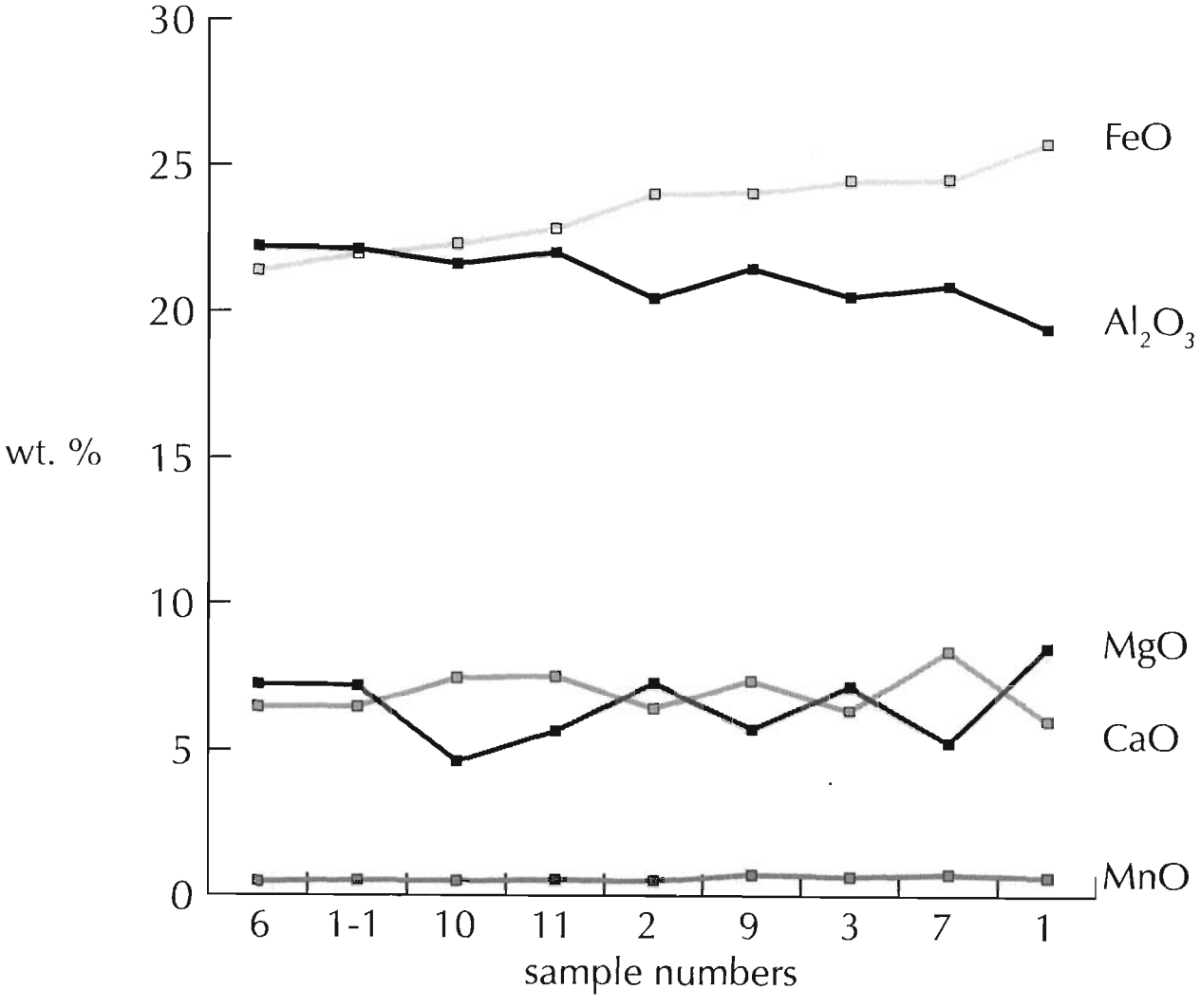



Figure 3. Chemical analyses of Matawa garnets, plotted in increasing order of FeO.

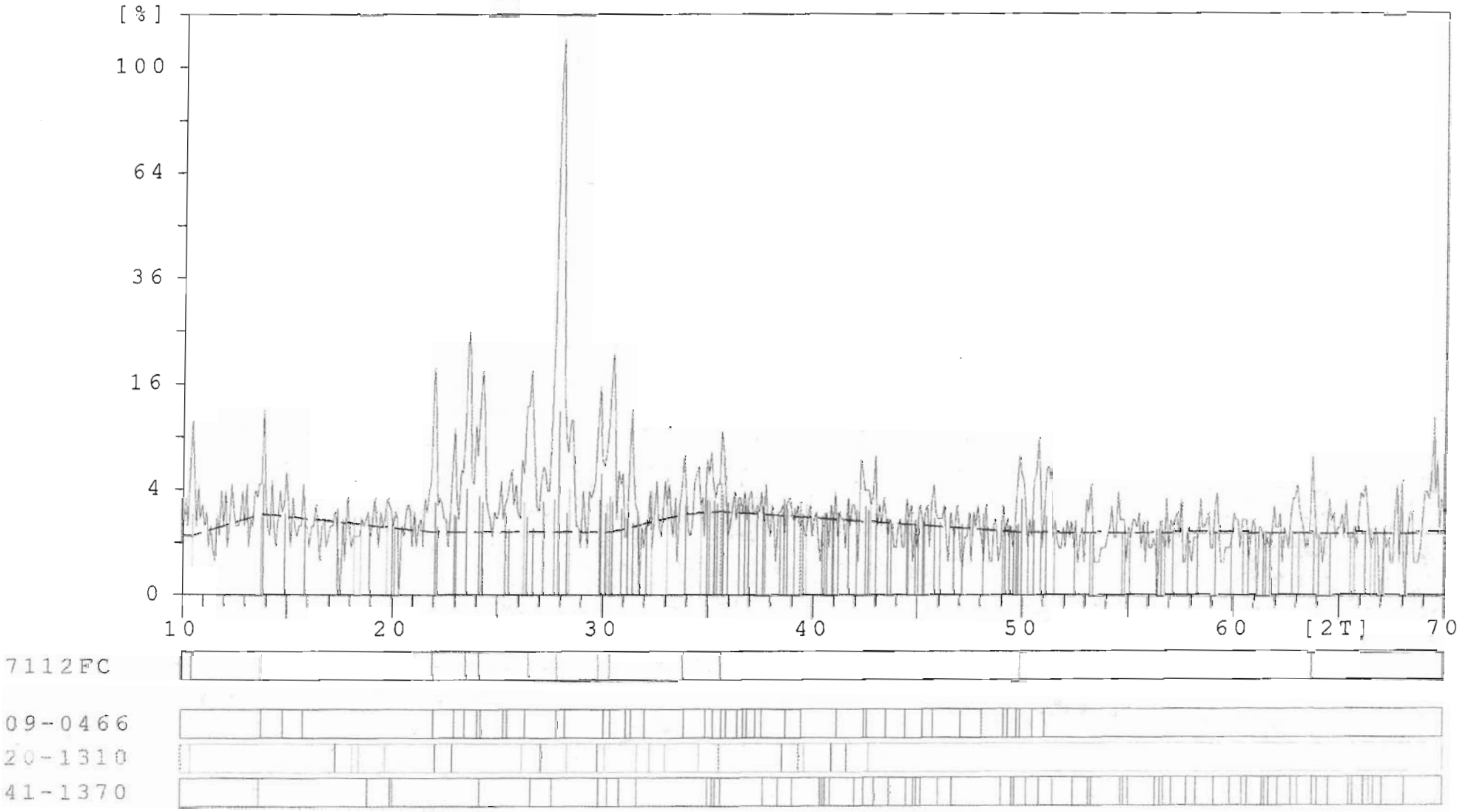
**Table 1. Mattawa mineral analyses (EDS)**

| | Oxide weight percent | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| garnet | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | FeO | MnO | MgO | CaO | $Na_2O$ | $K_2O$ | total* |
| MG-gar-6 | 42.14 | 0.00 | 22.22 | 21.40 | 0.49 | 7.25 | 6.49 | | | 99.99 |
| MG gar1-1 | 41.71 | 0.00 | 22.12 | 21.96 | 0.53 | 7.20 | 6.49 | | | 100.01 |
| MG-gar-10 | 43.50 | 0.00 | 21.62 | 22.30 | 0.51 | 4.60 | 7.46 | | | 99.99 |
| MG-gar-11 | 41.43 | 0.00 | 22.01 | 22.83 | 0.55 | 5.65 | 7.53 | | | 100.00 |
| MG-gar-2 | 40.55 | 0.75 | 20.44 | 24.01 | 0.52 | 7.29 | 6.44 | | | 100.00 |
| MG-gar-9 | 40.63 | 0.00 | 21.46 | 24.05 | 0.74 | 5.73 | 7.39 | | | 100.00 |
| MG-gar-3 | 40.14 | 0.66 | 20.50 | 24.48 | 0.67 | 7.18 | 6.37 | | | 100.00 |
| MG-gar-7 | 40.26 | 0.00 | 20.85 | 24.52 | 0.75 | 5.24 | 8.38 | | | 100.00 |
| MG-gar-1 | 38.79 | 0.83 | 19.41 | 25.76 | 0.67 | 8.50 | 6.04 | | | 100.00 |
| gar ave | 41.02 | 0.25 | 21.18 | 23.48 | 0.60 | 6.52 | 6.95 | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| MG-amph-1 | 45.24 | 2.79 | 13.21 | 12.18 | | 12.36 | 9.56 | 3.31 | 1.14 | 99.79 |
| MG-amph-2 | 44.93 | 2.73 | 13.26 | 12.23 | | 12.33 | 9.74 | 3.26 | 1.23 | 99.71 |
| MG-amph-4 | 42.24 | 6.05 | 13.82 | 12.31 | | 11.07 | 10.05 | 2.90 | 1.32 | 99.76 |
| MG-amph-3 | 42.62 | 5.34 | 13.87 | 12.36 | | 11.29 | 10.14 | 2.87 | 1.24 | 99.73 |
| amph ave | 43.76 | 4.23 | 13.54 | 12.27 | | 11.76 | 9.87 | 3.09 | 1.23 | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| MG-cpx-1 | 55.67 | | 2.30 | 7.42 | | 14.36 | 19.02 | 1.22 | | 99.99 |
| MG-cpx-2 | 55.48 | | 2.52 | 8.12 | | 14.11 | 18.46 | 1.31 | | 100.00 |
| cpx ave | 55.58 | | 2.41 | 7.77 | | 14.24 | 18.74 | 1.27 | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| MG-biot-1 | 39.63 | 6.26 | 15.27 | 15.16 | | 13.53 | | 0.37 | 9.55 | 99.77 |
| MG-biot-2 | 39.62 | 6.30 | 14.98 | 15.57 | | 13.60 | | 0.33 | 9.33 | 99.73 |
| biot ave | 39.63 | 6.28 | 15.13 | 15.37 | | 13.57 | | 0.35 | 9.44 | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| MG-plag-1 | 67.76 | | 20.00 | | | | 1.49 | 10.13 | 0.61 | 99.99 |
| MG-plag-3 | 68.02 | | 19.87 | | | | 4.06 | 8.05 | 0.00 | 100.00 |
| plag ave | 67.89 | | 19.94 | | | | 2.78 | 9.09 | 0.31 | |
| | | | | | | | | | | |
| %error** | ±0.05 | ±0.08 | ±0.04 | ±0.04 | ±0.19 | ±0.03 | ±.0.05 | ±0.12 | ±0.05 | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

*remainder of amphibole and biotite compositions are volatiles

**%error x wt% = error range

Sample ident.: 7112fc 11-jul-2007 10:36



Philips Analytical PC-APD, Diffraction software

S C O R E L I S T S H O R T N A M E :

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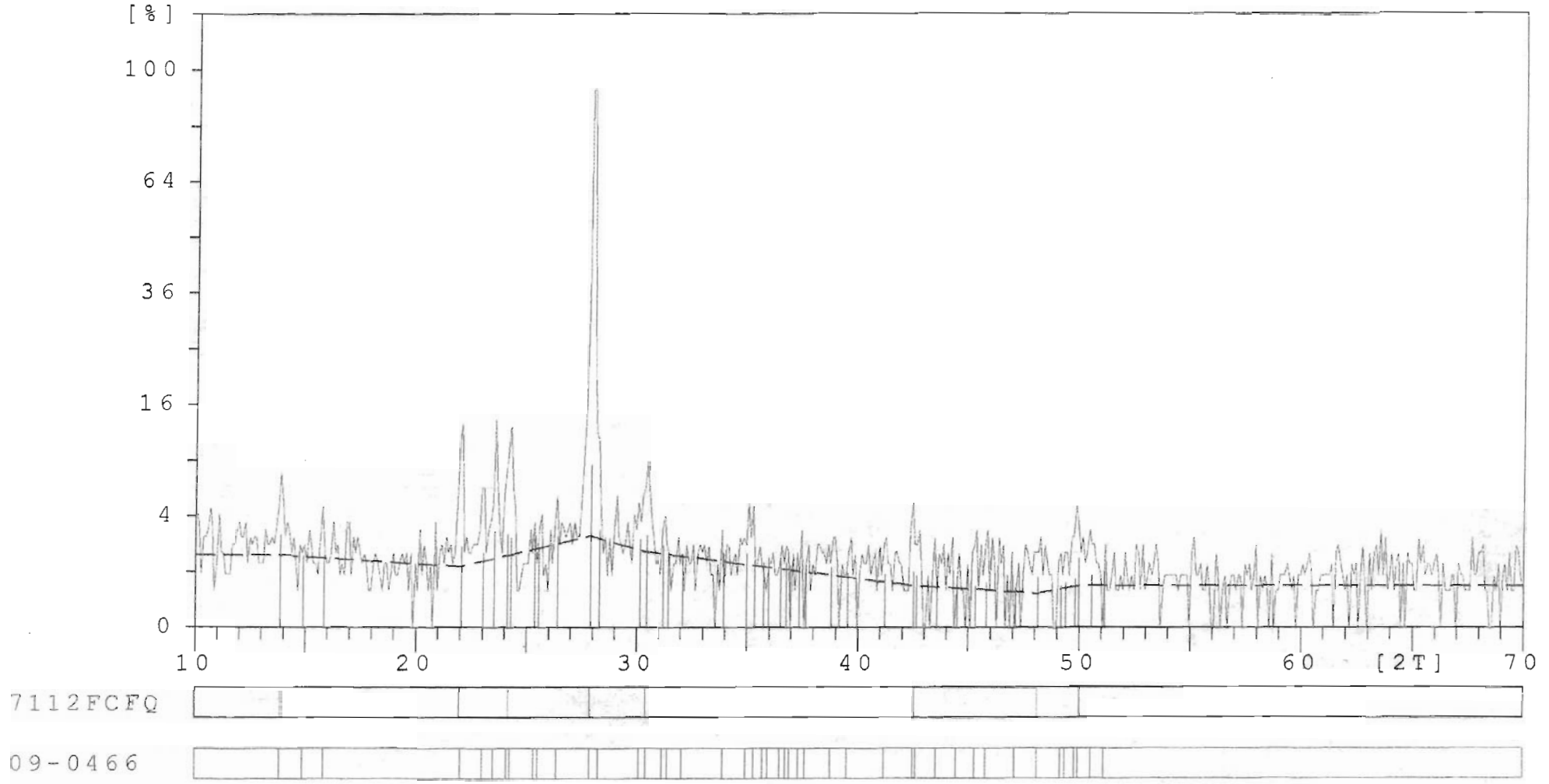
Sample identification: 7112fc
Database used : C:\APDW\IDENTDB
Restrictions file : MINERALS.RES

Results:

| | Card Id | Match score | Rel m score | I% | Displ | Names | Qual code | I |
|---|---|---|---|---|---|---|---|---|
| 1 | 09-0457 | 8.25 | 0.41 | 3 | -128 | Albite, calcian, ordered | I | |
| 2 | 09-0467 | 7.45 | 0.39 | 2 | -13 | Bytownite, low | O | |
| 3 | 09-0466 | 17.64 | 0.39 | 11 | -67 | Albite, ordered | S | * |
| 4 | 10-0360 | 7.15 | 0.38 | 2 | -13 | Anorthite, sodian, disordered, | O | |
| 5 | 10-0359 | 7.64 | 0.36 | 2 | 31 | Andesine, low | I | |
| 6 | 41-1480 | 22.23 | 0.35 | 13 | -98 | Albite, calcian, ordered | I | |
| 7 | 09-0465 | 6.39 | 0.34 | 2 | 56 | Anorthite, sodian, ordered | O | |
| 8 | 20-1310 | 7.94 | 0.33 | 3 | 8 | Tremolite, syn | I | * |
| 9 | 26-0909 | 4.27 | 0.33 | 2 | 50 | Annite-1M, aluminian | I | |
| 10 | 18-1221 | 10.02 | 0.32 | 2 | -98 | Acmite-augite | O | |
| 11 | 20-0554 | 24.21 | 0.32 | 4 | -131 | Albite, ordered | C | |
| 12 | 41-1370 | 22.45 | 0.31 | 4 | -58 | Diopside | S | * |
| 13 | 38-0466 | 22.40 | 0.31 | 4 | -98 | Diopside, aluminian | I | |
| 14 | 19-0239 | 17.46 | 0.31 | 3 | 116 | Diopside, syn | I | |
| 15 | 18-1202 | 15.84 | 0.30 | 2 | 56 | Anorthite, sodian, intermediat | I | |
| 16 | 41-1483 | 13.05 | 0.30 | 3 | -22 | Augite, aluminian | I | |
| 17 | 23-0666 | 8.76 | 0.30 | 4 | 65 | Tremolite, sodian, syn | I | |
| 18 | 31-1285 | 8.76 | 0.30 | 4 | 65 | Tremolite, sodian, syn | O | |
| 19 | 19-1184 | 37.50 | 0.30 | 3 | -141 | Albite, ordered | I | |
| 20 | 17-0318 | 16.92 | 0.30 | 3 | 116 | Diopside | S | |
| 21 | 41-1486 | 20.70 | 0.30 | 11 | 65 | Anorthite, ordered | S | |
| 22 | 20-0528 | 25.64 | 0.29 | 9 | -45 | Anorthite, sodian, ordered | C | |
| 23 | 10-0393 | 12.09 | 0.29 | 2 | 41 | Albite, disordered | S | |
| 24 | 20-0020 | 23.27 | 0.28 | 3 | 31 | Anorthite, ordered | C | |
| 25 | 12-0301 | 25.43 | 0.28 | 3 | 41 | Anorthite, ordered | I | |
| 26 | 11-0654 | 15.73 | 0.28 | 6 | 83 | Diopside | I | |

Sample ident.: 7112fcfq 11-jul-2007 10:44



Philips Analytical PC-APD, Diffraction software

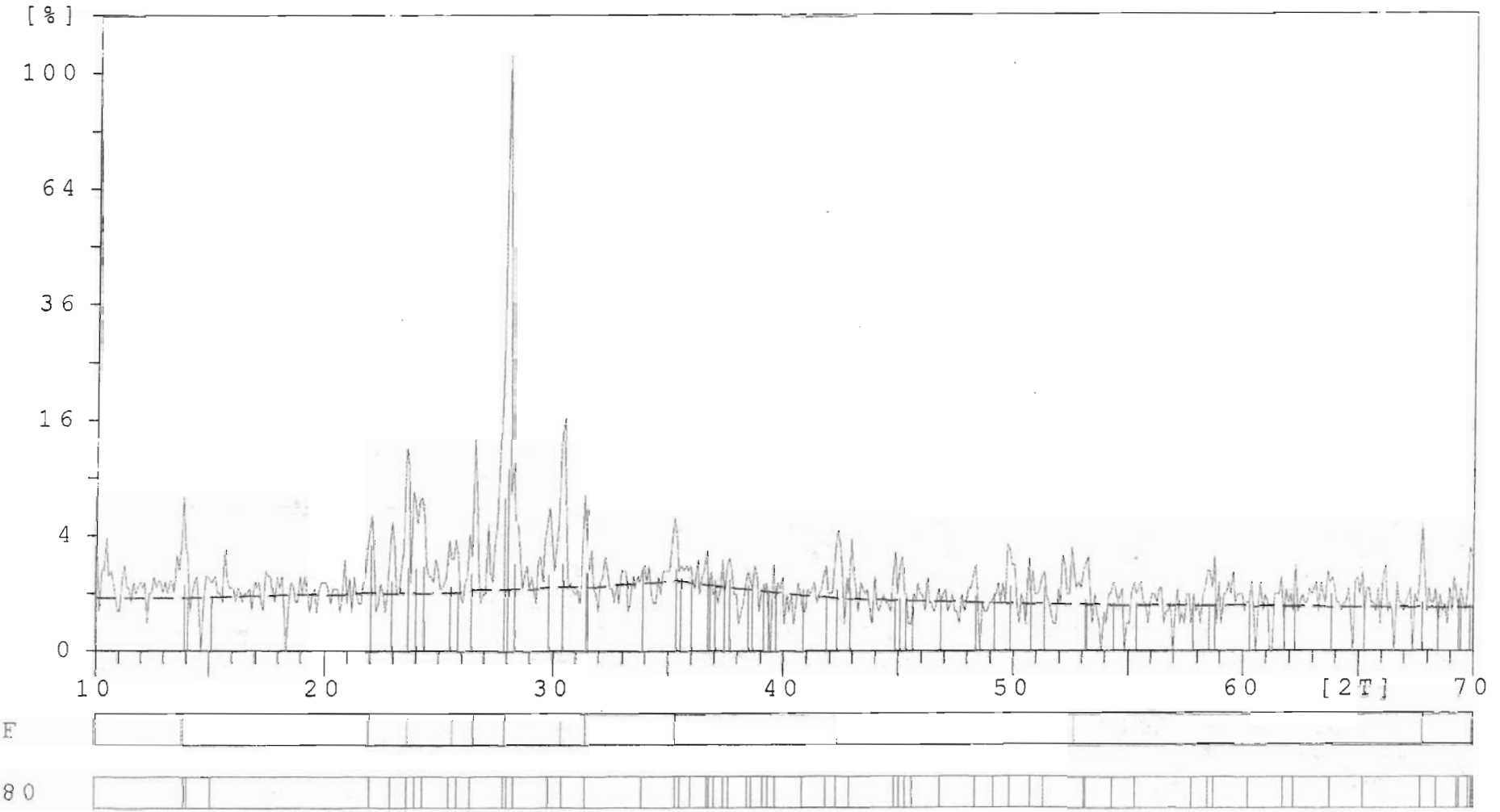
S C O R E L I S T S H O R T N A M E :

Analysed DI file : C:\MILLER\DATA\7112FCFQ.DI
Sample identification: 7112fcfq
Database used : C:\APDW\IDENTDB
Restrictions file : MINERALS.RES

Results:

| | Card Id | Match score | Rel m score | I% | Displ | Names | Qual code | I | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 09-0466 | 17.59 | 0.39 | 6 | -23 | Albite, ordered | S | * | |
| 2 | 09-0457 | 7.20 | 0.36 | 2 | -45 | Albite, calcian, ordered | I | | |
| 3 | 20-0554 | 24.78 | 0.33 | 3 | -70 | Albite, ordered | C | | |
| 4 | 10-0360 | 6.17 | 0.32 | 2 | -13 | Anorthite, sodian, disordered, | O | | |
| 5 | 09-0467 | 6.16 | 0.32 | 2 | -13 | Bytownite, low | O | | |
| 6 | 10-0359 | 6.80 | 0.32 | 2 | -21 | Andesine, low | I | | |
| 7 | 09-0456 | 6.03 | 0.32 | 2 | -13 | Albite, calcian, disordered, s | O | | |
| 8 | 09-0465 | 5.89 | 0.31 | 2 | 12 | Anorthite, sodian, ordered | O | | |
| 9 | 41-1480 | 19.75 | 0.31 | 6 | -67 | Albite, calcian, ordered | I | | |
| 10 | 18-1202 | 15.92 | 0.31 | 2 | 83 | Anorthite, sodian, intermediat | I | | |
| 11 | 20-0572 | 23.53 | 0.31 | 2 | -83 | Albite, disordered | C | | |
| 12 | 19-1184 | 38.38 | 0.30 | 2 | -70 | Albite, ordered | I | | |
| 13 | 25-0814 | 7.45 | 0.30 | 2 | 83 | Eudialyte, yttrian | O | | |
| 14 | 20-0548 | 22.60 | 0.30 | 3 | 116 | Albite, calcian, ordered | C | | |
| 15 | 12-0301 | 26.23 | 0.29 | 3 | 37 | Anorthite, ordered | I | | |
| 16 | 20-0020 | 23.65 | 0.29 | 3 | -23 | Anorthite, ordered | C | | |
| 17 | 20-0528 | 25.20 | 0.28 | 2 | 62 | Anorthite, sodian, ordered | C | | |
| 18 | 10-0393 | 11.57 | 0.28 | 9 | -23 | Albite, disordered | S | | |
| 19 | 24-0894 | 9.05 | 0.26 | 3 | 30 | Stilbite | I | | |
| 20 | 41-1486 | 17.59 | 0.25 | 2 | -23 | Anorthite, ordered | S | | |
| 21 | 33-0257 | 8.00 | 0.24 | 1 | 116 | Crandallite-H | I | | |
| 22 | 14-0285 | 6.55 | 0.24 | 2 | -83 | Aenigmatite | O | | |
| 23 | 35-0590 | 12.53 | 0.24 | 2 | -91 | Monticellite, syn | S | | |
| 24 | 43-0677 | 23.09 | 0.24 | 4 | 12 | Neptunite | I | | |
| 25 | 33-0659 | 6.71 | 0.24 | 1 | 12 | Ferrocolumbite | S | | |
| 26 | 44-1428 | 9.30 | 0.24 | 1 | -70 | Nanpingite-2M1 | S | | |
| 27 | 39-0364 | 4.72 | 0.24 | 2 | 98 | Gysinite-(Nd) | O | | |
| 28 | 02-0538 | 7.07 | 0.24 | 1 | -78 | Jordanite | O | | |
| 29 | 08-0143 | 5.66 | 0.24 | 1 | -83 | Florencite-(Ce) | O | | |
| 30 | 25-0119 | 6.79 | 0.23 | 1 | -50 | Crandallite | O | | |

Sample ident.: 7112ff 11-jul-2007 10:44



Philips Analytical PC-APD, Diffraction software

S C O R E L I S T S H O R T N A M E :

Analysed DI file : C:\MILLER\DATA\7112FF.DI
Sample identification: 7112ff
Database used : C:\APDW\IDENTDB
Restrictions file : MINERALS.RES

Results:

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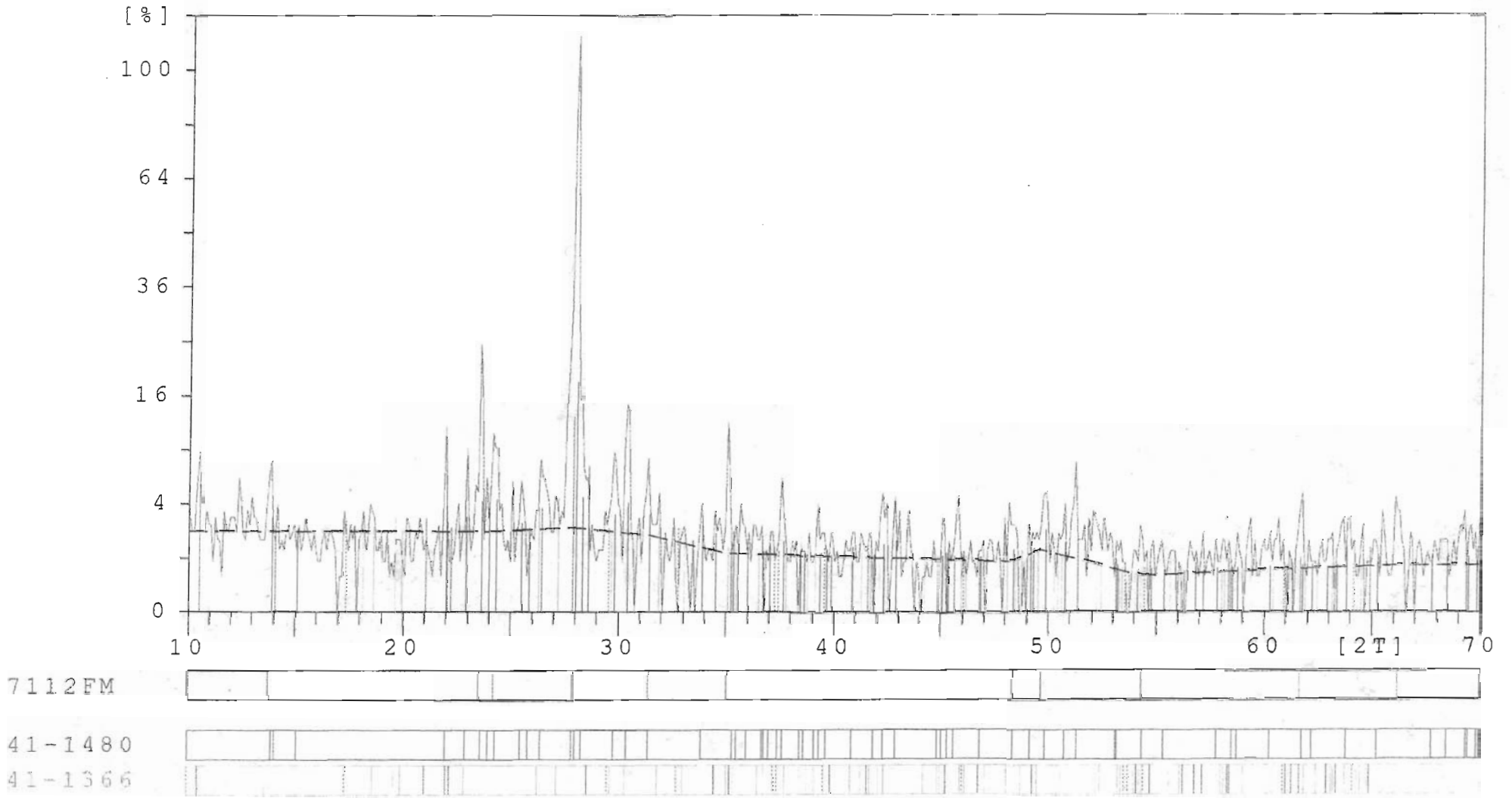
|---|---|---|---|---|---|---|---|---|---|
| 1 | 10-0359 | 8.34 | 0.40 | 1 | -58 | Andesine, low | I | | |
| 2 | 09-0457 | 7.83 | 0.39 | 1 | -67 | Albite, calcian, ordered | I | | |
| 3 | 10-0360 | 7.09 | 0.37 | 1 | -45 | Anorthite, sodian, disordered, | O | | |
| 4 | 09-0467 | 7.08 | 0.37 | 1 | -45 | Bytownite, low | O | | |
| 5 | 09-0465 | 6.93 | 0.36 | 1 | -45 | Anorthite, sodian, ordered | O | | |
| 6 | 39-1425 | 9.85 | 0.35 | 6 | -35 | Cristobalite, syn | S | | |
| 7 | 09-0456 | 6.68 | 0.35 | 1 | -103 | Albite, calcian, disordered, s | O | | |
| 8 | 41-1480 | 22.29 | 0.35 | 9 | -67 | Albite, calcian, ordered | I | * | |
| 9 | 29-1489 | 1.71 | 0.34 | 3 | -45 | Halloysite-10A | S | | |
| 10 | 11-0695 | 9.94 | 0.34 | 6 | 50 | Cristobalite, syn | I | | |
| 11 | 24-0058 | 19.70 | 0.34 | 2 | -45 | Anilite | C | | |
| 12 | 39-0313 | 11.15 | 0.34 | 3 | 8 | Sabugalite | I | | |
| 13 | 02-0723 | 7.75 | 0.34 | 1 | -17 | Jadeite | O | | |
| 14 | 14-0247 | 9.05 | 0.34 | 1 | -13 | Paravauxite | O | | |
| 15 | 25-1326 | 7.37 | 0.33 | 1 | -55 | Capgaronnite | O | | |
| 16 | 18-0153 | 8.33 | 0.33 | 1 | -17 | Celsian | I | | |
| 17 | 30-0100 | 5.96 | 0.33 | 3 | -16 | Arsenolamprite | C | | |
| 18 | 29-0926 | 2.97 | 0.33 | 1 | 144 | Carrboydite | O | | |
| 19 | 09-0466 | 14.75 | 0.33 | 4 | -41 | Albite, ordered | S | | |
| 20 | 18-1202 | 16.99 | 0.33 | 1 | -23 | Anorthite, sodian, intermediat | I | | |
| 21 | 09-0454 | 12.74 | 0.33 | 1 | -55 | Afwillite | O | | |
| 22 | 45-1470 | 10.02 | 0.32 | 1 | 70 | Wiserite | I | | |
| 23 | 33-1221 | 13.72 | 0.32 | 1 | -58 | Nyerereite | O | | |
| 24 | 42-1403 | 7.89 | 0.32 | 1 | 93 | Unnamed mineral, syn [NR] | O | | |
| 25 | 41-1387 | 8.83 | 0.32 | 2 | 45 | Celestine, barian | I | | |
| 26 | 29-0295 | 11.98 | 0.32 | 1 | -17 | Ferrarisite | O | | |
| 27 | 24-0542 | 8.16 | 0.31 | 1 | 93 | Schubnelite | O | | |
| 28 | 15-0284 | 10.91 | 0.31 | 2 | -17 | Barysilite | O | | |
| 29 | 10-0390 | 12.46 | 0.31 | 1 | 17 | Fairfieldite | O | | |
| 30 | 35-0478 | 11.21 | 0.31 | 3 | 83 | Sterlinghillite | O | | |

Sample ident.: 7112fm 11-jul-2007 10:52



Philips Analytical PC-APD, Diffraction software

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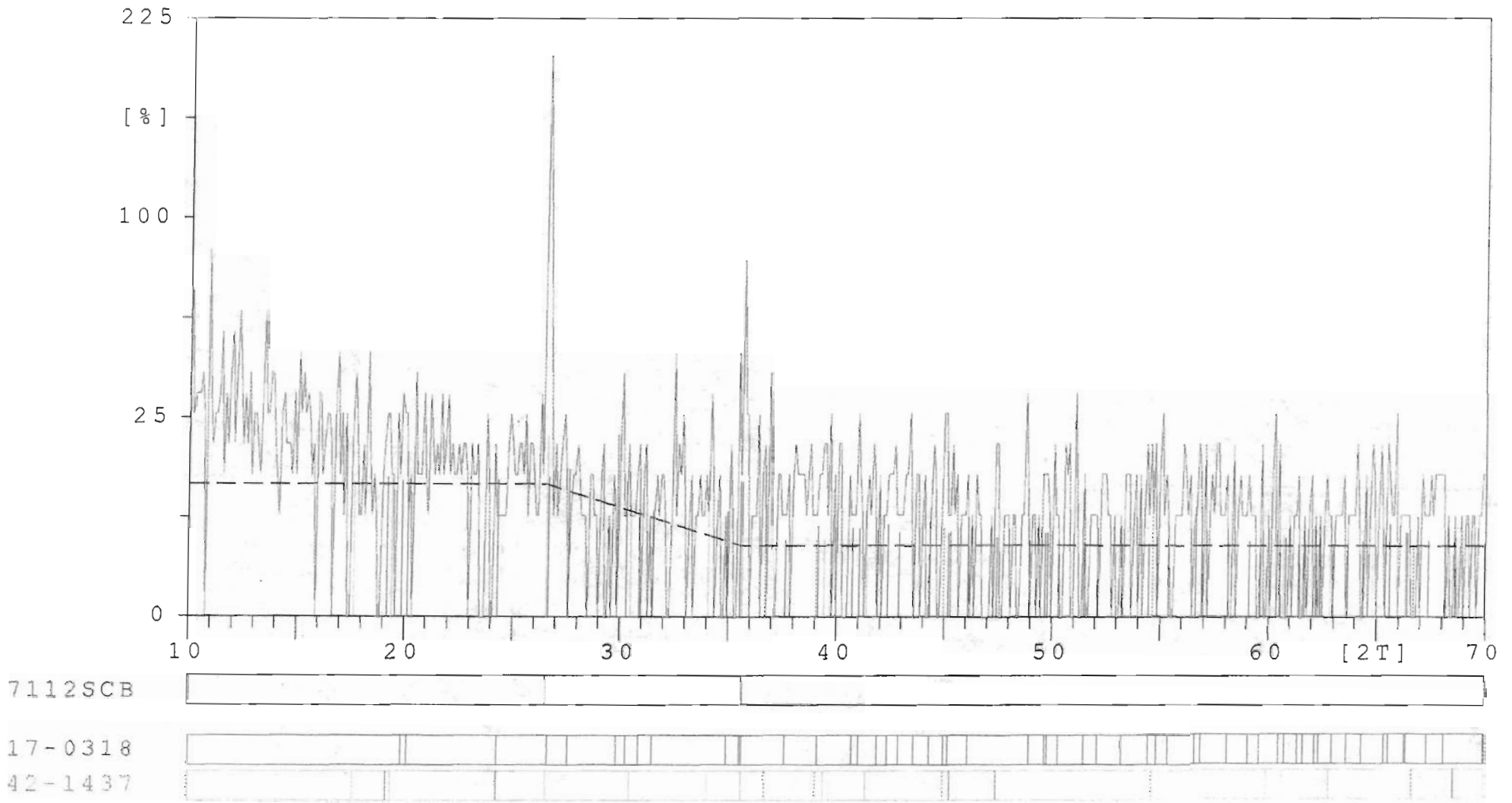
Sample identification: 7112fm
Database used : C:\APDW\IDENTDB
Restrictions file : MINERALS.RES

Results:

| | Card Id | Match score | Rel m score | I% | Displ | Names | Qual code | I | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 09-0457 | 8.43 | 0.42 | 3 | -121 | Albite, calcian, ordered | I | | |
| 2 | 10-0359 | 7.50 | 0.36 | 2 | -98 | Andesine, low | I | | |
| 3 | 41-1480 | 22.46 | 0.35 | 16 | -128 | Albite, calcian, ordered | I | * | |
| 4 | 09-0466 | 15.04 | 0.33 | 8 | -55 | Albite, ordered | S | | |
| 5 | 20-0554 | 23.52 | 0.31 | 4 | -121 | Albite, ordered | C | | |
| 6 | 18-1202 | 15.87 | 0.31 | 2 | -53 | Anorthite, sodian, intermediat | I | | |
| 7 | 19-1184 | 37.12 | 0.29 | 4 | -55 | Albite, ordered | I | | |
| 8 | 20-0020 | 23.44 | 0.29 | 3 | 25 | Anorthite, ordered | C | | |
| 9 | 20-0528 | 22.27 | 0.25 | 11 | -45 | Anorthite, sodian, ordered | C | | |
| 10 | 41-1486 | 17.35 | 0.25 | 13 | 40 | Anorthite, ordered | S | | |
| 11 | 10-0490 | 4.43 | 0.21 | 1 | 40 | Muscovite-2M2, barian | O | | |
| 12 | 34-0175 | 8.84 | 0.21 | 1 | -46 | Muscovite-2M2 | C | | |
| 13 | 41-1366 | 15.16 | 0.15 | 5 | 16 | Actinolite | I | * | |
| 14 | 33-1215 | 11.56 | 0.15 | 1 | 83 | Borax, syn | S | | |
| 15 | 22-0339 | 5.40 | 0.15 | 16 | -17 | Koninckite | I | | |
| 16 | 45-1332 | 4.90 | 0.14 | 2 | 48 | Euchlorine | O | | |
| 17 | 14-0369 | 1.62 | 0.13 | 1 | 144 | Murmanite | O | | |
| 18 | 14-0222 | 4.95 | 0.13 | 3 | 93 | Picropharmacolite | O | | |
| 19 | 44-0681 | 5.64 | 0.12 | 19 | 11 | Unnamed mineral [NR] | O | | |
| 20 | 12-0523 | 2.45 | 0.11 | 1 | 40 | Volborthite | O | | |
| 21 | 35-0574 | 1.02 | 0.09 | 3 | -88 | Niahite | I | | |
| 22 | 13-0526 | 2.46 | 0.08 | 3 | 16 | Polyhalite | O | | |
| 23 | 35-0608 | 1.92 | 0.08 | 3 | -98 | Wallkilldellite | O | | |
| 24 | 35-0641 | 3.32 | 0.08 | 1 | -88 | Janhaugite | I | | |
| 25 | 25-0322 | 0.39 | 0.08 | 4 | -30 | Brass, syn [NR] | O | | |
| 26 | 39-1380 | 2.49 | 0.07 | 2 | 83 | Faujasite | I | | |
| 27 | 03-0178 | 0.80 | 0.07 | 1 | -98 | Beidellite | O | | |
| 28 | 29-1497 | 0.25 | 0.03 | 9 | 93 | Nontronite-15A | S | | |
| 29 | 26-0527 | 0.13 | 0.01 | 5 | 28 | Briartite, syn | I | | |
| 30 | 40-1251 | -0.03 | -0.01 | 100 | -17 | Mgriite, syn | I | | |

Sample ident.: 7112scb 11-jul-2007 11:04



Philips Analytical PC-APD, Diffraction software

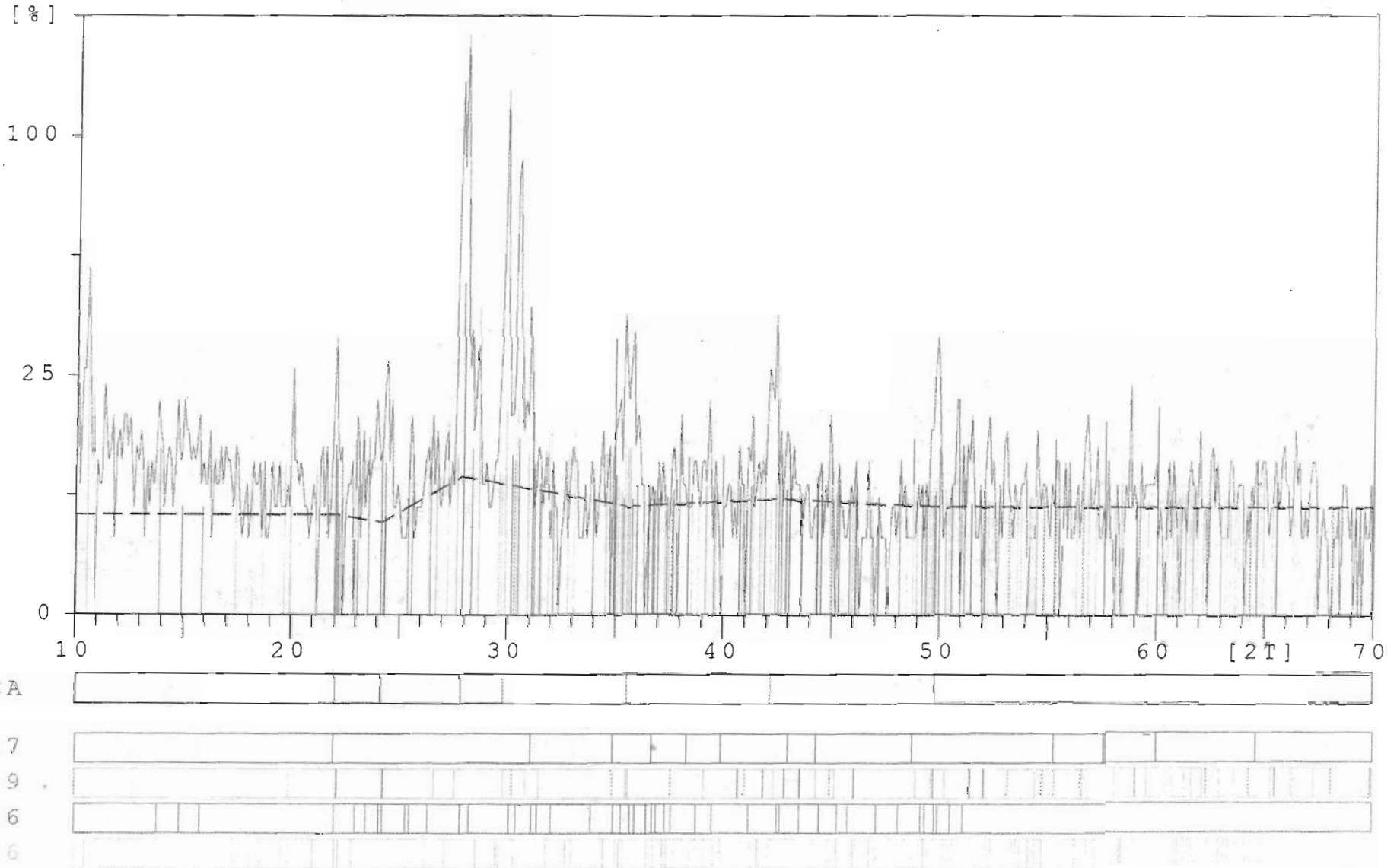
S C O R E L I S T S H O R T N A M E :

Analysed DI file : C:\MILLER\DATA\7112SCB.DI
Sample identification: 7112scb
Database used : C:\APDW\IDENTDB
Restrictions file : MINERALS.RES

Results:

| | Card Id | Match score | Rel m score | I% | Displ | Names | Qual code | I | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 17-0318 | 15.05 | 0.26 | 13 | 131 | Diopside | S | * | |
| 2 | 19-0239 | 15.05 | 0.26 | 13 | 131 | Diopside, syn | I | | |
| 3 | 11-0654 | 13.69 | 0.24 | 33 | 73 | Diopside | I | | |
| 4 | 33-1016 | 4.28 | 0.20 | 9 | 93 | Annite-1M, manganoan | I | | |
| 5 | 42-1413 | 7.22 | 0.20 | 28 | 73 | Annite-1M | I | | |
| 6 | 42-0604 | 9.90 | 0.19 | 19 | -78 | Zinnwaldite-1M | O | | |
| 7 | 42-1437 | 4.48 | 0.19 | 28 | 16 | Biotite-1M | I | * | |
| 8 | 42-1414 | 5.73 | 0.18 | 28 | -108 | Biotite-1M | O | | |
| 9 | 10-0492 | 4.61 | 0.18 | 9 | -58 | Phlogopite-3T | I | | |
| 10 | 10-0495 | 4.37 | 0.17 | 9 | -78 | Phlogopite-1M | I | | |
| 11 | 10-0493 | 4.79 | 0.17 | 9 | 103 | Phlogopite-2M1 | I | | |

Sample ident.: 7112sca 11-jul-2007 11:01



Philips Analytical PC-APD, Diffraction software

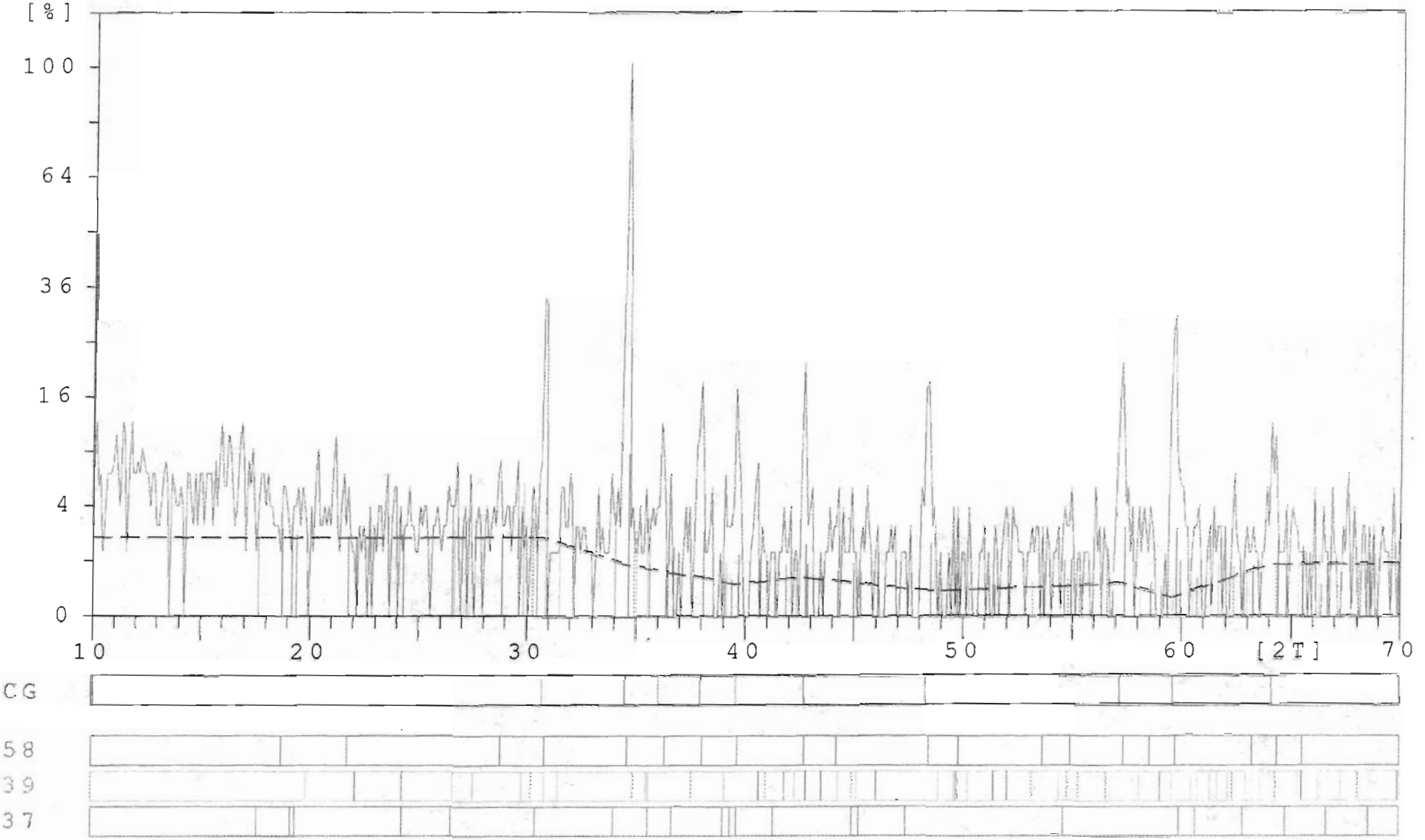
S C O R E L l S T S H O R T N A M E :

Analysed DI file : C:\MILLER\DATA\7112SCA.DI
Sample identification: 7112sca
Database used : C:\APDW\IDENTDB
Restrictions file : MINERALS.RES

Results:

| | Card Id | Match score | Rel m score | I% | Displ | Names | Qual code | I |
|---|---|---|---|---|---|---|---|---|
| 1 | 33-0664 | 5.16 | 0.34 | 11 | -21 | Hematite, syn | S | |
| 2 | 09-0427 | 4.23 | 0.33 | 28 | 67 | Almandine | O | * |
| 3 | 24-0201 | 6.71 | 0.32 | 16 | 58 | Augite | I | |
| 4 | 19-0239 | 18.12 | 0.32 | 11 | -128 | Diopside, syn | I | * |
| 5 | 03-0860 | 9.31 | 0.31 | 8 | 78 | Diopside, syn | O | |
| 6 | 09-0466 | 13.93 | 0.31 | 40 | -30 | Albite, ordered | S | * |
| 7 | 17-0318 | 17.58 | 0.31 | 11 | -128 | Diopside | S | |
| 8 | 09-0456 | 5.84 | 0.31 | 8 | -67 | Albite, calcian, disordered, s | O | |
| 9 | 24-0203 | 9.81 | 0.31 | 11 | -98 | Augite | I | |
| 10 | 11-0654 | 16.59 | 0.30 | 28 | -128 | Diopside | I | |
| 11 | 09-0465 | 5.63 | 0.30 | 8 | 65 | Anorthite, sodian, ordered | O | |
| 12 | 09-0467 | 5.60 | 0.29 | 8 | -22 | Bytownite, low | O | |
| 13 | 18-1202 | 15.23 | 0.29 | 9 | 116 | Anorthite, sodian, intermediat | I | |
| 14 | 41-1480 | 18.60 | 0.29 | 28 | -78 | Albite, calcian, ordered | I | |
| 15 | 20-0554 | 21.41 | 0.29 | 11 | -88 | Albite, ordered | C | |
| 16 | 20-0548 | 21.53 | 0.28 | 13 | 111 | Albite, calcian, ordered | C | |
| 17 | 10-0360 | 5.16 | 0.27 | 8 | 44 | Anorthite, sodian, disordered, | O | |
| 18 | 41-1486 | 18.91 | 0.27 | 9 | 58 | Anorthite, ordered | S | |
| 19 | 25-0160 | 12.36 | 0.27 | 9 | 50 | Hedenbergite, magnesian | O | |
| 20 | 19-1184 | 33.68 | 0.27 | 8 | -50 | Albite, ordered | I | |
| 21 | 12-0301 | 23.69 | 0.26 | 11 | 58 | Anorthite, ordered | I | |
| 22 | 20-0572 | 20.00 | 0.26 | 8 | -28 | Albite, disordered | C | |
| 23 | 09-0457 | 5.19 | 0.26 | 8 | -98 | Albite, calcian, ordered | I | |
| 24 | 33-0659 | 7.22 | 0.26 | 9 | -17 | Ferrocolumbite | S | |
| 25 | 25-0306 | 11.67 | 0.25 | 16 | 83 | Clinopyroxene, titanian, alumi | C | |
| 26 | 20-0020 | 20.78 | 0.25 | 11 | 45 | Anorthite, ordered | C | |
| 27 | 10-0359 | 5.30 | 0.25 | 8 | 65 | Andesine, low | I | |
| 28 | 34-0185 | 8.76 | 0.25 | 9 | -116 | Aegirine, syn | S | |
| 29 | 33-0899 | 8.50 | 0.25 | 8 | -16 | Manganocolumbite, syn | S | |
| 30 | 20-0528 | 21.91 | 0.25 | 8 | 40 | Anorthite, sodian, ordered | C | |

Sample ident.: 7112scg 11-jul-2007 11:11



Philips Analytical PC-APD, Diffraction software

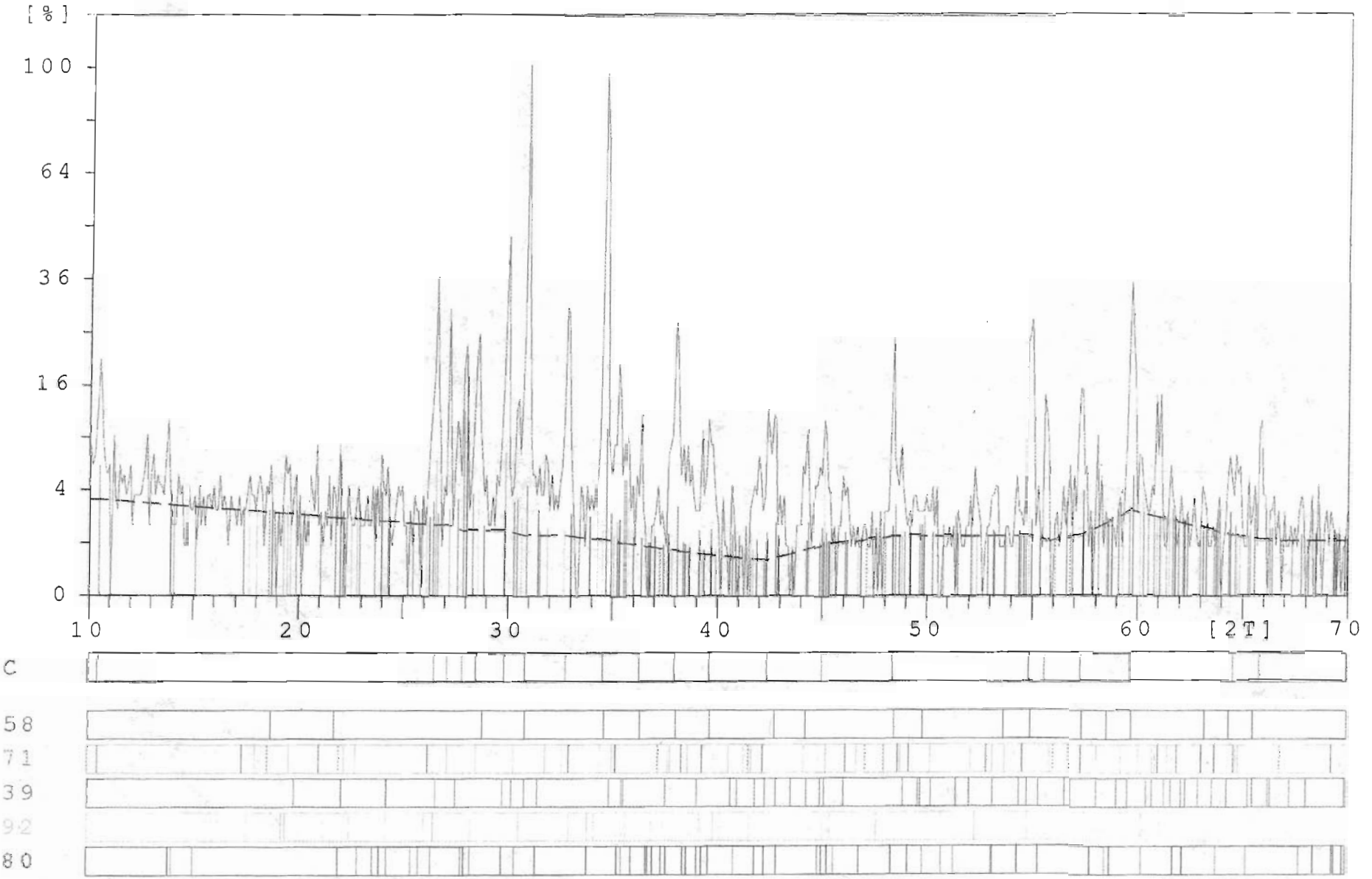
S C O R E L I S T S H O R T N A M E :

Analysed DI file : C:\MILLER\DATA\7112SCG.DI
Sample identification: 7112scg
Database used : C:\APDW\IDENTDB
Restrictions file : MINERALS.RES

Results:

| | Card Id | Match score | Rel m score | I% | Displ | Names | Qual code | I | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 02-0992 | 7.23 | 0.52 | 40 | 116 | Spessartine | O | | |
| 2 | 33-0658 | 7.28 | 0.36 | 8 | -144 | Almandine, manganoan | S | * | |
| 3 | 17-0318 | 10.99 | 0.19 | 4 | -224 | Diopside | S | | |
| 4 | 19-0239 | 10.99 | 0.19 | 4 | -224 | Diopside, syn | I | * | |
| 5 | 42-1437 | 3.03 | 0.13 | 6 | -67 | Biotite-1M | I | * | |
| 6 | 41-1480 | 4.71 | 0.07 | 16 | -213 | Albite, calcian, ordered | I | | |

Sample ident.: 7112sc 11-jul-2007 10:59



Philips Analytical PC-APD, Diffraction software

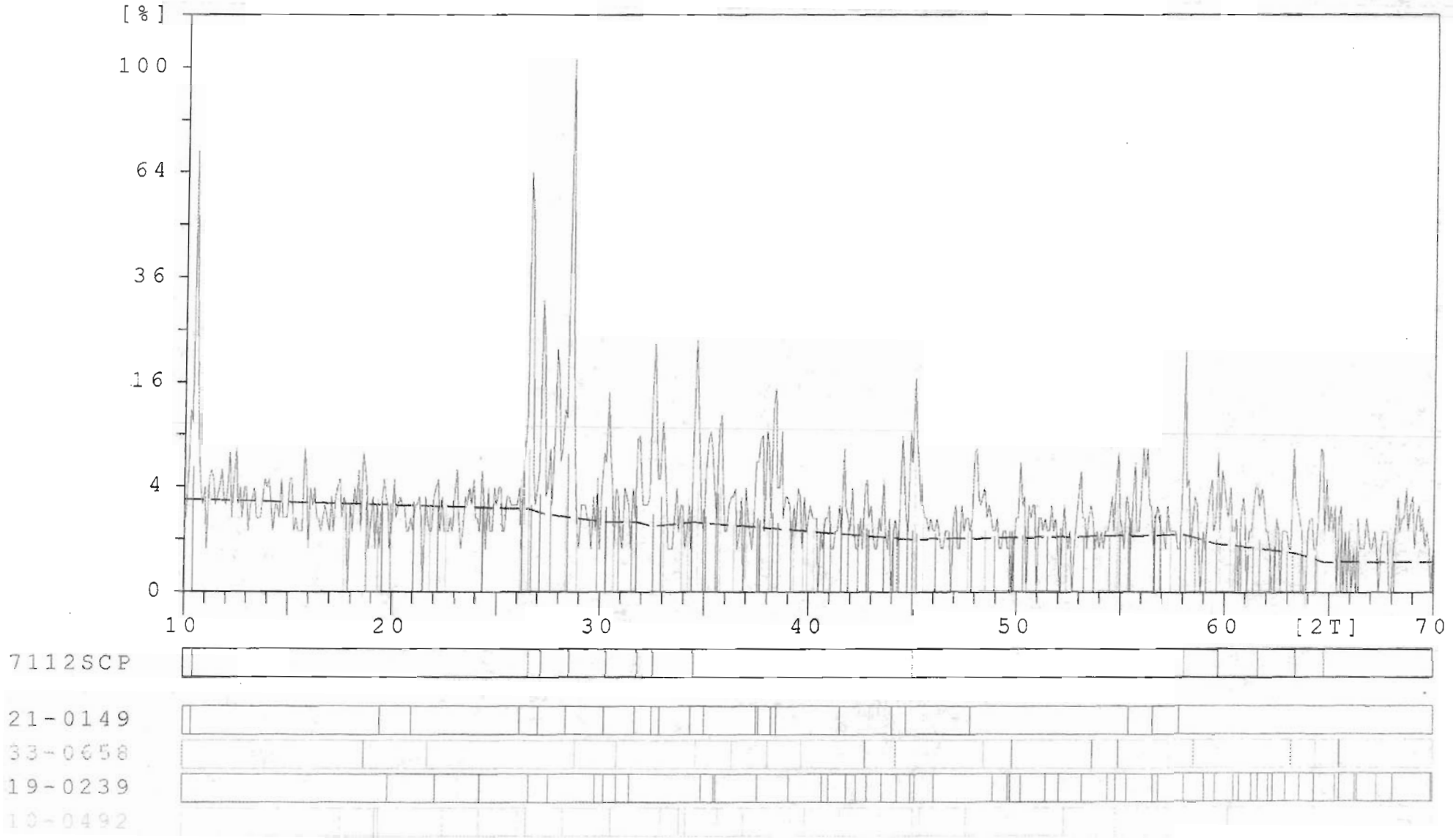
S C O R E L I S T S H O R T N A M E :

Analysed DI file : C:\MILLER\DATA\7112SC.DI
Sample identification: 7112sc
Database used : C:\APDW\IDENTDB
Restrictions file : MINERALS.RES

Results:

| | Card Id | Match score | Rel m score | I% | Displ | Names | Qual code | I | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 02-0992 | 6.42 | 0.46 | 9 | 116 | Spessartine | O | | |
| 2 | 33-0658 | 8.54 | 0.43 | 9 | -131 | Almandine, manganoan | S | * | |
| 3 | 13-0499 | 6.89 | 0.38 | 3 | 17 | Magnesioriebeckite, syn | I | | |
| 4 | 21-0149 | 8.41 | 0.37 | 4 | 123 | Magnesiohornblende, ferroan | I | | |
| 5 | 23-1406 | 7.77 | 0.34 | 6 | -45 | Pargasite | I | | |
| 6 | 23-0663 | 6.03 | 0.33 | 3 | 30 | Eckermannite, syn | I | | |
| 7 | 31-1281 | 6.03 | 0.33 | 3 | 30 | Eckermannite, calcian, syn | I | | |
| 8 | 23-1405 | 7.69 | 0.33 | 3 | -83 | Edenite | I | | |
| 9 | 23-0667 | 7.49 | 0.33 | 5 | 62 | Richterite, calcian, syn | S | | |
| 10 | 20-0469 | 12.38 | 0.32 | 3 | -13 | Hastingsite, magnesian | O | | |
| 11 | 13-0294 | 12.31 | 0.32 | 3 | 86 | Cordierite, syn | I | | |
| 12 | 39-0373 | 10.67 | 0.31 | 4 | 65 | Potassium pargasite | I | | |
| 13 | 10-0428 | 12.18 | 0.31 | 3 | -45 | Richterite, fluor, syn | S | | |
| 14 | 45-1371 | 23.33 | 0.31 | 3 | -70 | Magnesiohornblende, ferroan | I | * | |
| 15 | 23-0666 | 8.98 | 0.31 | 4 | -13 | Tremolite, sodian, syn | I | | |
| 16 | 31-1285 | 8.98 | 0.31 | 4 | -13 | Tremolite, sodian, syn | O | | |
| 17 | 41-1366 | 29.74 | 0.30 | 4 | -50 | Actinolite | I | | |
| 18 | 41-1430 | 13.31 | 0.30 | 3 | -13 | Pargasite, syn | I | | |
| 19 | 19-0239 | 16.31 | 0.29 | 6 | 46 | Diopside, syn | I | * | |
| 20 | 20-0656 | 12.76 | 0.28 | 23 | -88 | Magnesioriebeckite | O | | |
| 21 | 19-1061 | 9.67 | 0.26 | 13 | -83 | Riebeckite | S | | |
| 22 | 18-1222 | 7.09 | 0.24 | 3 | -50 | Aegirine | I | | |
| 23 | 34-0185 | 8.12 | 0.23 | 4 | 50 | Aegirine, syn | S | | |
| 24 | 10-0492 | 5.78 | 0.23 | 5 | -78 | Phlogopite-3T | I | * | |
| 25 | 42-0604 | 11.63 | 0.22 | 5 | -22 | Zinnwaldite-1M | O | | |
| 26 | 41-1480 | 11.73 | 0.18 | 16 | -50 | Albite, calcian, ordered | I | * | |
| 27 | 07-0032 | 4.56 | 0.12 | 3 | -58 | Muscovite 2M1, syn | O | | |

Sample ident.: 7112scp 11-jul-2007 11:15



Philips Analytical PC-APD, Diffraction software

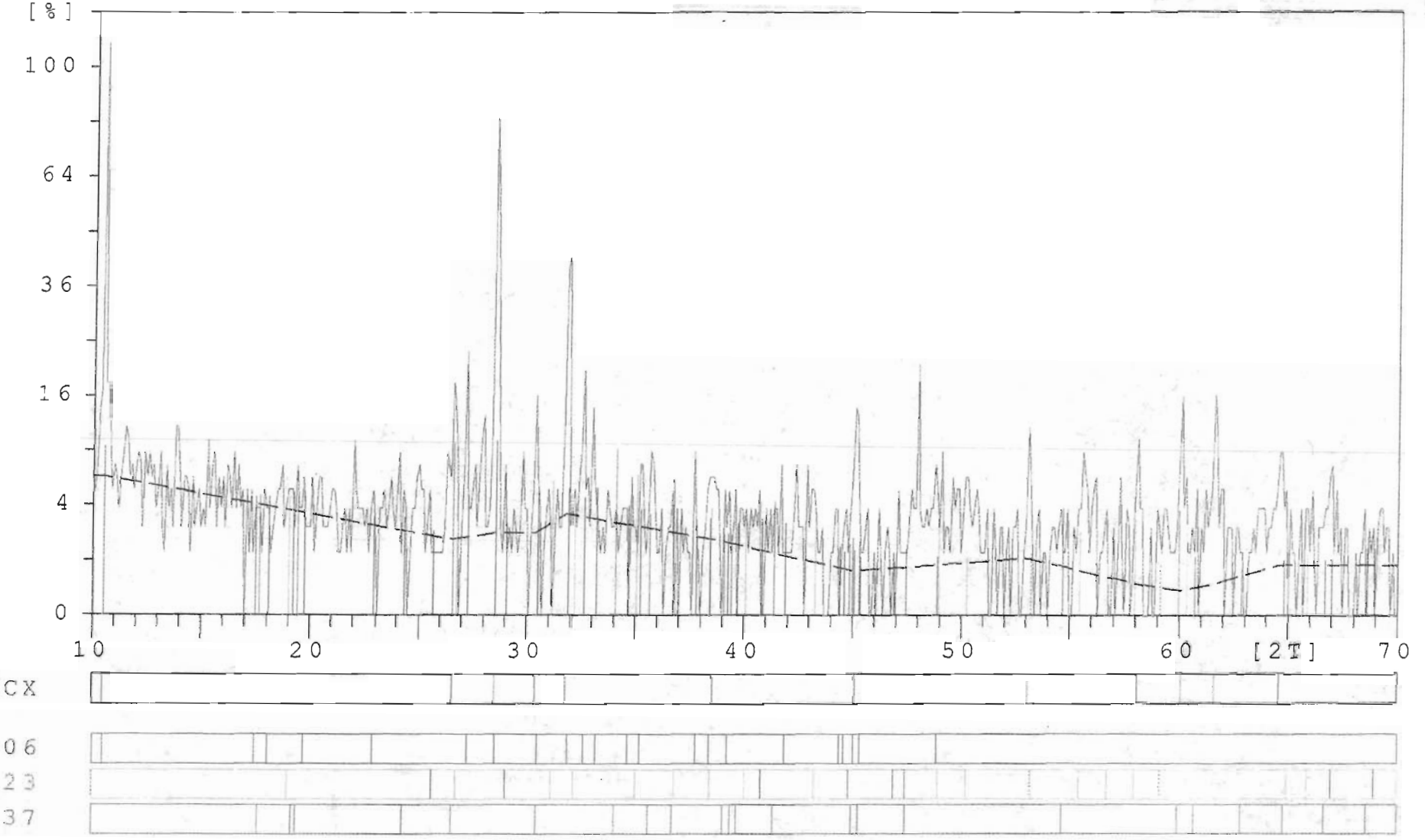
S C O R E L I S T S H O R T N A M E :

Analysed DI file : C:\MILLER\DATA\7112SCP.DI
Sample identification: 7112scp
Database used : C:\APDW\IDENTDB
Restrictions file : MINERALS.RES

Results:

| | Card Id | Match score | Rel m score | I% | Displ | Names | Qual code | I | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 21-0149 | 8.82 | 0.38 | 5 | 116 | Magnesiohornblende, ferroan | | I | * |
| 2 | 23-1406 | 8.24 | 0.36 | 6 | -108 | Pargasite | | I | |
| 3 | 13-0499 | 6.41 | 0.36 | 3 | -21 | Magnesioriebeckite, syn | | I | |
| 4 | 23-1405 | 7.80 | 0.34 | 23 | -124 | Edenite | | I | |
| 5 | 02-0992 | 4.59 | 0.33 | 2 | 53 | Spessartine | | O | |
| 6 | 13-0437 | 12.75 | 0.33 | 3 | -141 | Tremolite | | I | |
| 7 | 37-1463 | 1.94 | 0.32 | 13 | -78 | Stilleite, syn | | S | |
| 8 | 23-0666 | 9.31 | 0.32 | 4 | -58 | Tremolite, sodian, syn | | I | |
| 9 | 31-1285 | 9.31 | 0.32 | 4 | -58 | Tremolite, sodian, syn | | O | |
| 10 | 39-0373 | 10.87 | 0.32 | 4 | 53 | Potassium pargasite | | I | |
| 11 | 20-0469 | 12.39 | 0.32 | 3 | -13 | Hastingsite, magnesian | | O | |
| 12 | 38-0359 | 13.65 | 0.32 | 3 | 45 | Magnesiosadanagaite | | I | |
| 13 | 23-0663 | 5.58 | 0.31 | 3 | 28 | Eckermannite, syn | | I | |
| 14 | 31-1281 | 5.58 | 0.31 | 3 | 28 | Eckermannite, calcian, syn | | I | |
| 15 | 41-1366 | 30.75 | 0.31 | 4 | -58 | Actinolite | | I | |
| 16 | 23-0664 | 7.03 | 0.31 | 3 | 65 | Edenite, sodian, syn | | I | |
| 17 | 31-1282 | 7.03 | 0.31 | 3 | 65 | Edenite, sodian, syn | | I | |
| 18 | 44-1450 | 11.53 | 0.30 | 4 | -124 | Kaersutite | | S | |
| 19 | 33-0658 | 5.87 | 0.29 | 2 | -245 | Almandine, manganoan | | S | * |
| 20 | 45-1371 | 21.90 | 0.29 | 19 | -78 | Magnesiohornblende, ferroan | | I | |
| 21 | 23-0665 | 6.68 | 0.29 | 3 | 65 | Richterite, calcian, syn | | I | |
| 22 | 31-1284 | 6.68 | 0.29 | 3 | 65 | Richterite, calcian, syn | | I | |
| 23 | 23-0667 | 6.65 | 0.29 | 5 | 65 | Richterite, calcian, syn | | S | |
| 24 | 19-1061 | 10.64 | 0.29 | 3 | -108 | Riebeckite | | S | |
| 25 | 41-1430 | 12.88 | 0.29 | 3 | -33 | Pargasite, syn | | I | |
| 26 | 19-0239 | 14.96 | 0.26 | 3 | 113 | Diopside, syn | | I | * |
| 27 | 10-0492 | 5.15 | 0.21 | 5 | 12 | Phlogopite-3T | | I | * |
| 28 | 10-0495 | 4.82 | 0.19 | 6 | -16 | Phlogopite-1M | | I | |
| 29 | 42-0604 | 10.16 | 0.19 | 3 | -96 | Zinnwaldite-1M | | O | |

Sample ident.: 7112scx 11-jul-2007 11:18



Philips Analytical PC-APD, Diffraction software

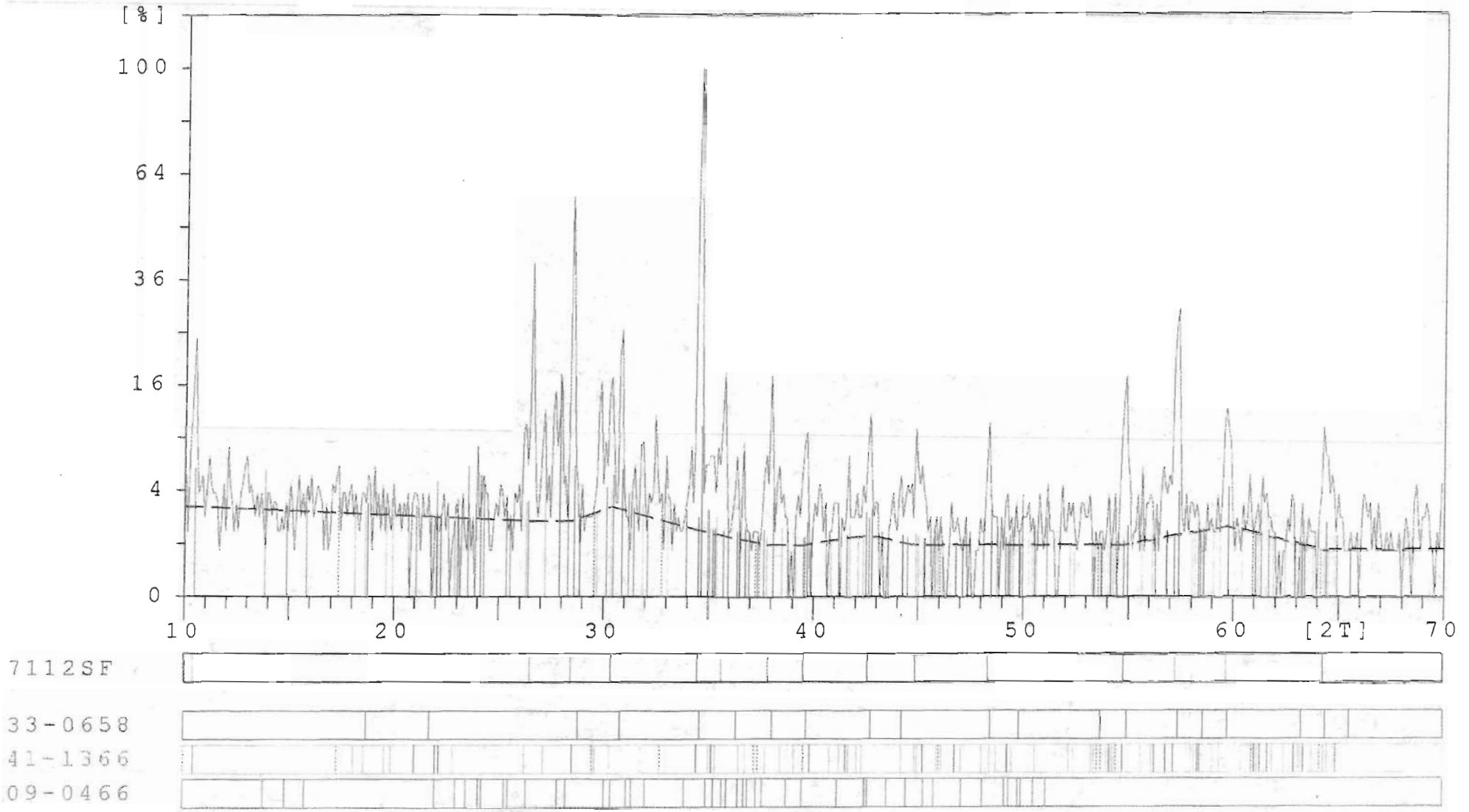
S C O R E L I S T S H O R T N A M E :

Analysed DI file : C:\MILLER\DATA\7112SCX.DI
Sample identification: 7112scx
Database used : C:\APDW\IDENTDB
Restrictions file : MINERALS.RES

Results:

| | Card Id | Match score | Rel m score | I% | Displ | Names | Qual code | I | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 17-0478 | 13.55 | 0.36 | 4 | -91 | Kaersutite | | I | |
| 2 | 21-0149 | 8.19 | 0.36 | 6 | 144 | Magnesiohornblende, ferroan | | I | |
| 3 | 23-1406 | 7.56 | 0.33 | 8 | -88 | Pargasite | | I | * |
| 4 | 23-0666 | 9.51 | 0.33 | 8 | -23 | Tremolite, sodian, syn | | I | |
| 5 | 31-1285 | 9.51 | 0.33 | 8 | -23 | Tremolite, sodian, syn | | O | |
| 6 | 23-0663 | 5.66 | 0.31 | 6 | 12 | Eckermannite, syn | | I | |
| 7 | 31-1281 | 5.66 | 0.31 | 6 | 12 | Eckermannite, calcian, syn | | I | |
| 8 | 23-1405 | 7.00 | 0.30 | 4 | -50 | Edenite | | I | |
| 9 | 20-0470 | 8.45 | 0.30 | 3 | -23 | Crossite | | O | |
| 10 | 31-1312 | 8.45 | 0.30 | 3 | -23 | Crossite | | O | |
| 11 | 25-0850 | 6.94 | 0.30 | 3 | 144 | Kozulite | | I | |
| 12 | 44-1402 | 21.12 | 0.29 | 3 | -131 | Tremolite | | I | |
| 13 | 41-1366 | 28.93 | 0.29 | 4 | -55 | Actinolite | | I | |
| 14 | 10-0428 | 11.05 | 0.28 | 3 | -63 | Richterite, fluor, syn | | S | |
| 15 | 20-0469 | 11.00 | 0.28 | 3 | -13 | Hastingsite, magnesian | | O | |
| 16 | 42-1369 | 13.22 | 0.28 | 4 | 62 | Magnesioarfvedsonite | | I | |
| 17 | 45-1371 | 20.98 | 0.28 | 23 | -83 | Magnesiohornblende, ferroan | | I | |
| 18 | 19-1061 | 10.31 | 0.28 | 3 | -83 | Riebeckite | | S | |
| 19 | 41-1423 | 7.38 | 0.27 | 4 | 116 | Almandine, syn | | O | * |
| 20 | 23-0665 | 6.22 | 0.27 | 4 | 62 | Richterite, calcian, syn | | I | |
| 21 | 31-1284 | 6.22 | 0.27 | 4 | 62 | Richterite, calcian, syn | | I | |
| 22 | 20-0656 | 11.99 | 0.27 | 23 | -38 | Magnesioriebeckite | | O | |
| 23 | 05-0490 | 4.77 | 0.27 | 2 | -108 | Quartz, low | | S | |
| 24 | 42-1437 | 5.70 | 0.24 | 23 | -16 | Biotite-1M | | I | * |
| 25 | 10-0492 | 5.90 | 0.24 | 6 | -42 | Phlogopite-3T | | I | |
| 26 | 10-0495 | 5.60 | 0.22 | 16 | -45 | Phlogopite-1M | | I | |
| 27 | 42-1413 | 8.26 | 0.22 | 19 | 103 | Annite-1M | | I | |
| 28 | 10-0493 | 5.72 | 0.20 | 4 | 83 | Phlogopite-2M1 | | I | |

Sample ident.: 7112sf 11-jul-2007 11:19



Philips Analytical PC-APD, Diffraction software

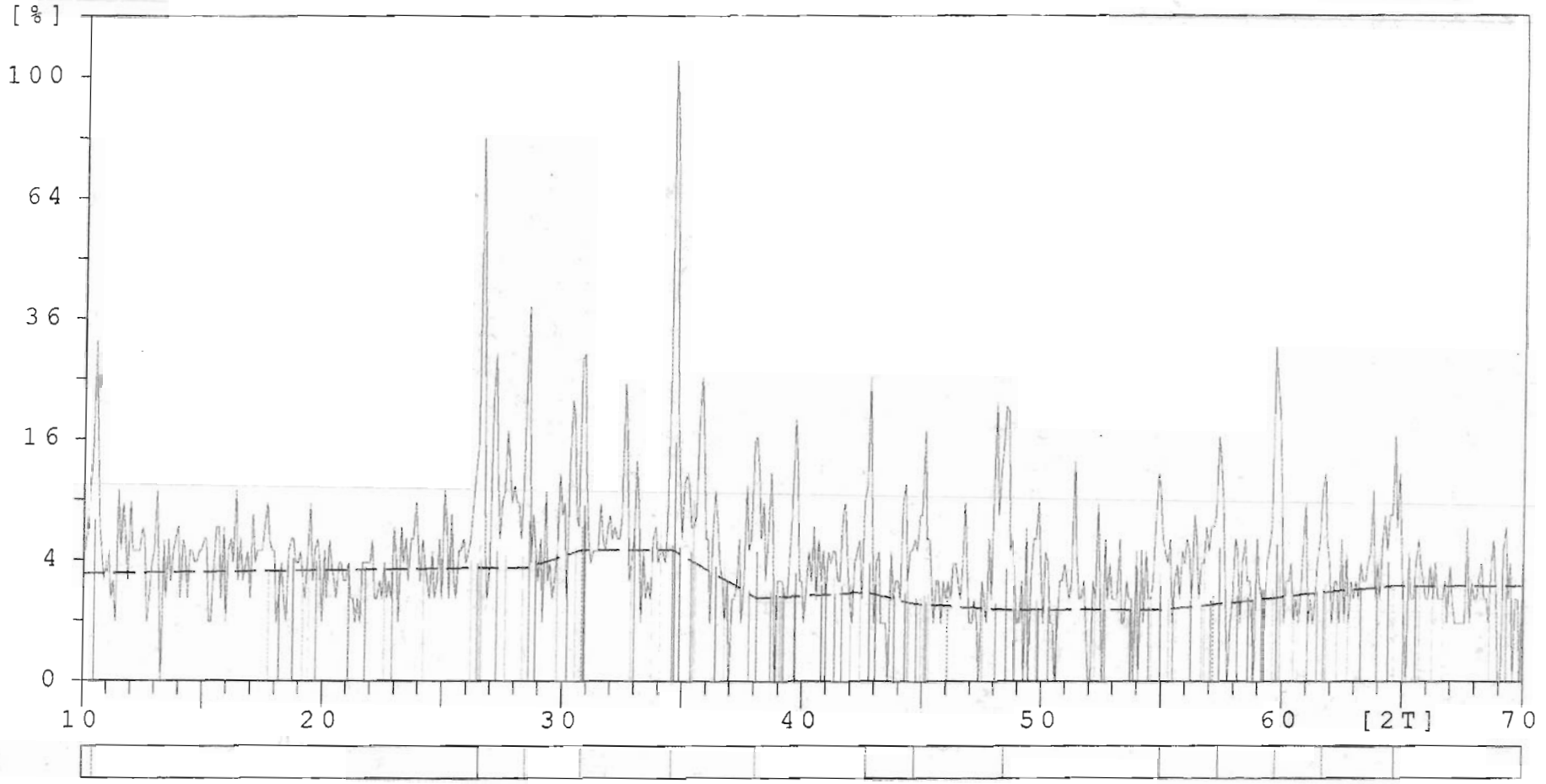
S C O R E L I S T S H O R T N A M E :

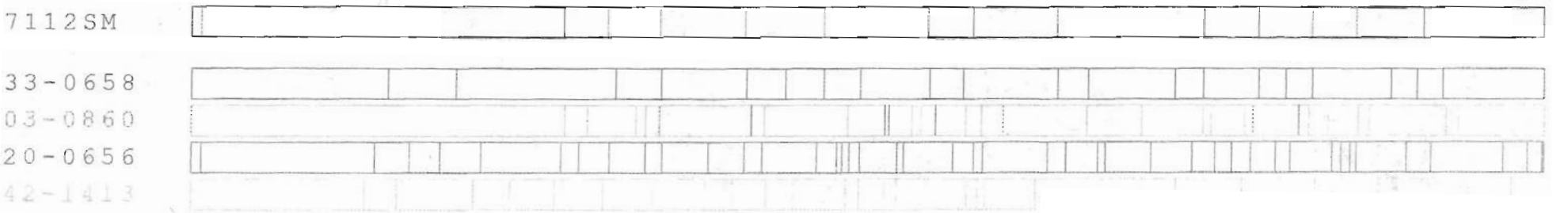
Analysed DI file : C:\MILLER\DATA\7112SF.DI
Sample identification: 7112sf
Database used : C:\APDW\IDENTDB
Restrictions file : MINERALS.RES

Results:

| | Card Id | Match score | Rel m score | I% | Displ | Names | Qual code | I | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 02-0992 | 6.98 | 0.50 | 4 | 58 | Spessartine | O | | |
| 2 | 33-0658 | 8.06 | 0.40 | 9 | -144 | Almandine, manganoan | S | * | |
| 3 | 23-0663 | 6.77 | 0.38 | 6 | -30 | Eckermannite, syn | I | | |
| 4 | 31-1281 | 6.77 | 0.38 | 6 | -30 | Eckermannite, calcian, syn | I | | |
| 5 | 19-1063 | 10.60 | 0.37 | 3 | 111 | Richterite | O | | |
| 6 | 23-1406 | 8.07 | 0.35 | 6 | -91 | Pargasite | I | | |
| 7 | 23-0666 | 9.35 | 0.32 | 5 | -13 | Tremolite, sodian, syn | I | | |
| 8 | 31-1285 | 9.35 | 0.32 | 5 | -13 | Tremolite, sodian, syn | O | | |
| 9 | 10-0428 | 11.64 | 0.30 | 3 | -91 | Richterite, fluor, syn | S | | |
| 10 | 41-1366 | 28.66 | 0.29 | 4 | -91 | Actinolite | I | * | |
| 11 | 20-0469 | 11.14 | 0.29 | 3 | -91 | Hastingsite, magnesian | O | | |
| 12 | 41-1430 | 12.76 | 0.28 | 3 | -13 | Pargasite, syn | I | | |
| 13 | 10-0492 | 6.00 | 0.24 | 4 | -98 | Phlogopite-3T | I | | |
| 14 | 10-0493 | 5.92 | 0.20 | 3 | 73 | Phlogopite-2M1 | I | | |
| 15 | 42-0604 | 10.72 | 0.20 | 4 | -131 | Zinnwaldite-1M | O | | |
| 16 | 41-1481 | 9.17 | 0.18 | 16 | 16 | Anorthite, sodian, disordered | I | | |
| 17 | 09-0466 | 6.46 | 0.14 | 16 | -21 | Albite, ordered | S | * | |

Sample ident.: 7112sm 11-jul-2007 11:21



Philips Analytical PC-APD, Diffraction software

S C O R E  L I S T  S H O R T  N A M E :

Analysed DI file : C:\MILLER\DATA\7112SM.DI
Sample identification: 7112sm
Database used : C:\APDW\IDENTDB
Restrictions file : MINERALS.RES

Results:

| | Card Id | Match score | Rel m score | I% | Displ | Names | Qual code | I | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 02-0992 | 6.33 | 0.45 | 5 | 144 | Spessartine | O | | |
| 2 | 33-0658 | 8.91 | 0.45 | 11 | -88 | Almandine, manganoan | S | I | * |
| 3 | 03-0845 | 6.19 | 0.44 | 6 | -141 | Almandite [NR] | O | | |
| 4 | 02-1008 | 5.15 | 0.37 | 3 | -144 | Pyrope | O | | |
| 5 | 23-0663 | 6.06 | 0.34 | 4 | -13 | Eckermannite, syn | I | | |
| 6 | 31-1281 | 6.06 | 0.34 | 4 | -13 | Eckermannite, calcian, syn | I | | |
| 7 | 03-0860 | 9.72 | 0.32 | 5 | 40 | Diopside, syn | O | I | * |
| 8 | 23-1406 | 7.27 | 0.32 | 9 | -58 | Pargasite | I | | |
| 9 | 20-0656 | 13.94 | 0.31 | 4 | -50 | Magnesioriebeckite | O | I | * |
| 10 | 23-0666 | 8.97 | 0.31 | 9 | -30 | Tremolite, sodian, syn | I | | |
| 11 | 31-1285 | 8.97 | 0.31 | 9 | -30 | Tremolite, sodian, syn | O | | |
| 12 | 10-0428 | 11.70 | 0.30 | 4 | -70 | Richterite, fluor, syn | S | | |
| 13 | 41-1430 | 13.19 | 0.29 | 4 | 30 | Pargasite, syn | I | | |
| 14 | 19-0607 | 10.15 | 0.27 | 5 | -88 | Orthoferrosilite, magnesian | O | | |
| 15 | 31-0635 | 10.15 | 0.27 | 5 | -88 | Ferrosilite, magnesian | O | | |
| 16 | 42-1437 | 4.84 | 0.20 | 40 | -42 | Biotite-1M | I | | |
| 17 | 42-0604 | 10.37 | 0.20 | 5 | -45 | Zinnwaldite-1M | O | | |
| 18 | 42-1413 | 7.07 | 0.19 | 6 | 37 | Annite-1M | I | I | * |

# Mattawa garnets 2007

7/11/2007 9:24.19 AM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa garnet 1

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 1 |
| Collected : | 28-Jun-2007 03:48 PM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 155.86 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 600 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Mg MgO 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Mn Mn 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Mg K | 4.36 | 0.8526 | 4.35 | 0.07 | 4.08 | 7.22 | MgO | 0.54 |
| Al K | 12.33 | 0.8949 | 11.73 | 0.09 | 9.91 | 22.15 | Al2O3 | 1.31 |
| Si K | 19.98 | 0.8712 | 19.52 | 0.11 | 15.85 | 41.75 | SiO2 | 2.10 |
| Ca K | 5.46 | 1.0047 | 4.62 | 0.07 | 2.63 | 6.47 | CaO | 0.35 |
| Mn K | 0.39 | 0.8208 | 0.40 | 0.07 | 0.17 | 0.52 | MnO | 0.02 |
| Fe K | 16.70 | 0.8352 | 17.02 | 0.17 | 6.95 | 21.89 | FeO | 0.92 |
| O | | | 42.36 | 0.17 | 60.40 | | | 8.00 |
| Totals | | | 100.00 | | | | | |

# Mattawa garnets 2007

7/2/2007 11:28:59 AM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa garnet

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 1 |
| Collected : | 2-Jul-2007 11:25 AM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 135.81 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 320 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Mg MgO 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Mn Mn 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Mg K | 3.18 | 0.8312 | 5.13 | 0.10 | 4.91 | 8.50 | MgO | 0.66 |
| Al K | 6.68 | 0.8730 | 10.27 | 0.12 | 8.87 | 19.41 | Al2O3 | 1.19 |
| Si K | 11.73 | 0.8683 | 18.13 | 0.15 | 15.04 | 38.79 | SiO2 | 2.01 |
| Ca K | 3.26 | 1.0132 | 4.31 | 0.09 | 2.51 | 6.04 | CaO | 0.34 |
| Ti K | 0.32 | 0.8516 | 0.50 | 0.07 | 0.24 | 0.83 | TiO2 | 0.03 |
| Mn K | 0.32 | 0.8259 | 0.52 | 0.11 | 0.22 | 0.67 | MnO | 0.03 |
| Fe K | 12.55 | 0.8405 | 20.03 | 0.25 | 8.35 | 25.76 | FeO | 1.12 |

| | | | | | |
|---|---|---|---|---|---|
| O | 41.11 | 0.23 | 59.86 | | 8.00 |
| Totals | 100.00 | | | | |
| | | | | Cation ... | 5.37 |

# Mattawa garnets 2007

7/9/2007 10 50 54 AM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa garnet

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 2 |
| Collected : | 2-Jul-2007 01:27 PM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 146.73 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 43 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Mg MgO 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Mn Mn 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Mg K | 3.80 | 0.8397 | 4.40 | 0.08 | 4.18 | 7.29 | MgO | 0.56 |
| Al K | 9.85 | 0.8855 | 10.82 | 0.10 | 9.26 | 20.44 | Al2O3 | 1.23 |
| Si K | 17.01 | 0.8723 | 18.96 | 0.13 | 15.59 | 40.55 | SiO2 | 2.07 |
| Ca K | 4.78 | 1.0098 | 4.60 | 0.08 | 2.65 | 6.44 | CaO | 0.35 |
| Ti K | 0.39 | 0.8475 | 0.45 | 0.06 | 0.22 | 0.75 | TiO2 | 0.03 |
| Mn K | 0.34 | 0.8235 | 0.40 | 0.09 | 0.17 | 0.52 | MnO | 0.02 |
| Fe K | 16.08 | 0.8381 | 18.66 | 0.21 | 7.72 | 24.01 | FeO | 1.03 |

| | | | | | |
|---|---|---|---|---|---|
| O | 41.71 | 0.20 | 60.22 | | 8.00 |
| Totals | 100.00 | | | | |
| | | | | Cation ... | 5.29 |

# Mattawa garnets 2007

7/2/2007 1 34 40 PM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa garnet

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 3 |
| Collected : | 2-Jul-2007 01:31 PM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 146.93 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 43 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Mg MgO 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Mn Mn 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Mg K | 4.47 | 0.8369 | 4.33 | 0.07 | 4.13 | 7.18 | MgO | 0.55 |
| Al K | 11.82 | 0.8841 | 10.85 | 0.09 | 9.31 | 20.50 | Al2O3 | 1.24 |
| Si K | 20.15 | 0.8714 | 18.76 | 0.12 | 15.47 | 40.14 | SiO2 | 2.06 |
| Ca K | 5.67 | 1.0108 | 4.55 | 0.07 | 2.63 | 6.37 | CaO | 0.35 |
| Ti K | 0.42 | 0.8487 | 0.40 | 0.06 | 0.19 | 0.66 | TiO2 | 0.03 |
| Mn K | 0.52 | 0.8243 | 0.52 | 0.08 | 0.22 | 0.67 | MnO | 0.03 |
| Fe K | 19.67 | 0.8389 | 19.03 | 0.19 | 7.89 | 24.48 | FeO | 1.05 |

| | | | | | |
|---|---|---|---|---|---|
| O | 41.56 | 0.18 | 60.16 | | 8.00 |
| Totals | 100.00 | | | | |
| | | | | Cation ... | 5.30 |

# Mattawa garnets 2007

7/9/2007 10:51:38 AM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa garnet

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 6 |
| Collected : | 2-Jul-2007 01:41 PM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 143.11 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 160 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Mg MgO 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Mn Mn 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Mg K | 4.01 | 0.8553 | 4.38 | 0.08 | 4.09 | 7.25 | MgO | 0.54 |
| Al K | 11.31 | 0.8966 | 11.76 | 0.10 | 9.92 | 22.22 | Al2O3 | 1.31 |
| Si K | 18.42 | 0.8718 | 19.70 | 0.12 | 15.96 | 42.14 | SiO2 | 2.11 |
| Ca K | 5.00 | 1.0038 | 4.64 | 0.08 | 2.63 | 6.49 | CaO | 0.35 |
| Mn K | 0.33 | 0.8201 | 0.38 | 0.08 | 0.16 | 0.49 | MnO | 0.02 |
| Fe K | 14.89 | 0.8345 | 16.63 | 0.19 | 6.78 | 21.40 | FeO | 0.90 |
| O | | | 42.51 | 0.18 | 60.46 | | | 8.00 |
| Totals | | | 100.00 | | | | | |

# Mattawa garnets 2007

7/2/2007 1:48:35 PM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa garnet

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 7 |
| Collected : | 2-Jul-2007 01:45 PM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 140.65 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 300 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
Peak possibly omitted : 10.800 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Mg MgO 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Mn Mn 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Mg K | 2.88 | 0.8337 | 3.16 | 0.07 | 3.03 | 5.24 | MgO | 0.40 |
| Al K | 10.78 | 0.8925 | 11.04 | 0.10 | 9.52 | 20.85 | Al2O3 | 1.27 |
| Si K | 18.05 | 0.8761 | 18.82 | 0.12 | 15.60 | 40.26 | SiO2 | 2.07 |
| Ca K | 6.63 | 1.0118 | 5.99 | 0.08 | 3.48 | 8.38 | CaO | 0.46 |
| Mn K | 0.53 | 0.8243 | 0.58 | 0.09 | 0.25 | 0.75 | MnO | 0.03 |
| Fe K | 17.51 | 0.8390 | 19.06 | 0.20 | 7.95 | 24.52 | FeO | 1.06 |
| O | | | 41.35 | 0.18 | 60.18 | | | 8.00 |
| Totals | | | 100.00 | | | | | |

# Mattawa garnets 2007

7/9/2007 10:52:07 AM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa garnet

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 9 |
| Collected : | 2-Jul-2007 01:50 PM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 142.82 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 320 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Mg MgO 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Mn Mn 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Mg K | 3.18 | 0.8381 | 3.46 | 0.07 | 3.29 | 5.73 | MgO | 0.44 |
| Al K | 11.13 | 0.8928 | 11.36 | 0.10 | 9.74 | 21.46 | Al2O3 | 1.29 |
| Si K | 18.22 | 0.8737 | 18.99 | 0.12 | 15.66 | 40.63 | SiO2 | 2.08 |
| Ca K | 5.86 | 1.0099 | 5.28 | 0.08 | 3.05 | 7.39 | CaO | 0.41 |
| Mn K | 0.52 | 0.8238 | 0.57 | 0.08 | 0.24 | 0.74 | MnO | 0.03 |
| Fe K | 17.20 | 0.8383 | 18.69 | 0.20 | 7.75 | 24.05 | FeO | 1.03 |
| O | | | 41.64 | 0.18 | 60.26 | | | 8.00 |
| Totals | | | 100.00 | | | | | |

# Mattawa garnets 2007

7/2/2007 1 58 21 PM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa garnet

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 10 |
| Collected : | 2-Jul-2007 01:55 PM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 139.77 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 160 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Mg MgO 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Mn Mn 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Mg K | 2.32 | 0.8468 | 2.78 | 0.07 | 2.62 | 4.60 | MgO | 0.34 |
| Al K | 10.22 | 0.9056 | 11.44 | 0.10 | 9.72 | 21.62 | Al2O3 | 1.28 |
| Si K | 17.66 | 0.8807 | 20.33 | 0.13 | 16.60 | 43.50 | SiO2 | 2.19 |
| Ca K | 5.29 | 1.0060 | 5.33 | 0.09 | 3.05 | 7.46 | CaO | 0.40 |
| Mn K | 0.32 | 0.8211 | 0.40 | 0.09 | 0.17 | 0.51 | MnO | 0.02 |
| Fe K | 14.29 | 0.8357 | 17.34 | 0.20 | 7.12 | 22.30 | FeO | 0.94 |
| O | | | 42.38 | 0.19 | 60.73 | | | 8.00 |
| Totals | | | 100.00 | | | | | |

# Mattawa garnets 2007

7/2/2007 2 02 54 PM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa garnet

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 11 |
| Collected : | 2-Jul-2007 01:59 PM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 152.14 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 40 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Mg MgO 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Mn Mn 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Mg K | 3.67 | 0.8449 | 3.41 | 0.06 | 3.23 | 5.65 | MgO | 0.43 |
| Al K | 13.32 | 0.8983 | 11.65 | 0.09 | 9.93 | 22.01 | Al2O3 | 1.32 |
| Si K | 21.56 | 0.8746 | 19.36 | 0.11 | 15.86 | 41.43 | SiO2 | 2.10 |
| Ca K | 6.90 | 1.0075 | 5.38 | 0.07 | 3.09 | 7.53 | CaO | 0.41 |
| Mn K | 0.45 | 0.8220 | 0.43 | 0.08 | 0.18 | 0.55 | MnO | 0.02 |
| Fe K | 18.90 | 0.8366 | 17.74 | 0.18 | 7.31 | 22.83 | FeO | 0.97 |
| O | | | 42.02 | 0.17 | 60.41 | | | 8.00 |
| Totals | | | 100.00 | | | | | |

# Mattawa garnets 2007

7/9/2007 10:44:35 AM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa clinopyroxene

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 1 |
| Collected : | 2-Jul-2007 10:57 AM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 156.17 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 320 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Na K | 1.31 | 1.0418 | 0.91 | 0.05 | 0.87 | 1.22 | Na2O | 0.12 |
| Mg K | 10.80 | 0.9038 | 8.66 | 0.08 | 7.83 | 14.36 | MgO | 1.04 |
| Al K | 1.50 | 0.8920 | 1.22 | 0.05 | 0.99 | 2.30 | Al2O3 | 0.13 |
| Si K | 33.91 | 0.9442 | 26.02 | 0.11 | 20.37 | 55.67 | SiO2 | 2.71 |
| Ca K | 18.55 | 0.9887 | 13.60 | 0.10 | 7.46 | 19.02 | CaO | 0.99 |
| Fe K | 6.49 | 0.8157 | 5.77 | 0.13 | 2.27 | 7.42 | FeO | 0.30 |
| O | | | 43.83 | 0.14 | 60.21 | | | 8.00 |
| Totals | | | 100.00 | | | | | |

# Mattawa garnets 2007

7/9/2007 10 46 14 AM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa clinopyroxene

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 2 |
| Collected : | 2-Jul-2007 11:01 AM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 155.06 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 320 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Na K | 1.36 | 1.0368 | 0.97 | 0.06 | 0.93 | 1.31 | Na2O | 0.12 |
| Mg K | 10.34 | 0.8999 | 8.49 | 0.08 | 7.69 | 14.08 | MgO | 1.02 |
| Al K | 1.62 | 0.8910 | 1.35 | 0.05 | 1.10 | 2.54 | Al2O3 | 0.15 |
| Si K | 33.06 | 0.9426 | 25.92 | 0.11 | 20.33 | 55.46 | SiO2 | 2.70 |
| Ca K | 17.67 | 0.9894 | 13.20 | 0.10 | 7.25 | 18.47 | CaO | 0.96 |
| Fe K | 6.98 | 0.8166 | 6.32 | 0.13 | 2.49 | 8.13 | FeO | 0.33 |
| O | | | 43.74 | 0.15 | 60.20 | | | 8.00 |
| Totals | | | 100.00 | | | | | |

# Mattawa garnets 2007

7/11/2007 9:22:46 AM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa amph

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 1 |
| Collected : | 2-Jul-2007 10:30 AM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 156.46 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 160 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
Peak possibly omitted : 2.269 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Cl KCl 1-Jun-1999 12:00 AM
K MAD-10 Feldspar 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Na K | 3.37 | 1.0238 | 2.45 | 0.07 | 2.37 | 3.31 | Na2O | 0.32 |
| Mg K | 8.76 | 0.8766 | 7.46 | 0.08 | 6.80 | 12.36 | MgO | 0.91 |
| Al K | 8.28 | 0.8833 | 6.99 | 0.08 | 5.75 | 13.21 | Al2O3 | 0.77 |
| Si K | 25.37 | 0.8951 | 21.15 | 0.11 | 16.71 | 45.24 | SiO2 | 2.25 |
| Cl K | 0.21 | 0.7810 | 0.20 | 0.04 | 0.13 | 0.00 | | 0.02 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| K K | 1.34 | 1.0509 | 0.95 | 0.05 | 0.54 | 1.14 | K2O | 0.07 |
| Ca K | 9.10 | 0.9939 | 6.83 | 0.08 | 3.78 | 9.56 | CaO | 0.51 |
| Ti K | 1.85 | 0.8243 | 1.67 | 0.06 | 0.77 | 2.79 | TiO2 | 0.10 |
| Fe K | 10.46 | 0.8241 | 9.47 | 0.15 | 3.76 | 12.18 | FeO | 0.51 |
| O | | | 42.82 | 0.16 | 59.39 | | | 7.98 |
| Totals | | | 100.00 | | | | | |
| | | | | | | | Cation ... | 5.44 |

# Mattawa garnets 2007

7/11/2007 9:23:07 AM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa amph

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 2 |
| Collected : | 2-Jul-2007 10:34 AM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 156.62 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 160 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Cl KCl 1-Jun-1999 12:00 AM
K MAD-10 Feldspar 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Na K | 3.34 | 1.0231 | 2.42 | 0.07 | 2.34 | 3.26 | Na2O | 0.31 |
| Mg K | 8.79 | 0.8765 | 7.44 | 0.08 | 6.80 | 12.33 | MgO | 0.91 |
| Al K | 8.36 | 0.8834 | 7.02 | 0.08 | 5.78 | 13.26 | Al2O3 | 0.78 |
| Si K | 25.35 | 0.8951 | 21.00 | 0.11 | 16.61 | 44.93 | SiO2 | 2.23 |
| Cl K | 0.29 | 0.7816 | 0.27 | 0.04 | 0.17 | 0.00 | | 0.02 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| K K | 1.44 | 1.0514 | 1.02 | 0.05 | 0.58 | 1.23 | K2O | 0.08 |
| Ca K | 9.33 | 0.9939 | 6.96 | 0.08 | 3.86 | 9.74 | CaO | 0.52 |
| Ti K | 1.82 | 0.8242 | 1.64 | 0.06 | 0.76 | 2.73 | TiO2 | 0.10 |
| Fe K | 10.57 | 0.8242 | 9.51 | 0.15 | 3.78 | 12.23 | FeO | 0.51 |
| O | | | 42.72 | 0.16 | 59.32 | | | 7.98 |
| Totals | | | 100.00 | | | | | |
| | | | | | | | Cation ... | 5.45 |

# Mattawa garnets 2007

7/11/2007 9:23:47 AM

| | |
|---|---|
| Project: Mattawa garnets 2007 | Sample: Sample 1 |
| Owner: support | Type: Default |
| Site: Mattawa biotite | ID: |

| | |
|---|---|
| Label : | Spectrum 1 |
| Collected : | 2-Jul-2007 10:48 AM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 146.88 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 320 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Cl KCl 1-Jun-1999 12:00 AM
K MAD-10 Feldspar 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Na K | 0.33 | 0.9961 | 0.27 | 0.05 | 0.27 | 0.37 | Na2O | 0.04 |
| Mg K | 8.63 | 0.8825 | 8.16 | 0.09 | 7.65 | 13.53 | MgO | 1.04 |
| Al K | 8.55 | 0.8827 | 8.08 | 0.08 | 6.83 | 15.27 | Al2O3 | 0.93 |
| Si K | 19.75 | 0.8894 | 18.52 | 0.11 | 15.04 | 39.63 | SiO2 | 2.04 |
| Cl K | 0.23 | 0.7924 | 0.24 | 0.04 | 0.15 | 0.00 | | 0.02 |
| K K | 10.03 | 1.0558 | 7.93 | 0.09 | 4.62 | 9.55 | K2O | 0.63 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Ti K | 3.76 | 0.8355 | 3.75 | 0.09 | 1.79 | 6.26 | TiO2 | 0.24 |
| Fe K | 11.74 | 0.8312 | 11.78 | 0.17 | 4.81 | 15.16 | FeO | 0.65 |
| O | | | 41.26 | 0.17 | 58.82 | | | 7.98 |
| Totals | | | 100.00 | | | | | |
| | | | | | | | Cation ... | 5.56 |

inca

# Mattawa garnets 2007

7/11/2007 9:23:18 AM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa amph

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 3 |
| Collected : | 2-Jul-2007 10:40 AM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 148.48 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 300 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Cl KCl 1-Jun-1999 12:00 AM
K MAD-10 Feldspar 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Na K | 2.72 | 1.0096 | 2.13 | 0.07 | 2.07 | 2.87 | Na2O | 0.28 |
| Mg K | 7.51 | 0.8715 | 6.81 | 0.08 | 6.28 | 11.29 | MgO | 0.84 |
| Al K | 8.23 | 0.8862 | 7.34 | 0.08 | 6.10 | 13.87 | Al2O3 | 0.82 |
| Si K | 22.58 | 0.8957 | 19.92 | 0.11 | 15.90 | 42.62 | SiO2 | 2.13 |
| Cl K | 0.27 | 0.7869 | 0.27 | 0.04 | 0.17 | 0.00 | | 0.02 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| K K | 1.37 | 1.0578 | 1.03 | 0.05 | 0.59 | 1.24 | K2O | 0.08 |
| Ca K | 9.17 | 0.9997 | 7.24 | 0.08 | 4.05 | 10.14 | CaO | 0.54 |
| Ti K | 3.35 | 0.8266 | 3.20 | 0.08 | 1.50 | 5.34 | TiO2 | 0.20 |
| Fe K | 10.04 | 0.8256 | 9.61 | 0.15 | 3.86 | 12.36 | FeO | 0.52 |
| O | | | 42.44 | 0.17 | 59.47 | | | 7.98 |
| Totals | | | 100.00 | | | | | |
| | | | | | | | Cation ... | 5.41 |

# Mattawa garnets 2007

7/11/2007 9:23:30 AM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa amph

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 4 |
| Collected : | 2-Jul-2007 10:43 AM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 148.55 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 300 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Cl KCl 1-Jun-1999 12:00 AM
K MAD-10 Feldspar 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Na K | 2.74 | 1.0073 | 2.15 | 0.07 | 2.10 | 2.90 | Na2O | 0.28 |
| Mg K | 7.34 | 0.8699 | 6.67 | 0.08 | 6.16 | 11.07 | MgO | 0.83 |
| Al K | 8.20 | 0.8864 | 7.32 | 0.08 | 6.09 | 13.82 | Al2O3 | 0.82 |
| Si K | 22.37 | 0.8963 | 19.74 | 0.11 | 15.78 | 42.24 | SiO2 | 2.12 |
| Cl K | 0.24 | 0.7880 | 0.24 | 0.04 | 0.15 | 0.00 | | 0.02 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| K K | 1.47 | 1.0592 | 1.10 | 0.05 | 0.63 | 1.32 | K2O | 0.08 |
| Ca K | 9.09 | 1.0009 | 7.18 | 0.08 | 4.02 | 10.05 | CaO | 0.54 |
| Ti K | 3.80 | 0.8272 | 3.63 | 0.08 | 1.70 | 6.05 | TiO2 | 0.23 |
| Fe K | 9.99 | 0.8259 | 9.57 | 0.15 | 3.85 | 12.31 | FeO | 0.52 |
| O | | | 42.40 | 0.17 | 59.51 | | | 7.98 |
| Totals | | | 100.00 | | | | | |
| | | | | | | | Cation ... | 5.41 |

# Mattawa garnets 2007

7/11/2007 9:24:05 AM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa biotite

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 2 |
| Collected : | 2-Jul-2007 10:51 AM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 147.17 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 320 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Cl KCl 1-Jun-1999 12:00 AM
K MAD-10 Feldspar 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Na K | 0.30 | 0.9926 | 0.25 | 0.05 | 0.24 | 0.33 | Na2O | 0.03 |
| Mg K | 8.74 | 0.8804 | 8.20 | 0.08 | 7.70 | 13.60 | MgO | 1.04 |
| Al K | 8.46 | 0.8810 | 7.93 | 0.08 | 6.71 | 14.98 | Al2O3 | 0.91 |
| Si K | 19.94 | 0.8894 | 18.52 | 0.11 | 15.06 | 39.62 | SiO2 | 2.04 |
| Cl K | 0.26 | 0.7926 | 0.27 | 0.04 | 0.18 | 0.00 | | 0.02 |
| K K | 9.90 | 1.0561 | 7.74 | 0.08 | 4.52 | 9.33 | K2O | 0.61 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Ti K | 3.82 | 0.8363 | 3.77 | 0.09 | 1.80 | 6.30 | TiO2 | 0.24 |
| Fe K | 12.18 | 0.8317 | 12.10 | 0.17 | 4.95 | 15.57 | FeO | 0.67 |
| O | | | 41.21 | 0.17 | 58.83 | | | 7.98 |
| Totals | | | 100.00 | | | | | |
| | | | | | | | Cation ... | 5.56 |

# Mattawa garnets 2007

7/2/2007 11.10 43 AM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa plagioclase

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 1 |
| Collected : | 2-Jul-2007 11:07 AM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 153.85 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 43 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
Peak possibly omitted : 2.250 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 3

Standard :
Na Albite 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
K MAD-10 Feldspar 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Na K | 11.62 | 1.1876 | 7.52 | 0.08 | 6.64 | 10.13 | Na2O | 0.86 |
| Al K | 13.53 | 0.9818 | 10.59 | 0.08 | 7.96 | 20.00 | Al2O3 | 1.03 |
| Si K | 38.11 | 0.9243 | 31.67 | 0.12 | 22.89 | 67.76 | SiO2 | 2.97 |
| K K | 0.67 | 1.0051 | 0.51 | 0.04 | 0.26 | 0.61 | K2O | 0.03 |
| Ca K | 1.33 | 0.9593 | 1.07 | 0.05 | 0.54 | 1.49 | CaO | 0.07 |
| O | | | 48.65 | 0.13 | 61.71 | | | 8.00 |
| Totals | | | 100.00 | | | | | |
| | | | | | | | Cation ... | 4.96 |

INCA

# Mattawa garnets 2007

7/2/2007 2 30 55 PM

Project: Mattawa garnets 2007
Owner: support
Site: Mattawa plagioclase

Sample: Sample 1
Type: Default
ID:

| | |
|---|---|
| Label : | Spectrum 3 |
| Collected : | 2-Jul-2007 02:28 PM |
| Livetime (s) : | 100.00 |
| Real time (s) : | 105.82 |
| Detector : | Silicon |
| Window : | SATW |
| Tilt (deg) : | 0.0 |
| Elevation (deg) : | 35.0 |
| Azimuth (deg) : | 0.0 |
| Magnification : | 80 X |
| Accelerating voltage ( kV ) : | 15.00 |
| Process time : | 5 |

Sample is unpolished X-ray corrections may be approximate.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
The element used for optimization was Copper
Detector efficiency : Calculation

Spectrum processing :
Peak possibly omitted : 6.389 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of ions calculation based on 8.00 anions per formula
Number of iterations = 2

Standard :
Na Albite 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM

| Element | App Conc. | Intensity Corrn. | Weight% | Weight% Sigma | Atomic% | Compd% | Formula | Number of ions |
|---|---|---|---|---|---|---|---|---|
| Na K | 0.62 | 1.1721 | 5.97 | 0.27 | 5.30 | 8.05 | Na2O | 0.68 |
| Al K | 0.92 | 0.9894 | 10.51 | 0.30 | 7.94 | 19.87 | Al2O3 | 1.02 |
| Si K | 2.63 | 0.9306 | 31.80 | 0.44 | 23.08 | 68.02 | SiO2 | 2.97 |
| Ca K | 0.25 | 0.9620 | 2.90 | 0.25 | 1.48 | 4.06 | CaO | 0.19 |
| O | | | 48.81 | 0.49 | 62.20 | | | 8.00 |
| Totals | | | 100.00 | | | | | |
| | | | | | | | Cation ... | 4.86 |

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