

The Ejecta Ray from the Ø 420 km Southern Ocean Crater in West-Australia

- RAMAN Spectra of selected Rock Samples - by Harry K. Hahn, 30.6.2021 -

Summary :

The linear Fraser Range in Western Australia seems to be the result of an ejecta ray that was ejected from the Ø 420 km "Southern Ocean Crater". Different geophysical maps indicate this impact crater on the floor of the Southern Ocean, which I think is a secondary crater of the Permian Triassic Impact Event (→ weblink to my Permian Triassic Impact Hypothesis : → [Part 1 \(P1\)](#), [Part 2 \(P2\)](#), ... of my hypothesis)

The best indication comes from a magnetic anomaly map of the ocean floor which shows a precise semi-circular anomaly (see map below). Further indication comes from a combination of a gravity anomaly map of Australia and a topographic map of Antarctica, where Australia and Antarctica were placed to each other, so as they were placed approx. 200-250 Ma ago. The visible bow-shaped structures indicate an impact crater of up to Ø 420 km.

To provide first evidence for this impact Crater I collected rock samples from the linear Fraser Range, which I believe was caused by a massive ejecta ray from this crater (see maps below). The age of the rock which forms the linear Fraser Range is given with ≈ 1.3 Ga. But this is the age of the crust-material that was ejected by the SOC ! I believe the impact event itself occurred at the PT-boundary ≈ 252 Ma ago
Note : The coastal area between Albany and Esperance should also contain shock-metamorphosed rocks.

With a Raman microscope I analysed rock samples which I collected in the Fraser Range. The Raman spectra of quartz grains from the sample sites **50**, **52** and **55** provide first indication for a shock event, the impact of an ejecta ray from the Southern Ocean Crater, which probably formed the Fraser Range.

The shifts of two main Raman peaks of the analysed quartz grains from **sample site 55** (Stone 1) to the lower frequencies **263** and **205** cm^{-1} and to **261/264** and **205** cm^{-1} , and the shifts of two main Raman peaks in the quartz grains from **sample site 50** (Stone 2) to the lower frequencies **204** and **124** cm^{-1} and to **260/265** and **204 (200,209)** cm^{-1} (double peaks), and similar shifts in samples from **site 52**, which are visible in the Raman Spectra provide a first indication that the quartz from these sample sites was exposed to a **shock pressure in the range of 20 - 22 GPa**. (→ see diagram in Appendix at page **34**).

Even if these frequency shifts are small and didn't affect more than two of the main quartz peaks, at least this is a first indication for an impact shock event. The **microscopic images of some analysed quartz grains from site 50, 52 & 55** may provide further proof for a shock event (see pages **7-9, 14 & 21**)

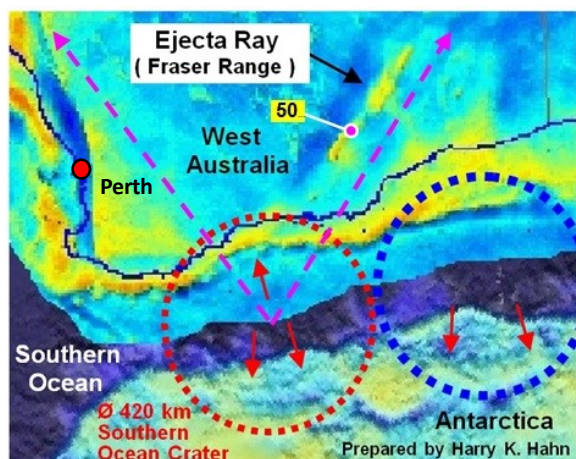
The rock material from sample sites 50 and 55 may provide further evidence for the ejecta ray theory. On **site 55** the rock consists of **glass-like material** that contains **pipe-shaped bubbles filled with air** (gas)
All spectra were made with a **BRUKER Senterra-II Raman Microscope** (wavenumber precision $< 0.1 \text{cm}^{-1}$)

→ Images of the analysed rock samples and photos of the sample sites are in the Appendix at **page 31**

→ More images of all sample sites are available on www.permiantriassic.de or www.permiantriassic.at

→ **General Summary** of my Analysis : see [Part 6 \(P6\)](#) of my [PTI-hypothesis \(P1\)](#) / References : **page 35**

Note : A shock pressure of 20 GPa exceeds every pressure caused by normal terrestrial metamorphism. This indicates that the linear Fraser Range may be indeed the result of a strong **ejecta ray of the Southern Ocean Crater** as indicated on the gravity- and magnetic anomaly maps (→ see images below)



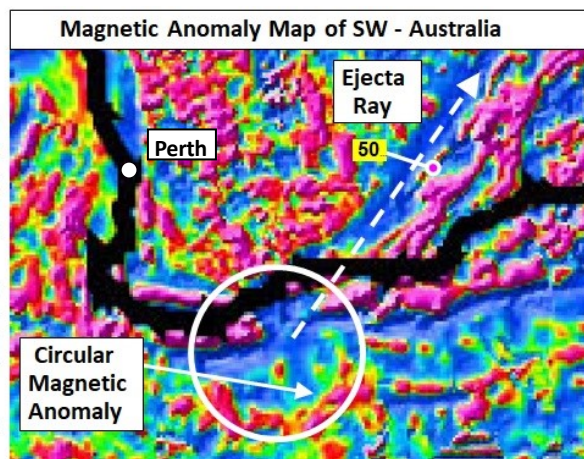
→ Gravity Anomaly Map

Explanation to this map :

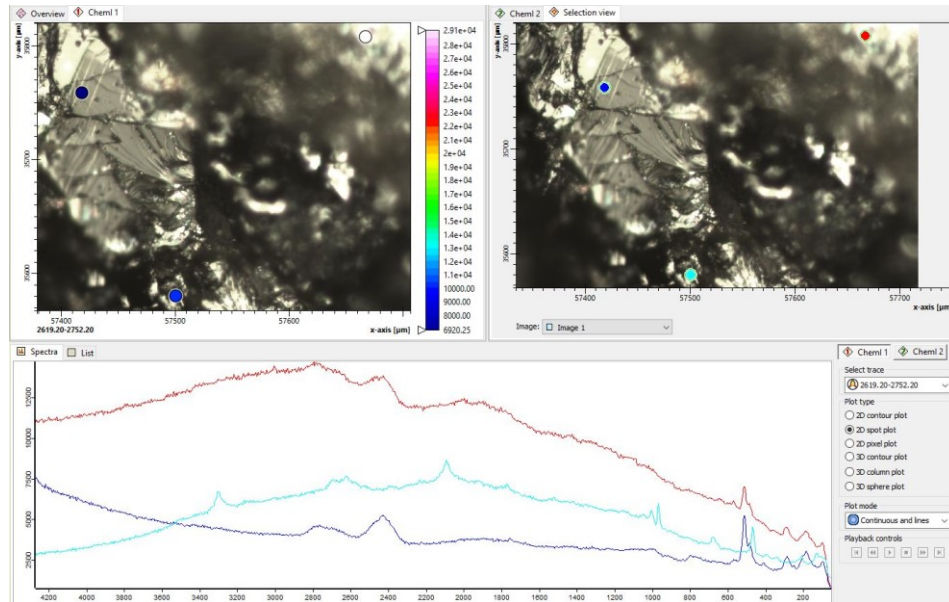
A map combination of a gravity anomaly map of Australia and a topographic map of Antarctica, arranged as if they were ~ 200 Ma ago indicate a $\approx \text{Ø } 420$ km Impact Crater.

Note the ring structures, the strong ejecta ray and the triangular shaped gravity anomaly which has its apex in the center of the red marked impact crater.

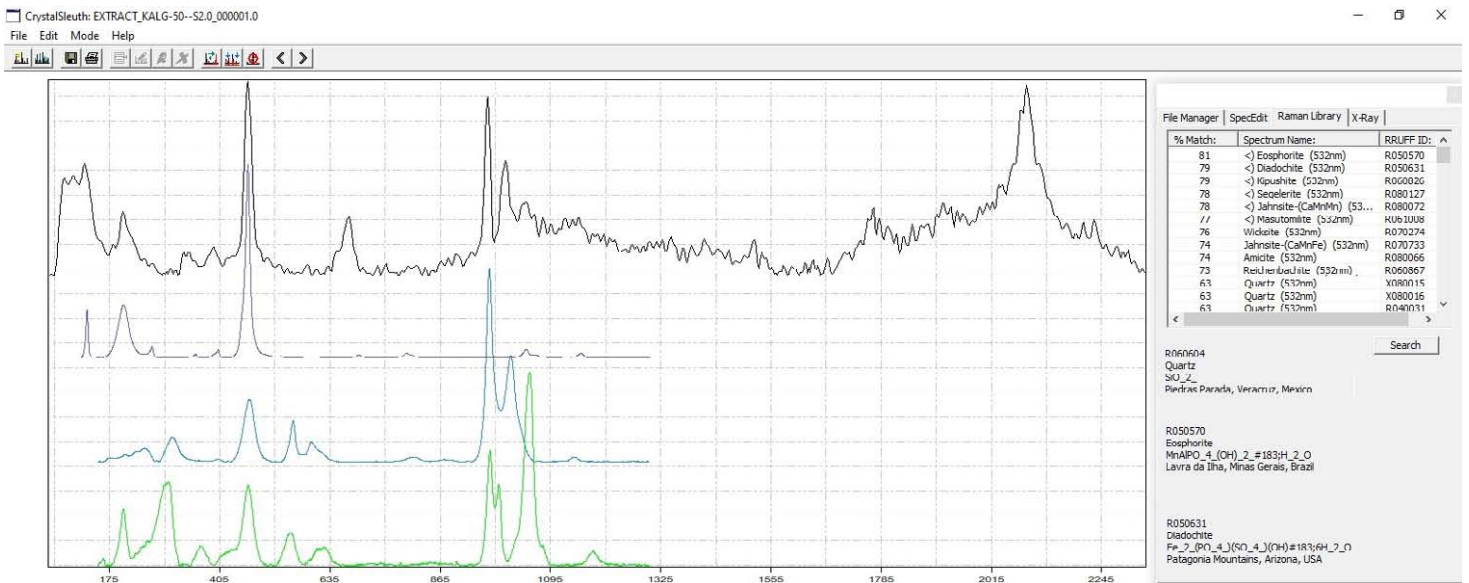
And there may be another impact crater (blue marked).



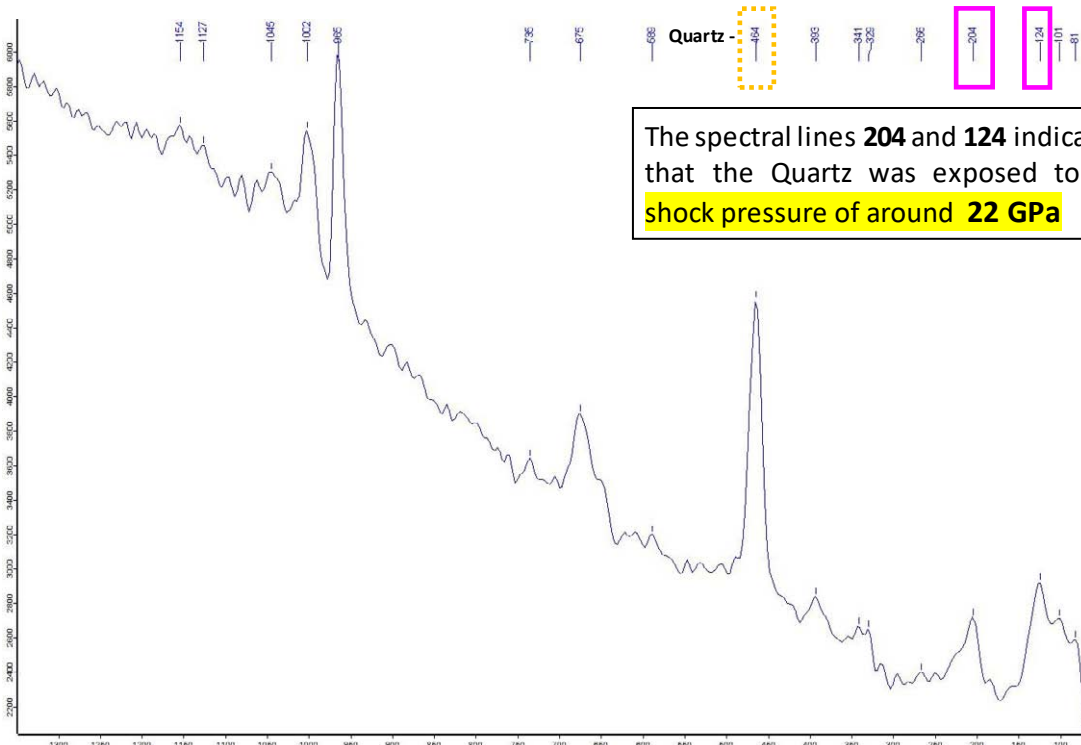
Sample Site 50 : Stone 2_spectra 1 indicates: **Quartz & Eosphorite, Diadochite** (→ see RRUFF_CS results)



Sample :

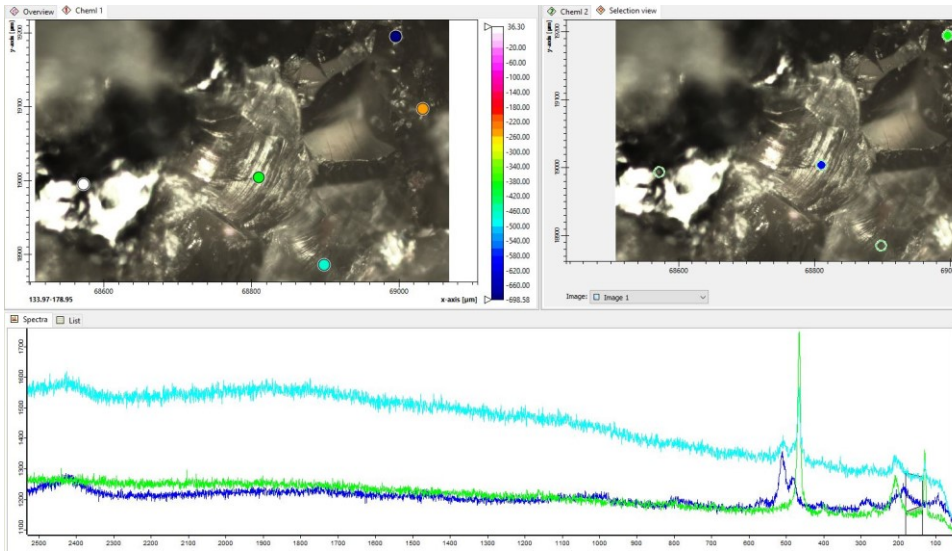


Indication for a shock event are the shifts of the marked Quartz spectral lines towards 204 and 124



The spectral lines 204 and 124 indicate that the Quartz was exposed to a shock pressure of around **22 GPa**

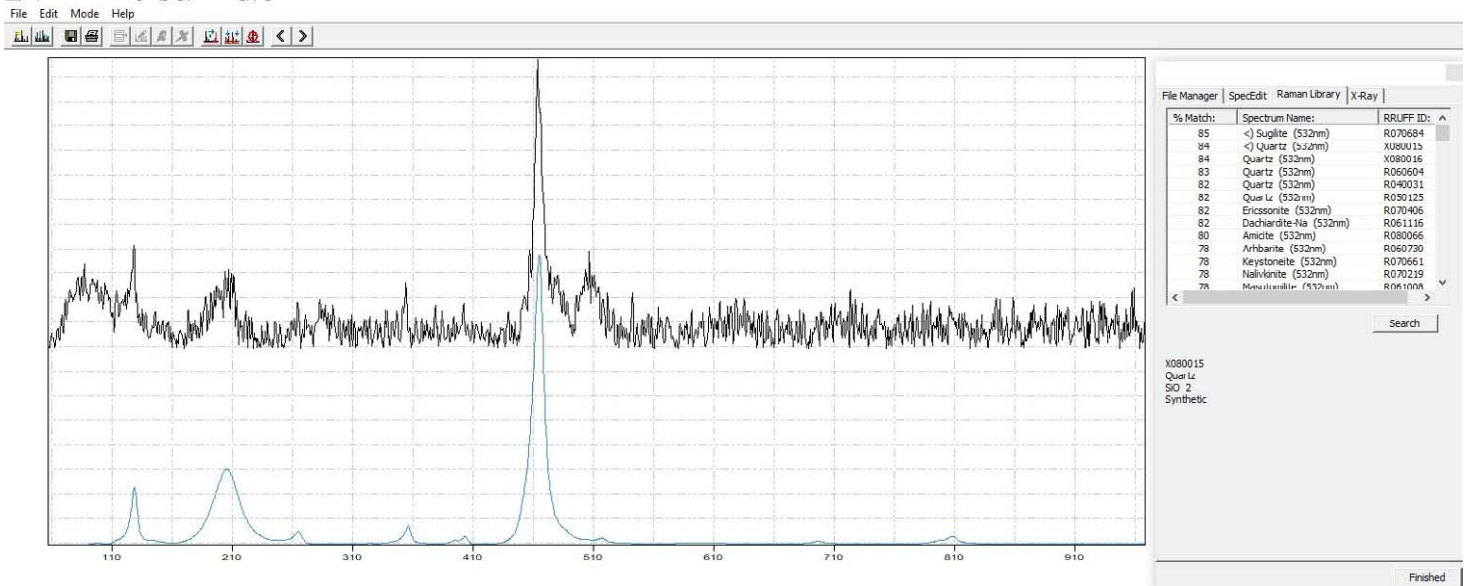
Sample Site 50 : Stone 2_spectra 2 indicates: **Quartz** (→ see RRUFF_CS results)



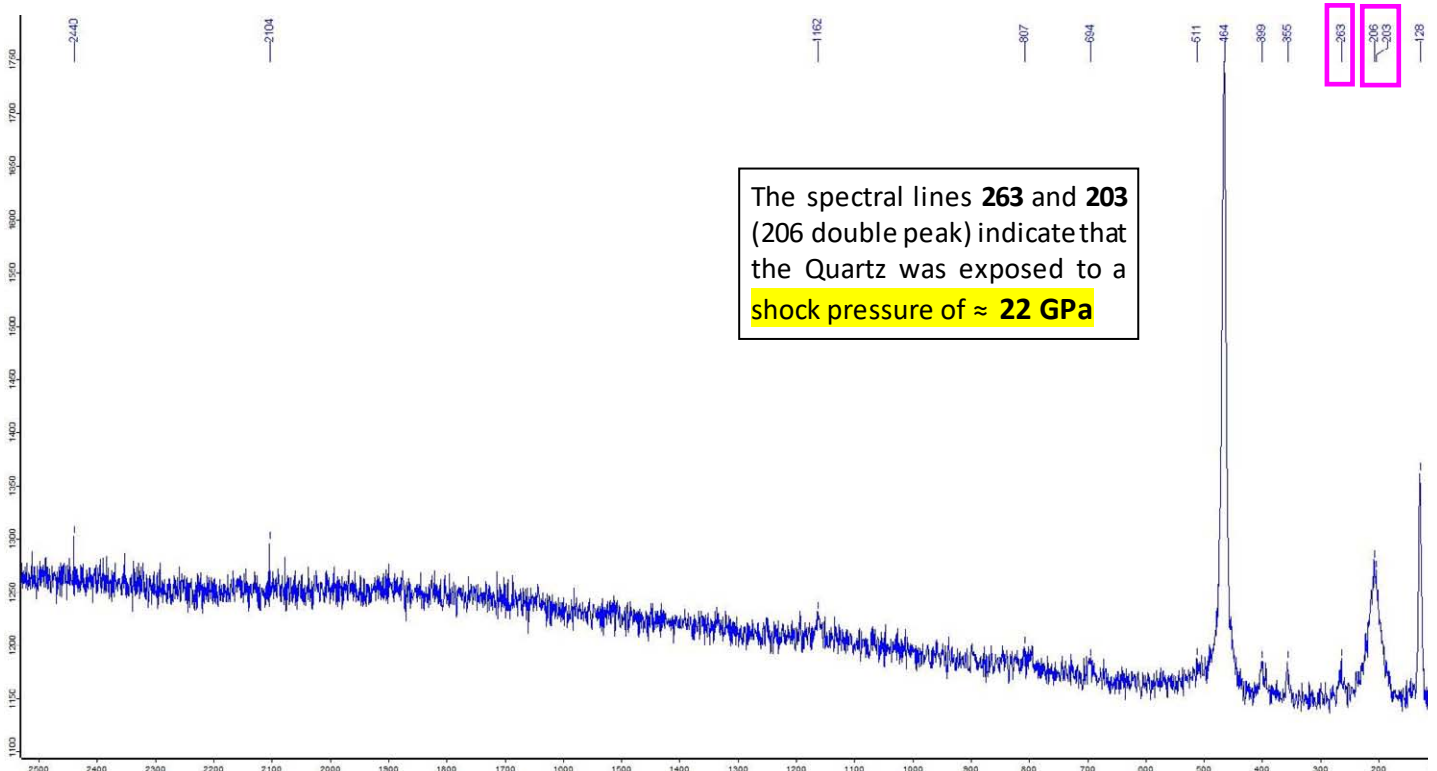
Sample :



CrystalSleuth: EXTRACT_Kalq_50_spitzer Stein_(2)_1_000003.0

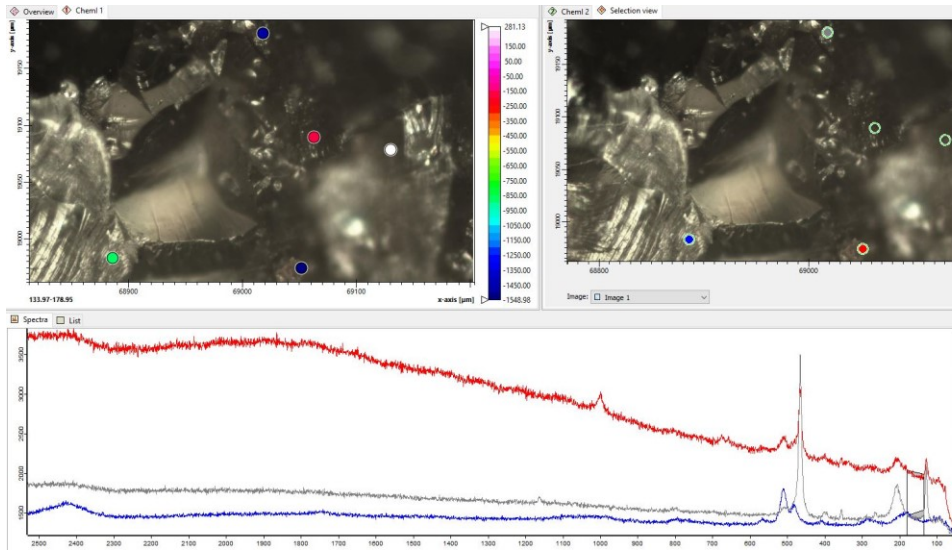


Indication for a shock event are the shifts of the marked Quartz spectral lines towards 263 and 203 (206)

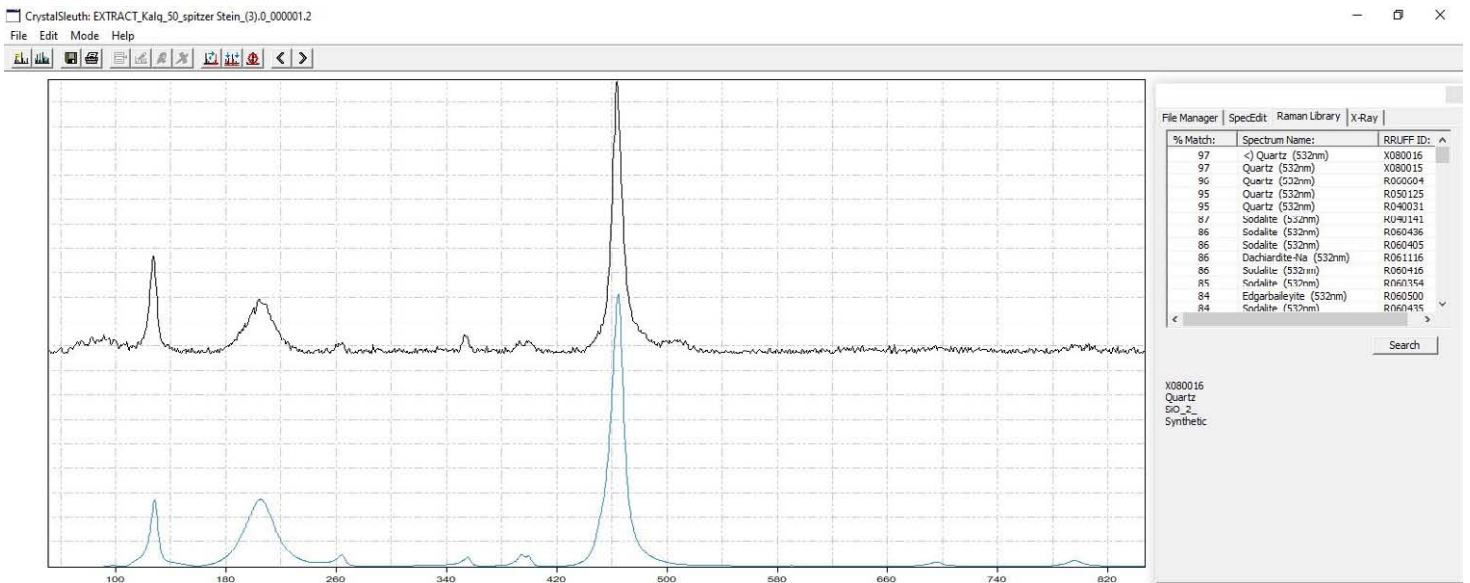


The spectral lines **263** and **203** (206 double peak) indicate that the Quartz was exposed to a shock pressure of **≈ 22 GPa**

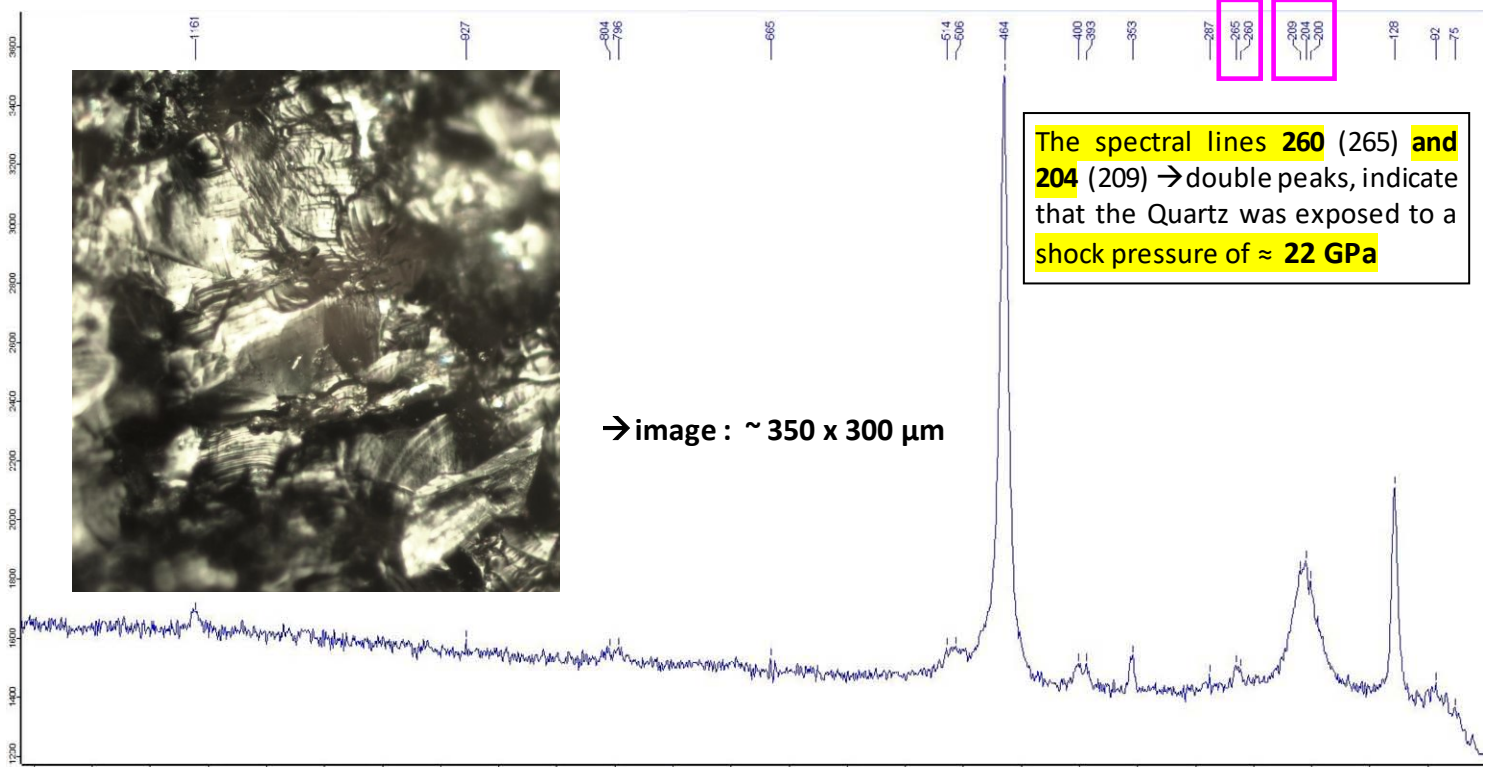
Sample Site 50 : Stone 2_spectra 3 indicates: **Quartz** (→ see RRUFF_CS results)



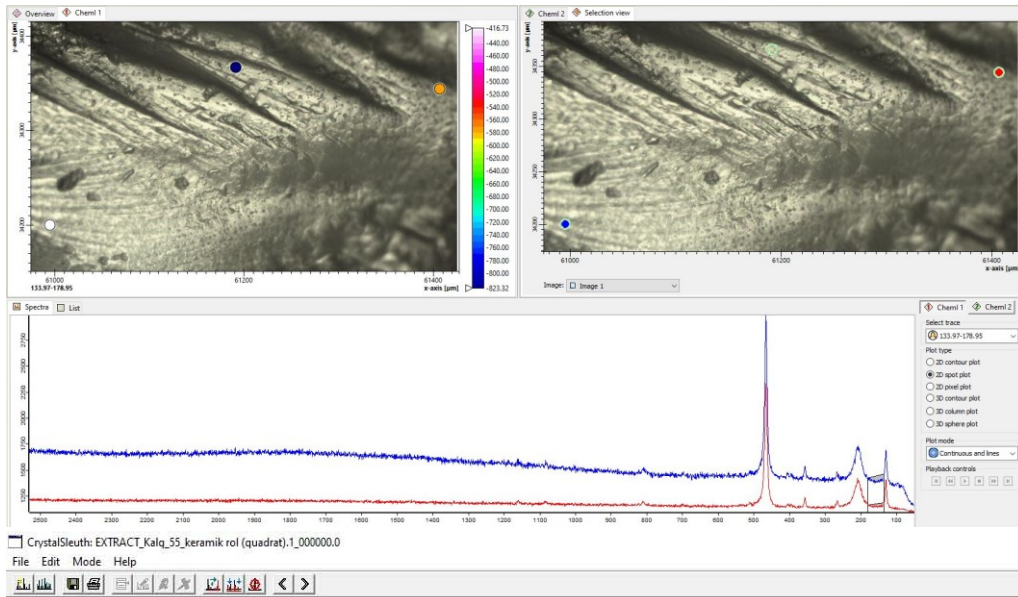
Sample :



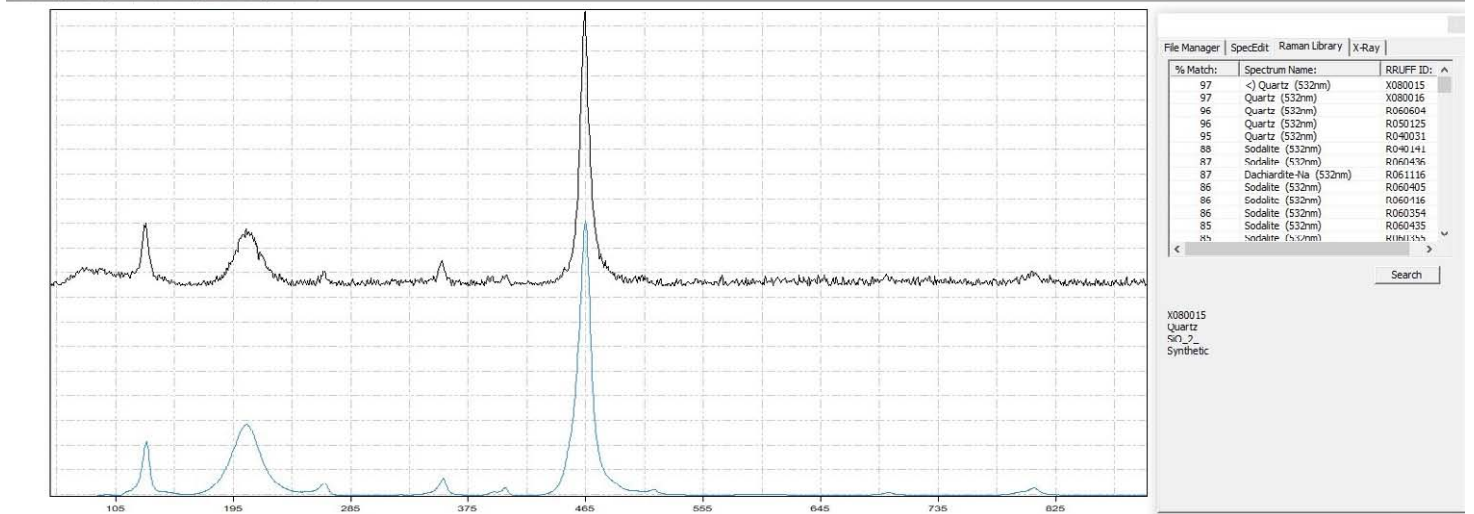
Indication for a shock event are the shifts of the marked Quartz spectral lines towards 260 (265) and 204 (209)



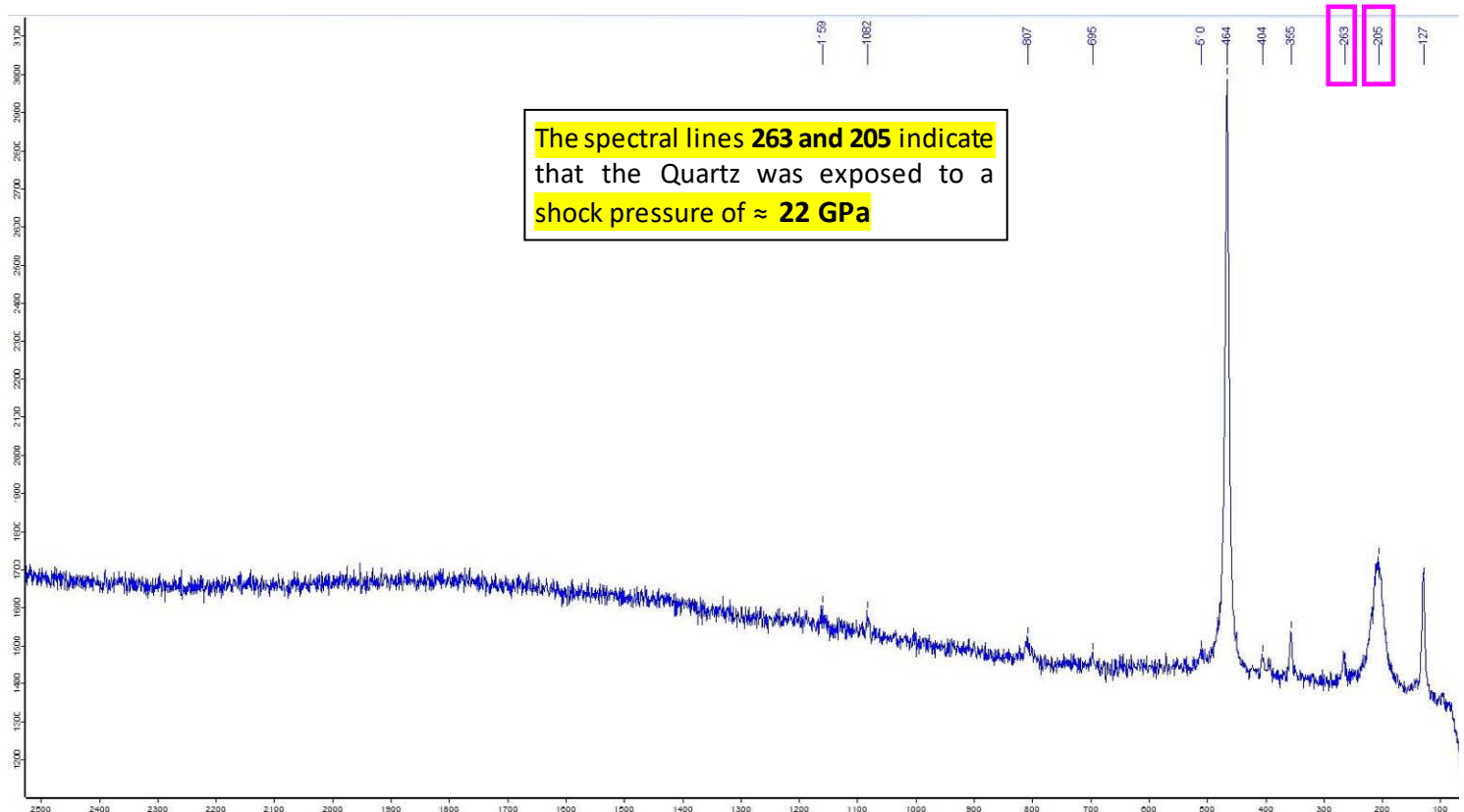
Sample Site 55 : Stone 1_spectra 1 (white mineral) indicates : **Quartz** (→ see RRUFF_CS results)



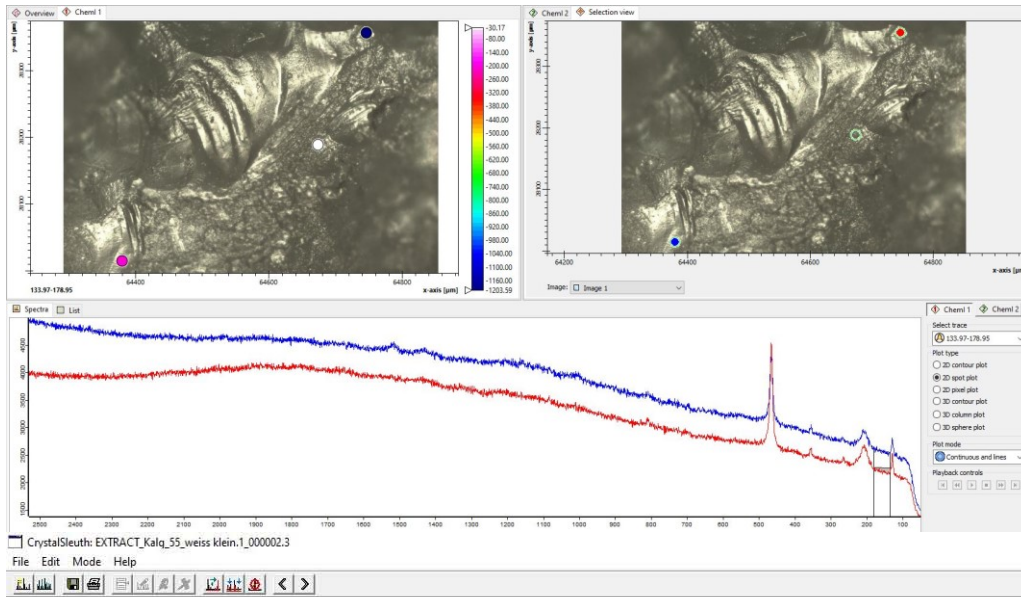
Sample :



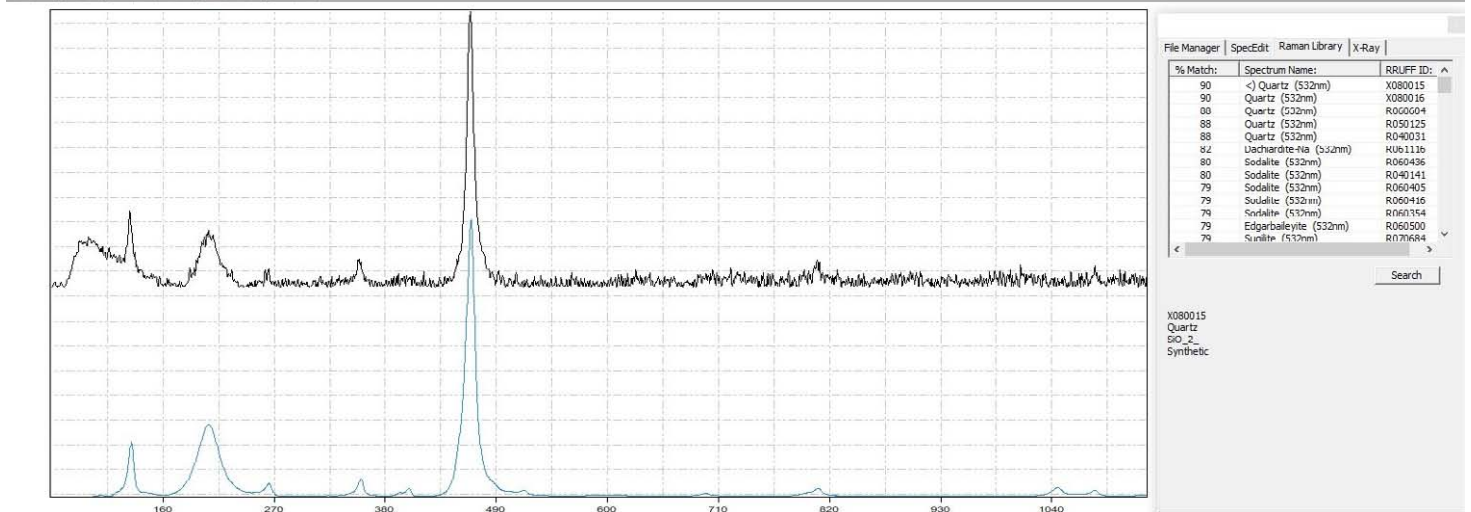
Indication for a shock event are the shifts of the marked Quartz spectral lines towards 263 and 205



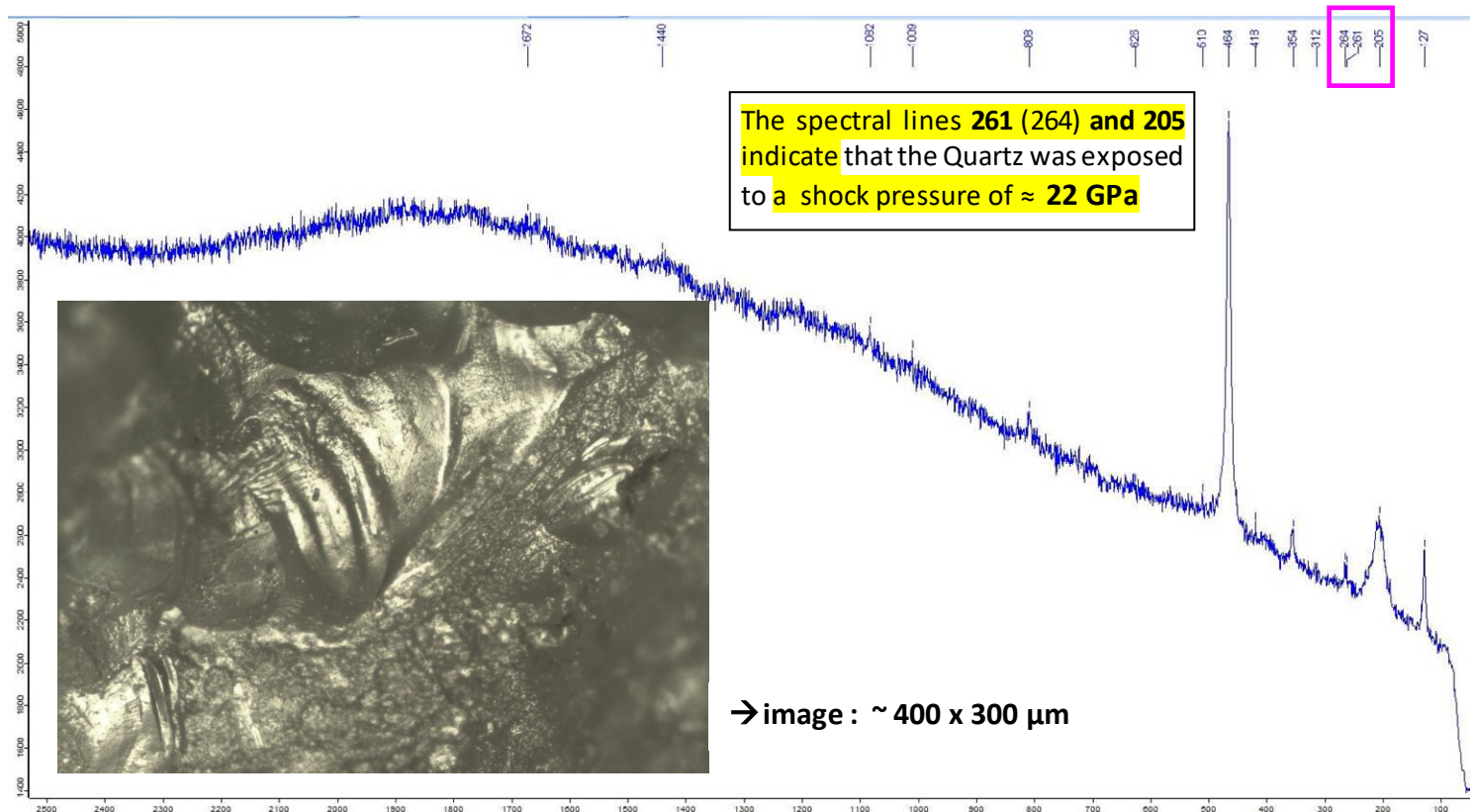
Sample Site 55 : Stone 2_spectra 1 (white mineral) indicates : **Quartz** (→ see RRUFF_CS results)



Sample :

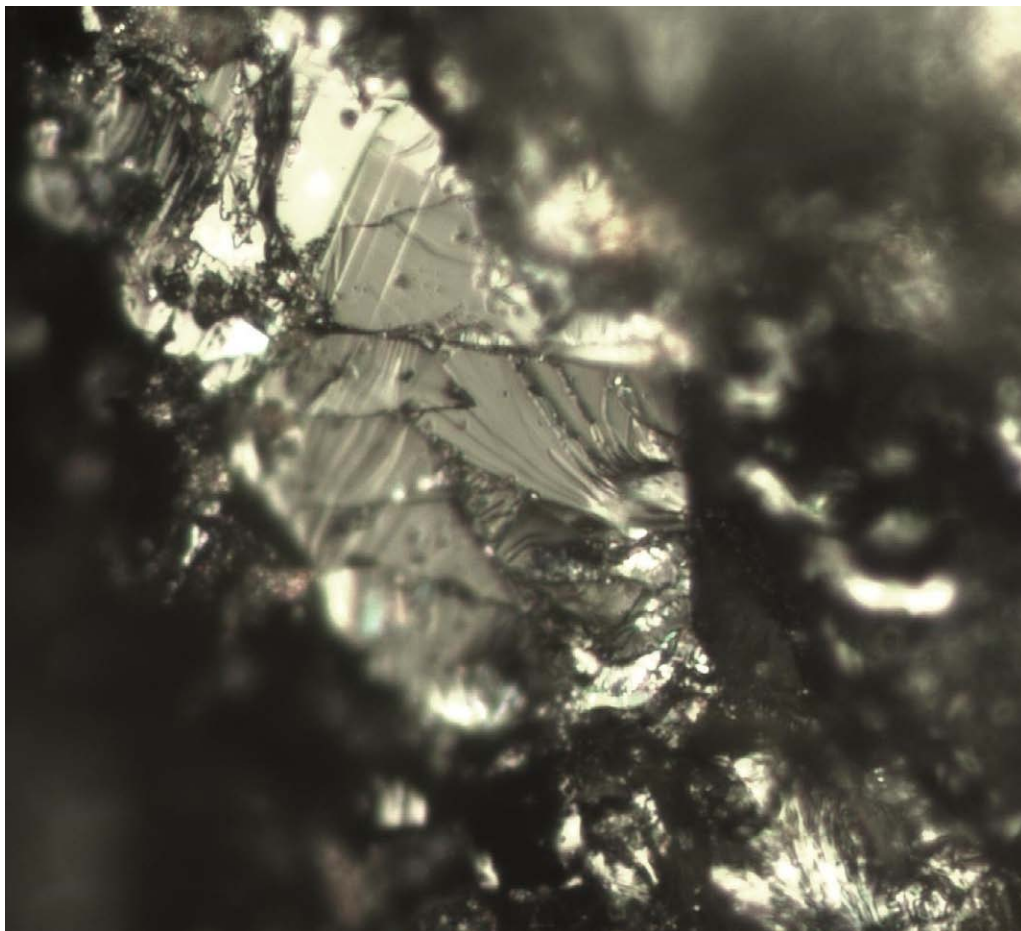


Indication for a shock event are the shifts of the marked Quartz spectral lines towards 261 (264) and 205

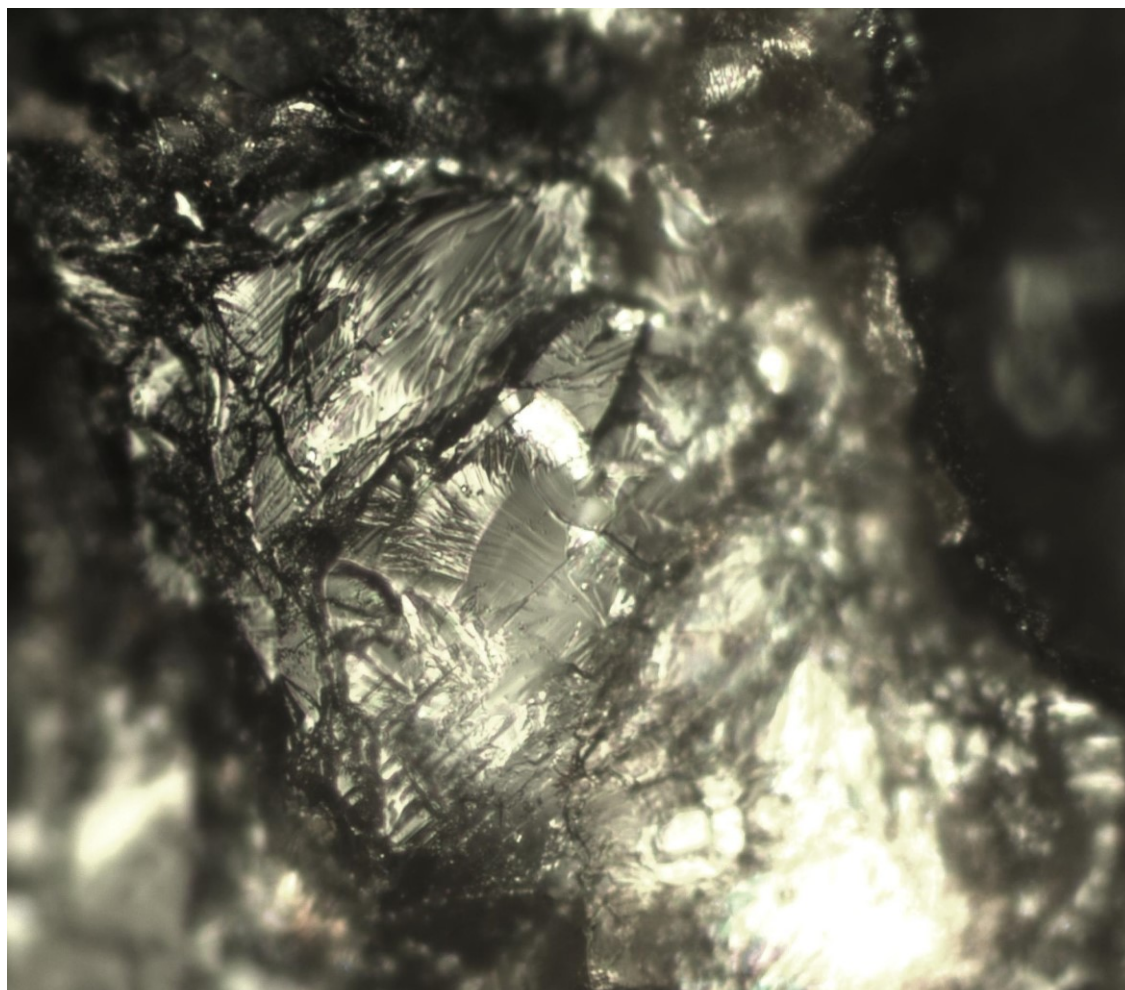


Microscopic Images : Samples from Site 50 → original state (no preparation)

Sample Site 50: Stone 2_spectra 1 : Quartz & Eosphorite, Diadochite - Image size : ~ 250 x 250 μm

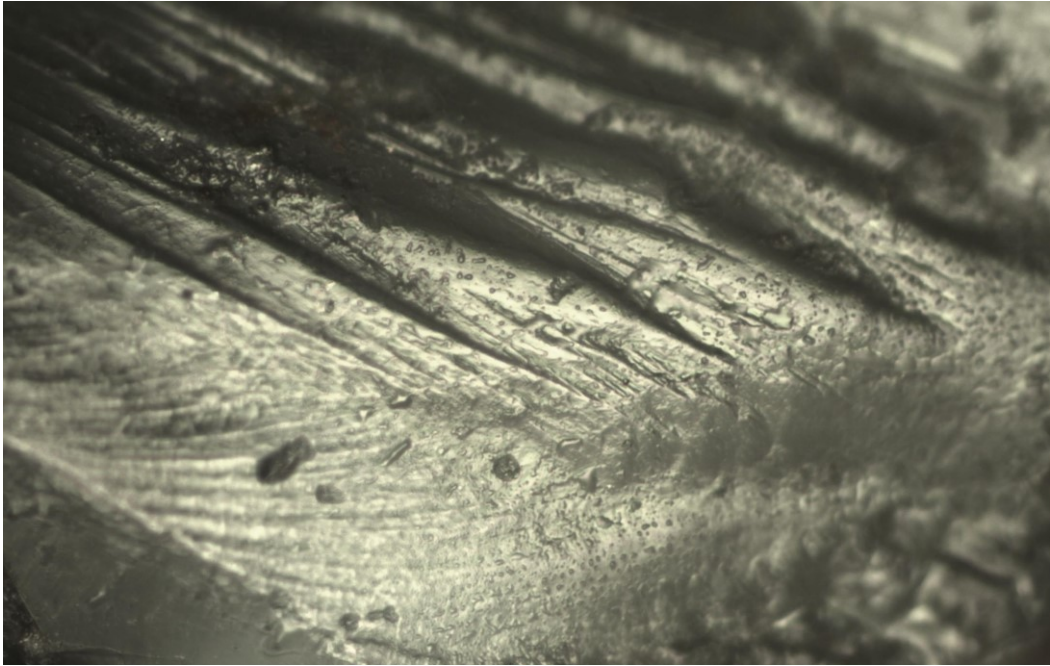


Sample Site 50 : Stone 2_spectra 2 indicates : Augite, Diopside, Johannsenite - image : ~ 400 x 300 μm

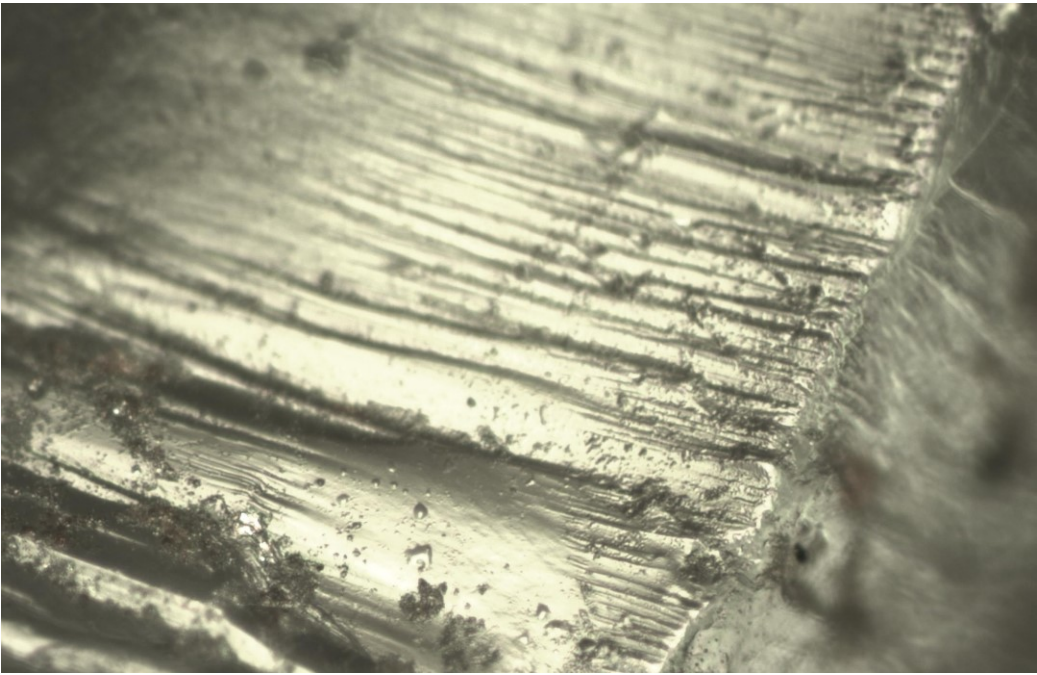


Microscopic Images : Samples from Site 55 → original state (no preparation)

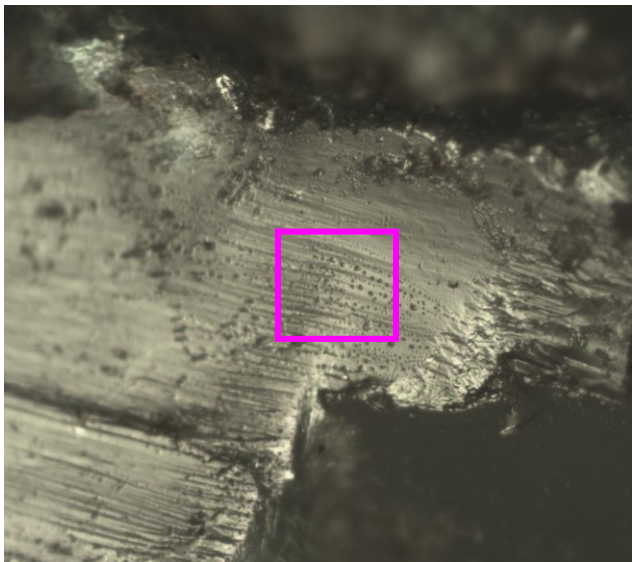
Sample Site 55 : Stone 1_spectra 1 indicates : Quartz - Image size : ~ 500 x 350 μm



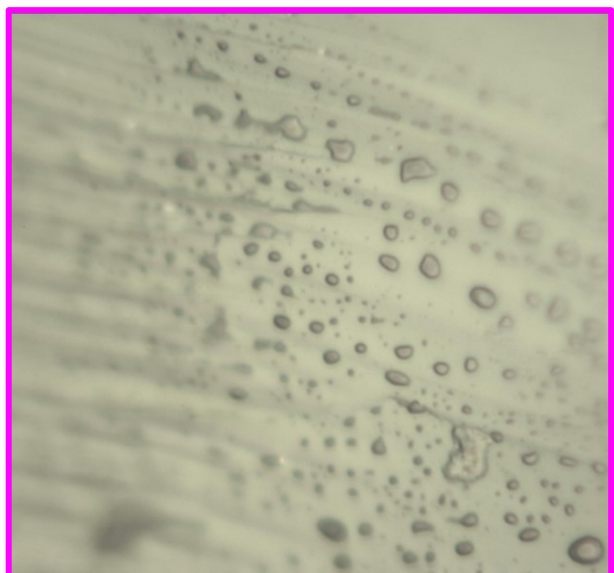
Sample Site 55 : Stone 1_spectra 1 indicates : Quartz : ~ 400 x 300 μm



Site 55 : Stone 1 : Quartz - Image: 400 x 350 μm

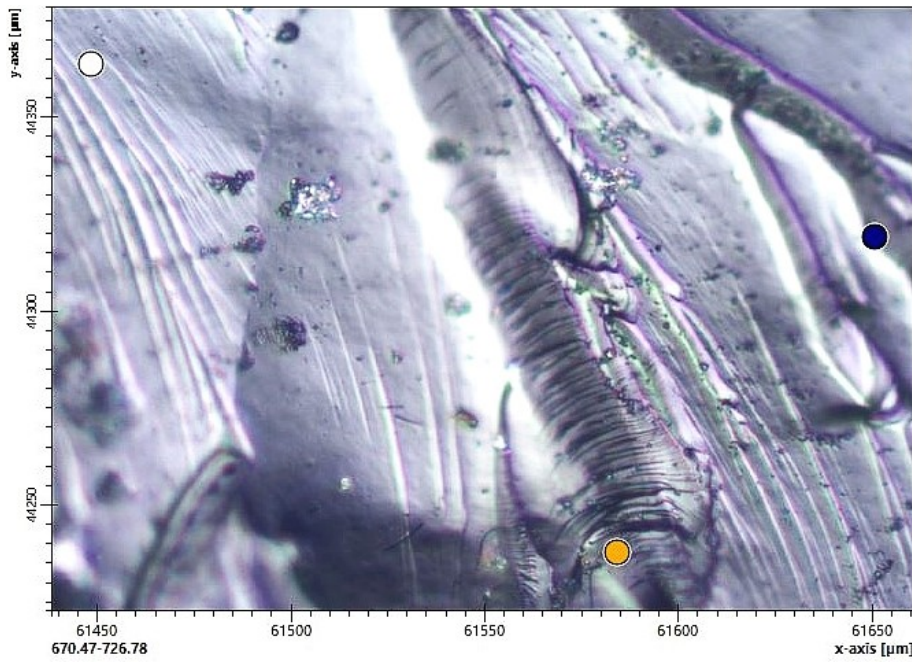


Site 55 : Stone 1 : Quartz - Image Detail : ≈ 90 x 70 μm

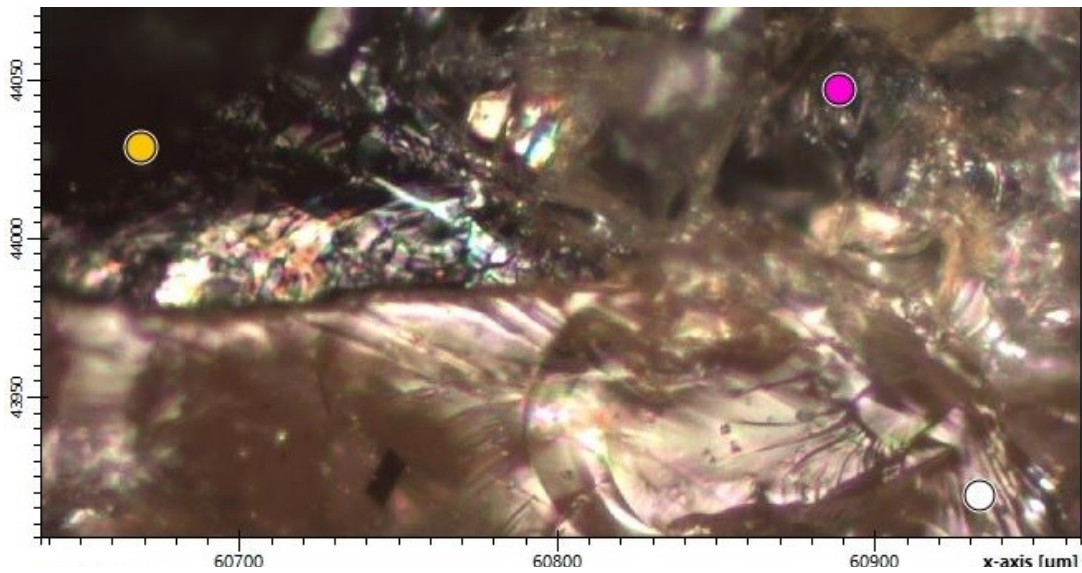


Microscopic Images : Samples from Site 52 → original state (no preparation)

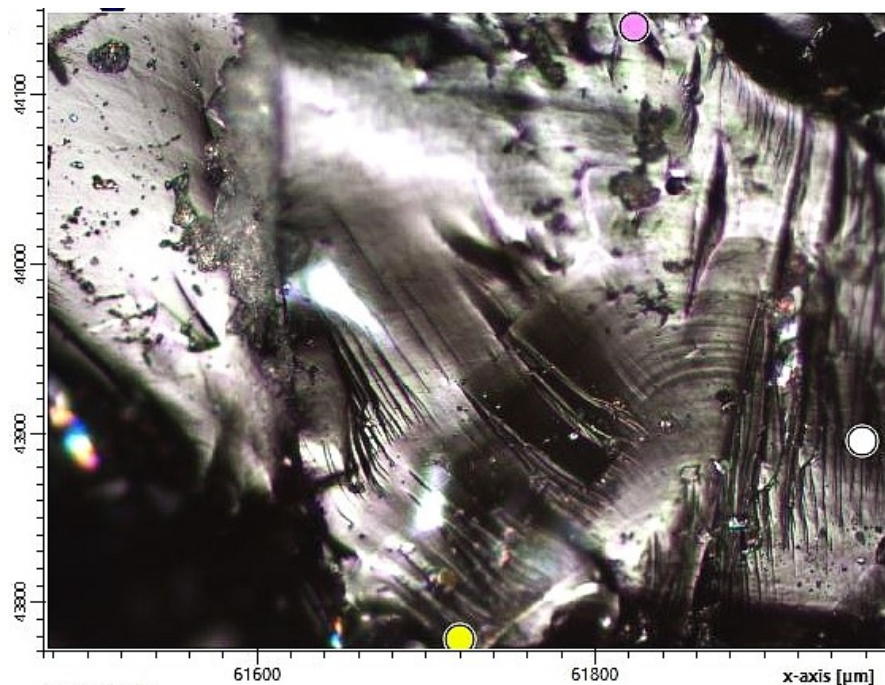
Sample Site 52 : Stone 2_spectra 2 indicates : Quartz - Image size : ~ 250 x 150 μm



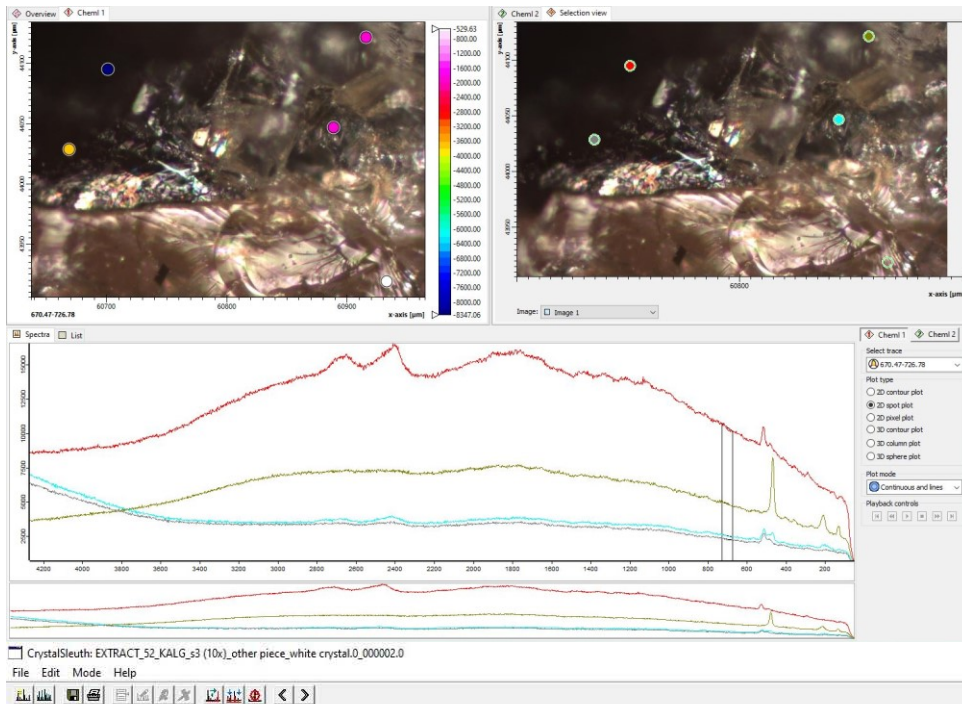
Sample Site 52 : Stone 3-B_spectra 3: Quartz (& Labradorite, Anorthoclase) - Image size : 250 x 150 μm



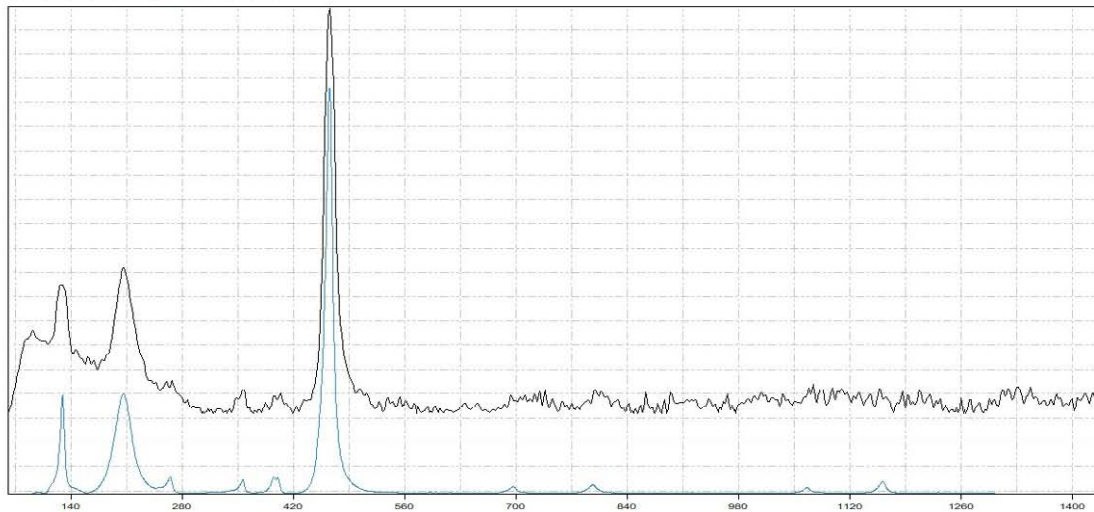
Sample Site 52 : Stone 2_spectra 3 indicates : Quartz : ~ 400 x 300 μm



Sample Site 52 : Stone 3-B_spectra 3 (white mineral) indicates : Quartz (→ RRUFF_CS)



Sample :

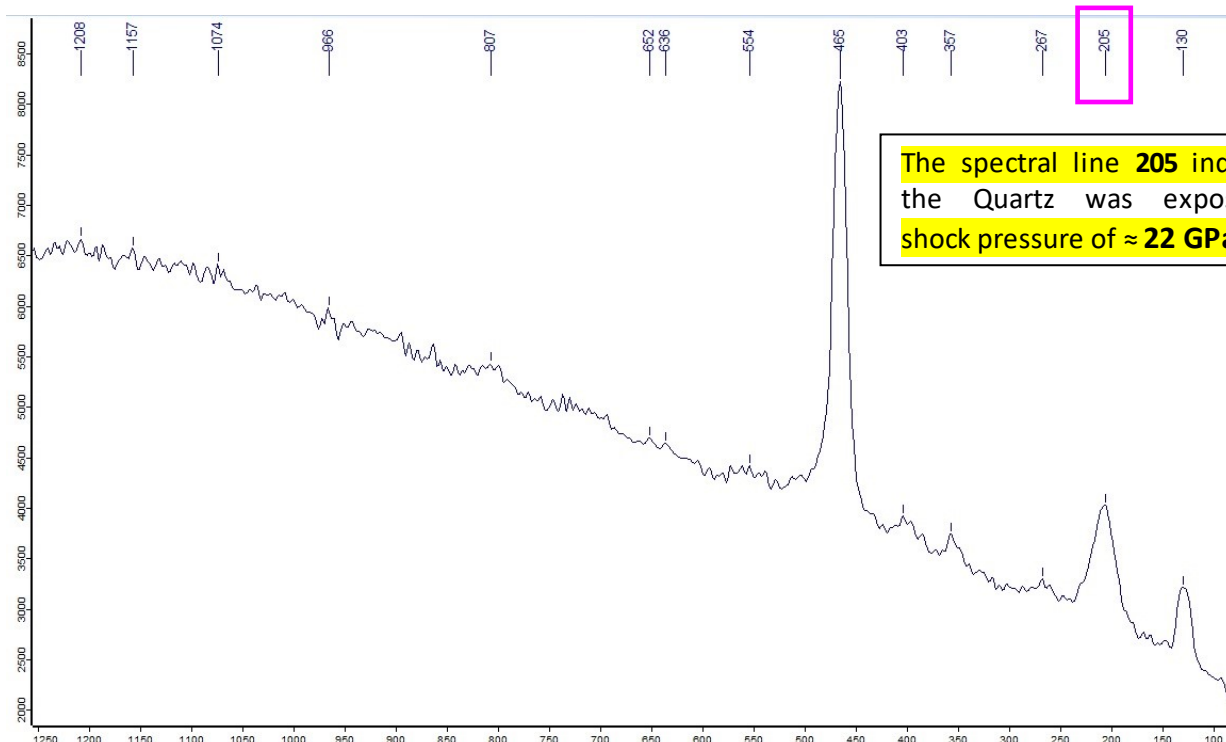


% Match:	Spectrum Name:	RRUFF ID:
88	-) Quartz (532nm)	X080016
88	Quartz (532nm)	X080015
80	Quartz (532nm)	R000004
87	Quartz (532nm)	R050125
87	Quartz (532nm)	R040031
84	Amoite (532nm)	K080066
83	Dachardite-Na (532nm)	R061116
79	Edgarbaleyite (532nm)	R060500
78	Sugilite (532nm)	R070664
77	Villeneuveite (532nm)	R060514
75	SrWilite (532nm)	R060405
75	Sodalite (532nm)	R060436
75	SrWilite (532nm)	R061504

Search

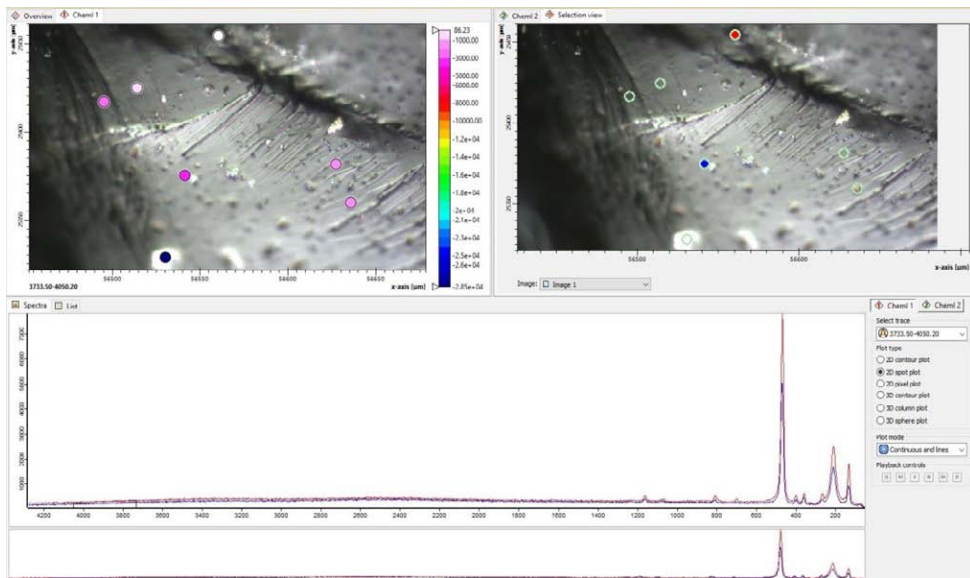
X080016
Quartz
SiO₂
Synthetic

Indication for a shock event is the shift of the marked Quartz spectral line towards 205



The spectral line 205 indicates that the Quartz was exposed to a shock pressure of ≈ 22 GPa

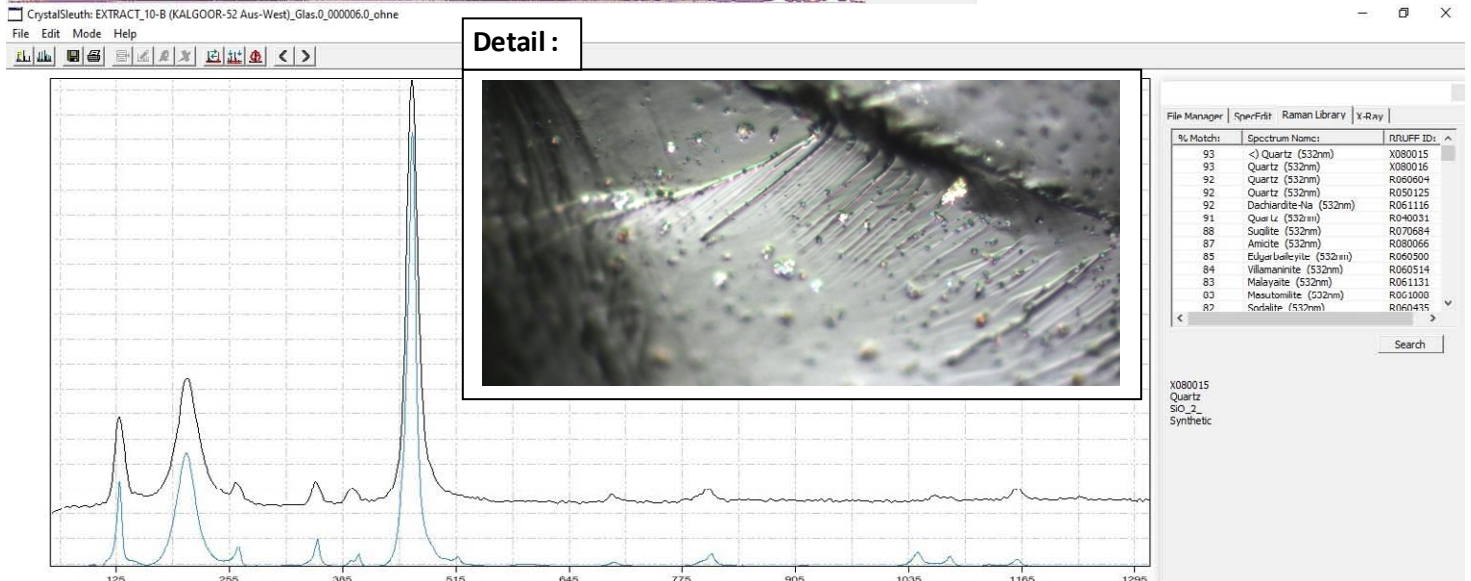
Sample Site 52 : Stone 2_spectra 1 indicates: Quartz (→ see RRUFF_CS results)



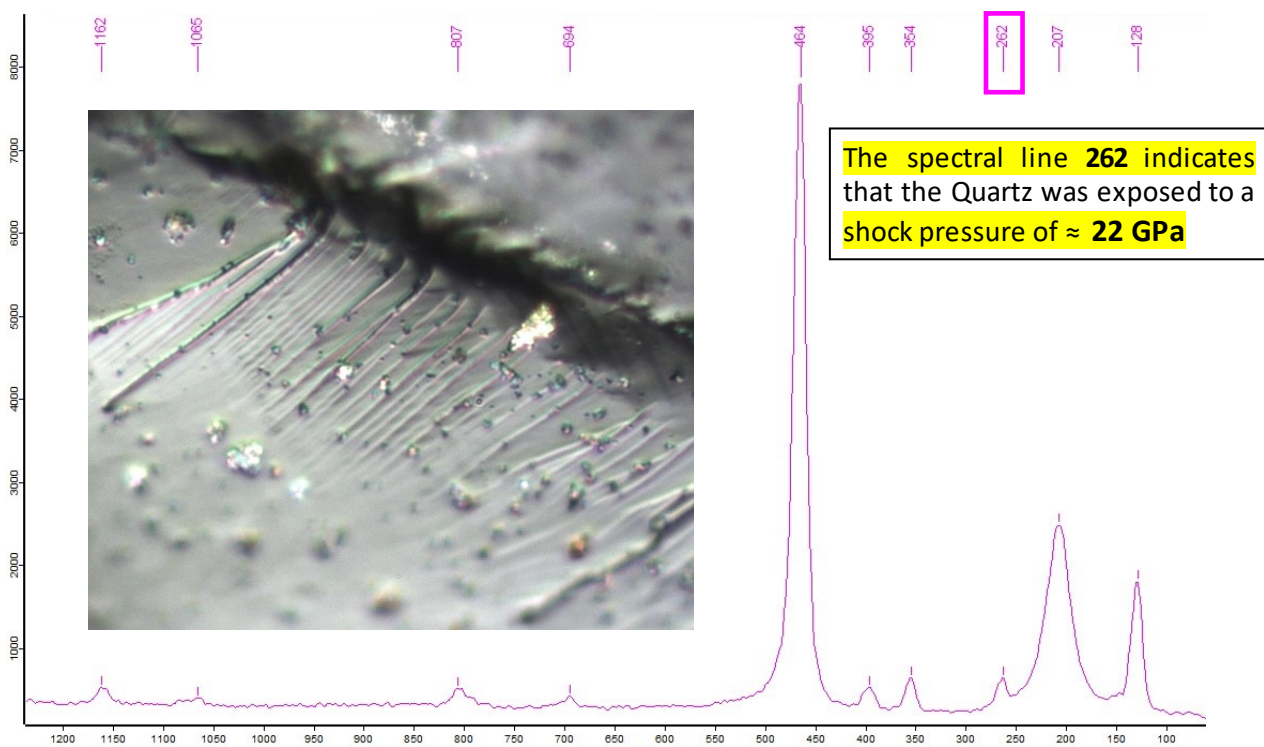
Sample :



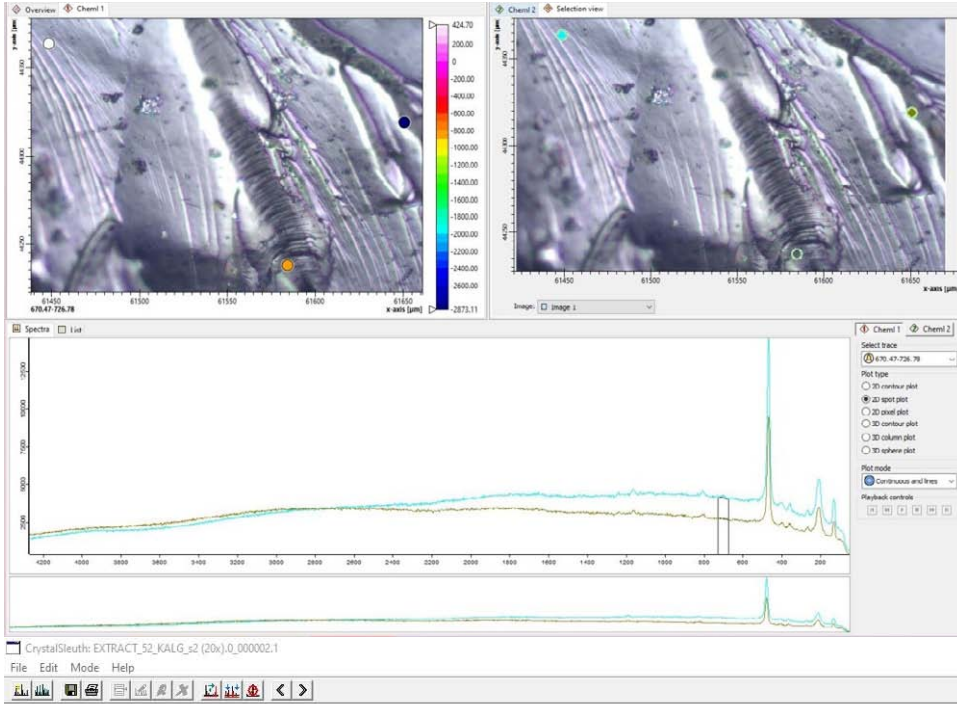
Detail :



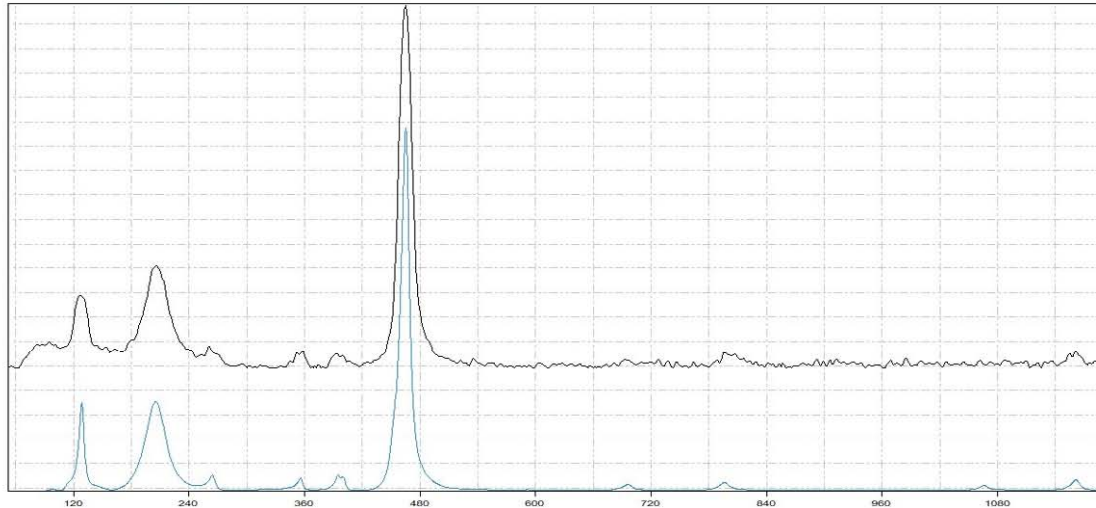
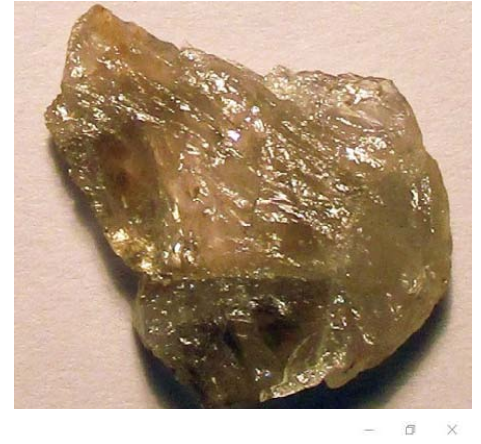
Indication for a shock event is the shift of the marked Quartz spectral line towards 262



Sample-Site 52 : Stone 2_spectra 2 indicates : Quartz (→ see RRUFF_CS results)



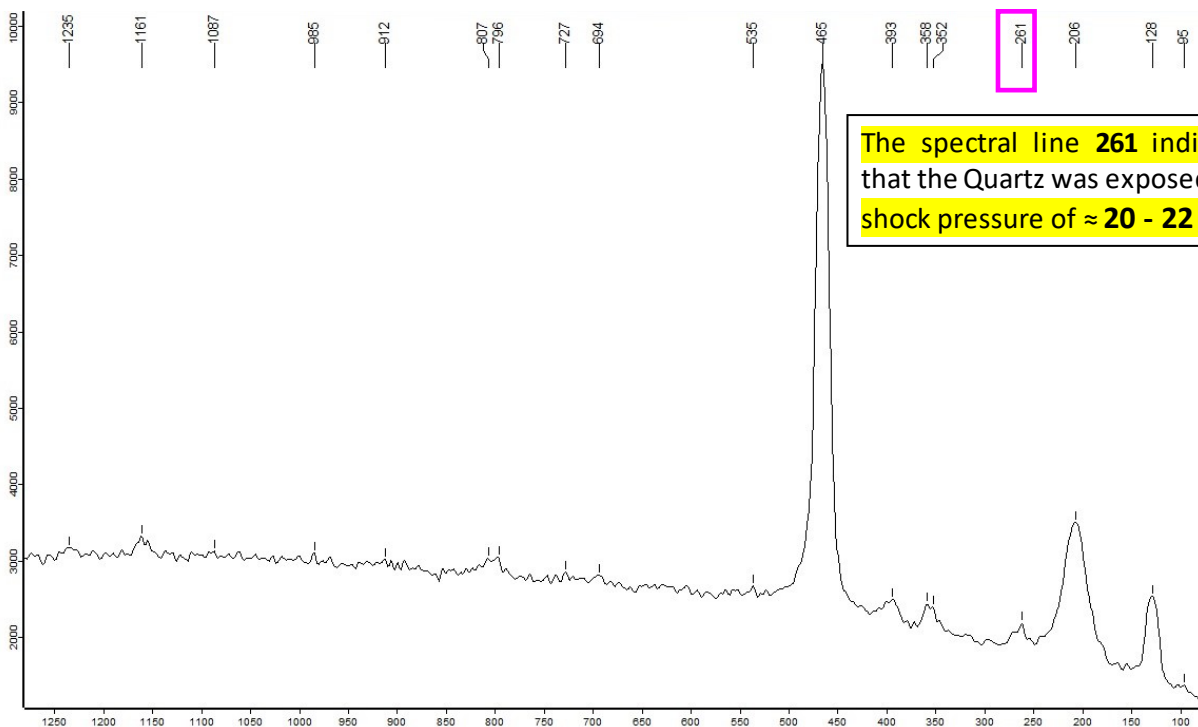
Sample :



% Match:	Spectrum Name:	RRUFF ID:
97	Quartz (532nm)	X080016
97	Quartz (532nm)	X080015
96	Quartz (532nm)	R000004
96	Quartz (532nm)	R050125
95	Quartz (532nm)	R040031
89	Daohardite-11a (532nm)	KU6111b
87	Amicite (532nm)	R080066
85	Edgarbaleyite (532nm)	R060500
85	Villamaninite (532nm)	R060514
84	Sodalite (532nm)	R060436
84	Sodalite (532nm)	R060354
84	Sodalite (532nm)	R040141
84	Sodalite (532nm)	R061415

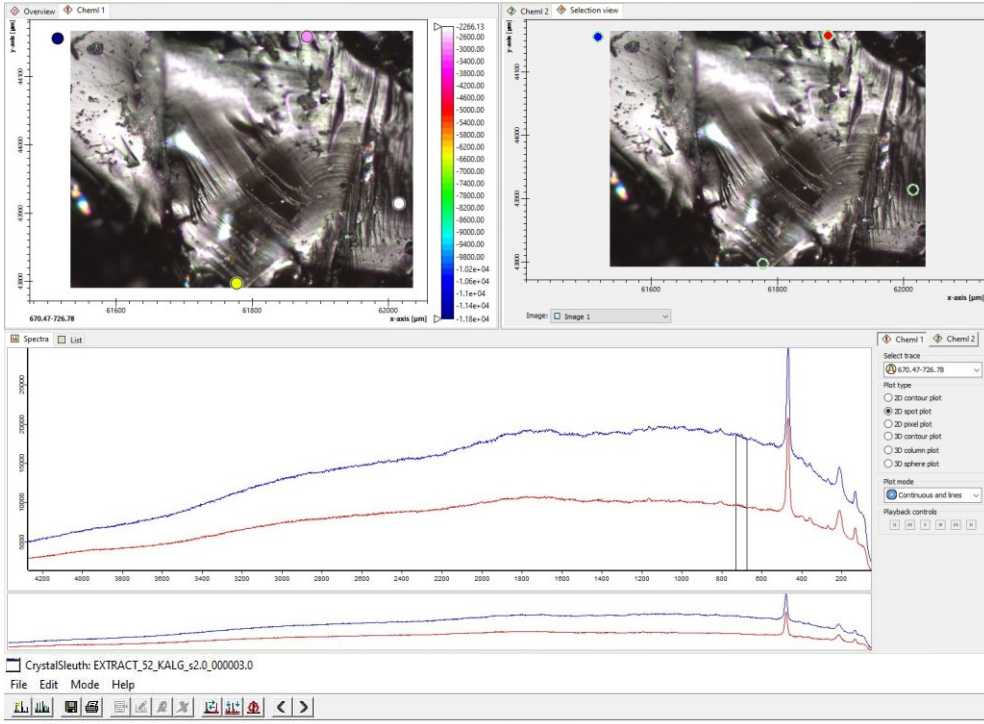
X080016
Quartz
510_2
Synthetic

Indication for a shock event is the shift of the marked Quartz spectral line towards 261

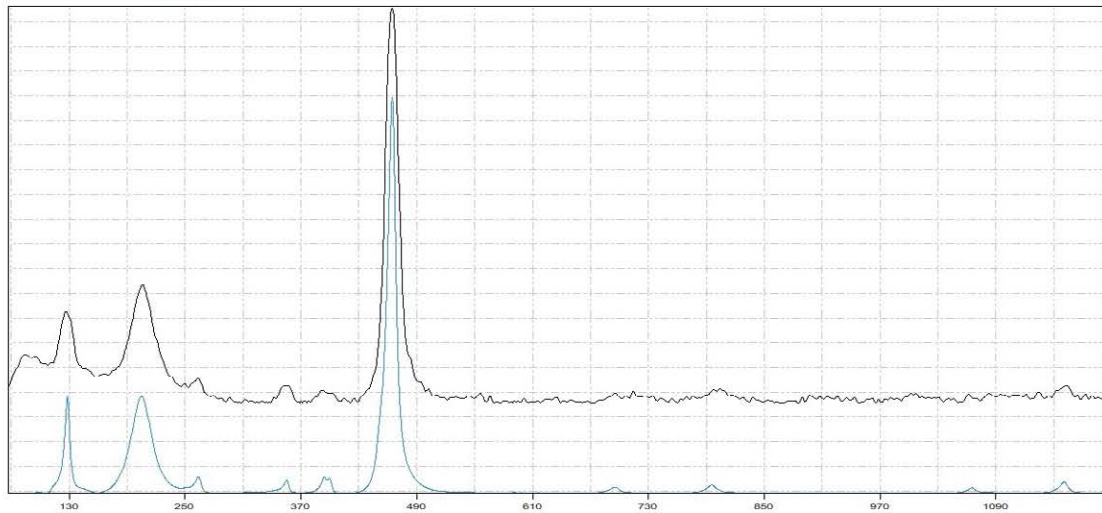


The spectral line 261 indicates that the Quartz was exposed to a shock pressure of ≈ 20 - 22 GPa

Sample-Site 52 : Stone 2_spectra 3 indicates : Quartz (→ see RRUFF_CS results)



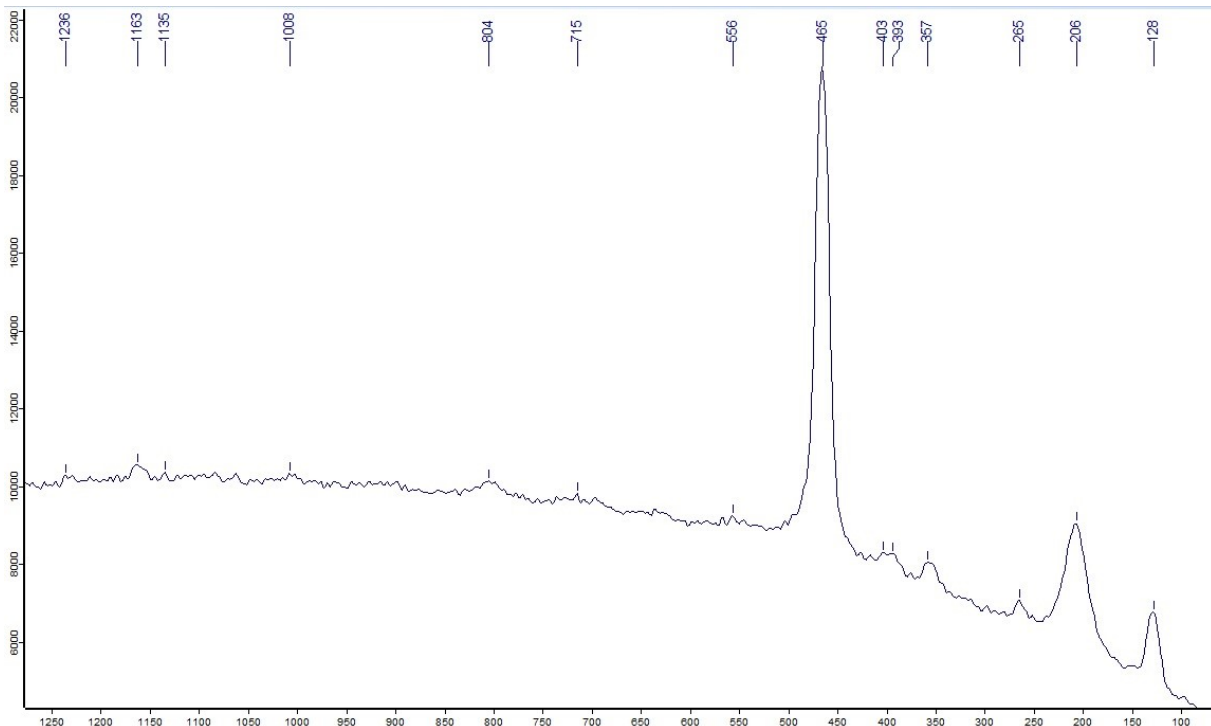
Sample :



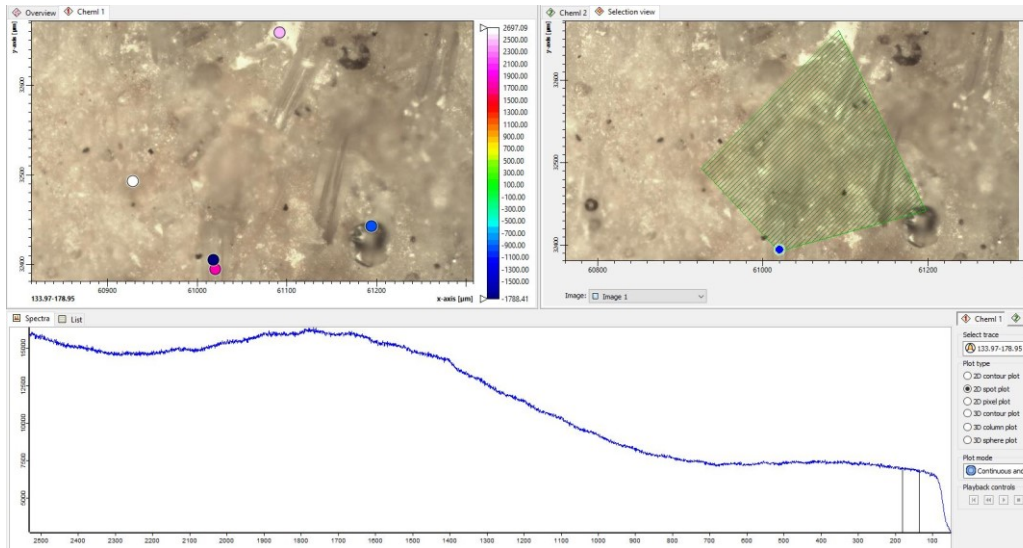
% Match	Spectrum Name	RRUFF ID
95	< Quartz (532nm)	X080016
95	Quartz (532nm)	X080015
94	Quartz (532nm)	R060604
94	Quartz (532nm)	R050125
93	Quartz (532nm)	R040031
88	Daikaniite-Na (532nm)	R061116
87	Amicite (532nm)	R080066
84	Edgarbaileite (532nm)	R060500
83	Villarsite (532nm)	R060514
82	Sodalite (532nm)	R060436
82	Sodalite (532nm)	R060354
02	Sodalite (532nm)	R060435
02	Sodalite (532nm)	R060405

Search

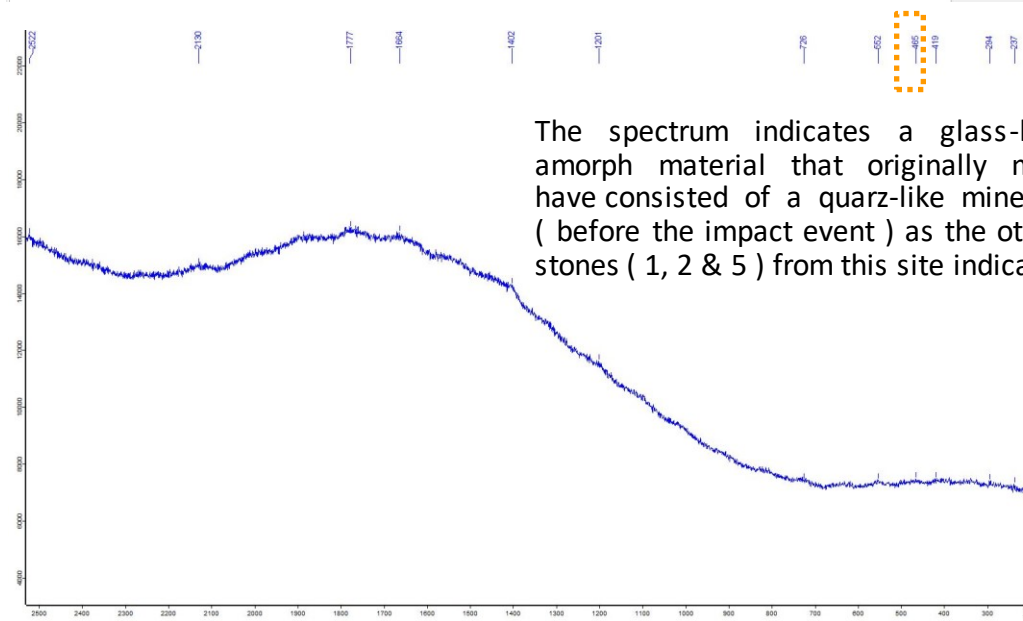
X080016
Quartz
SiO₂
Synthetic



Sample Site 55 : Stone 3_spectra 1 indicates: **no result !** (→ see RRUFF_CS results)



Sample :

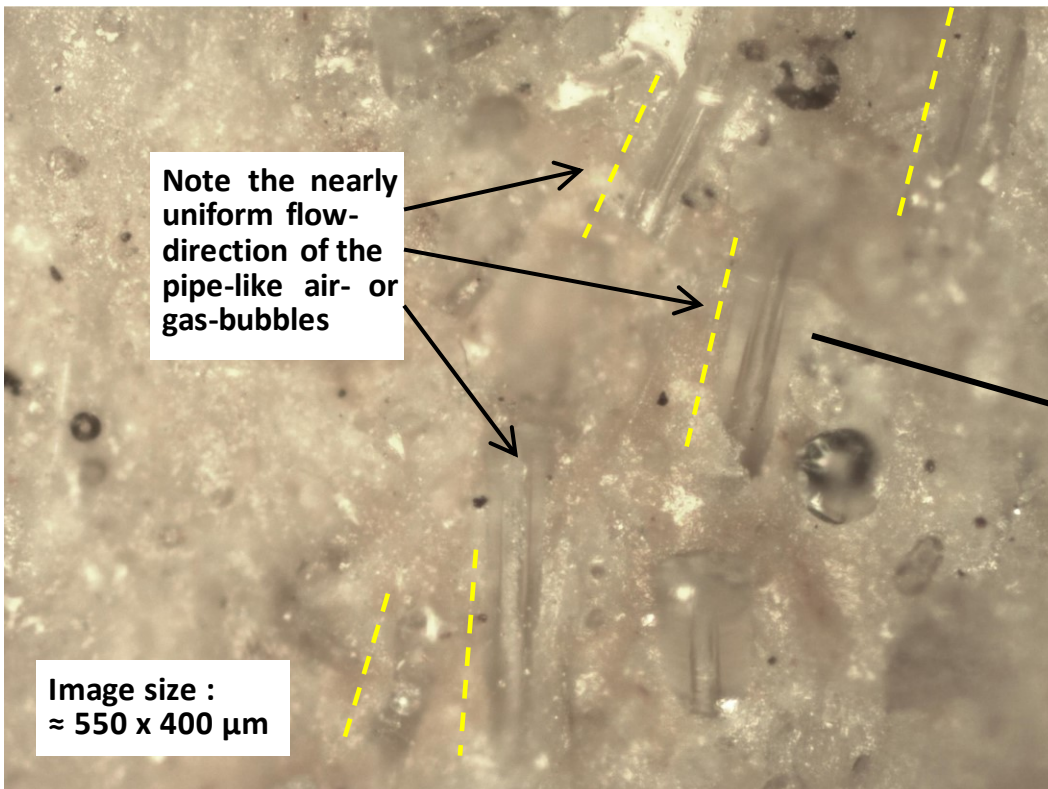


The spectrum indicates a glass-like amorphous material that originally may have consisted of a quartz-like mineral (before the impact event) as the other stones (1, 2 & 5) from this site indicate.



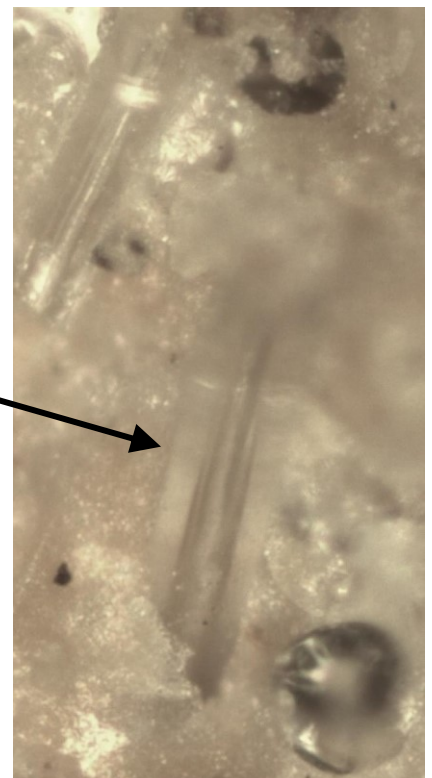
The ground on sample site 55 seems to consist of one coherent mass of ceramic-(glass-) like material with linear flow-texture and a low density like wood ! The flow direction of the material was along the axis of the Fraser Range !

The light-weight glass-like (ceramic-like) material contains pipe-shaped bubbles which are filled with air or gas ! Probably a result of the ejecta process (atmospheric trajectory)

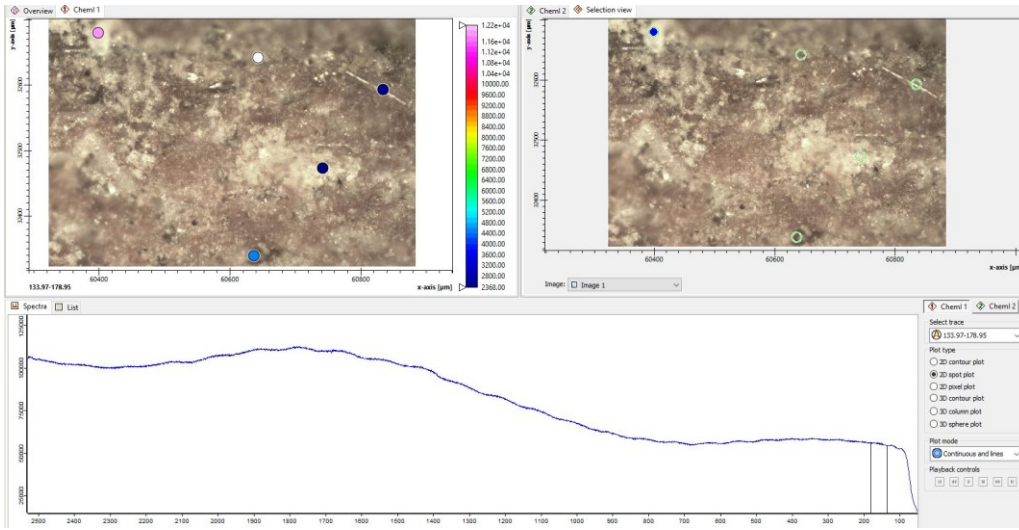


Note the nearly uniform flow-direction of the pipe-like air- or gas-bubbles

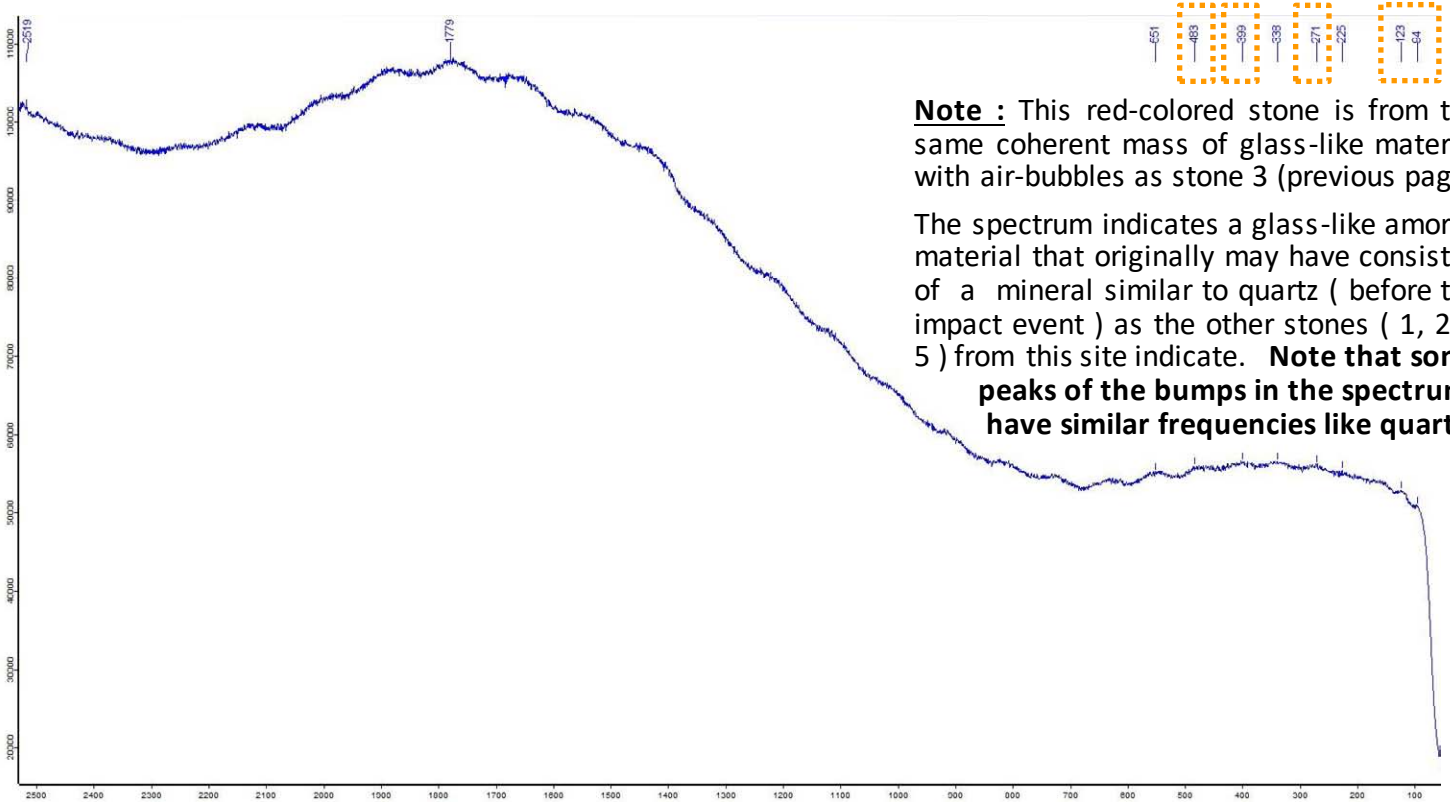
Image size :
≈ 550 x 400 μm



Sample Site 55 : Stone 4_spectra 1 indicates: **no result !** (→ see RRUFF_CS results)

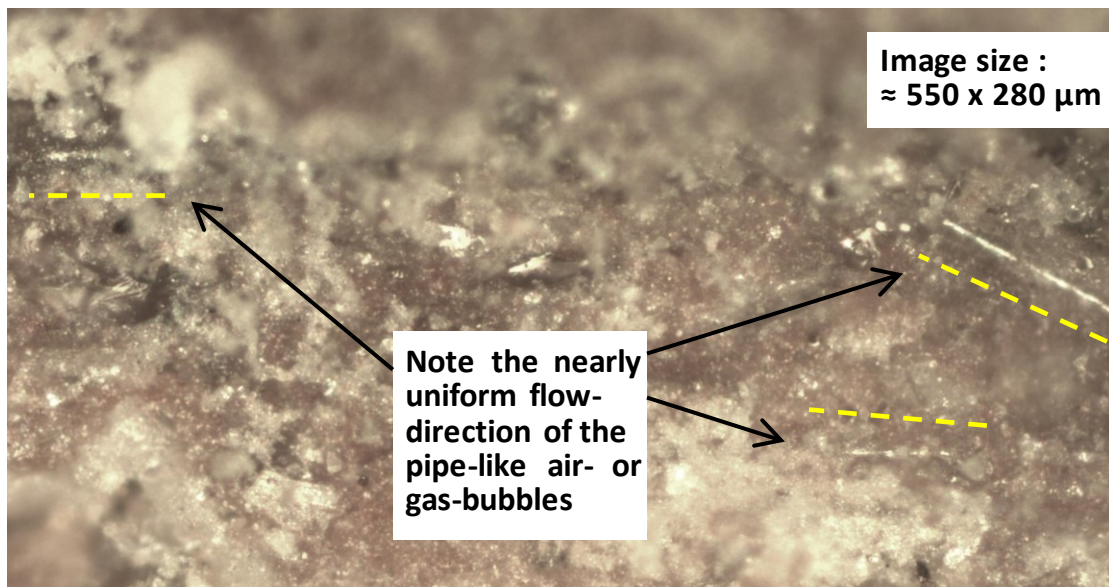


Sample :

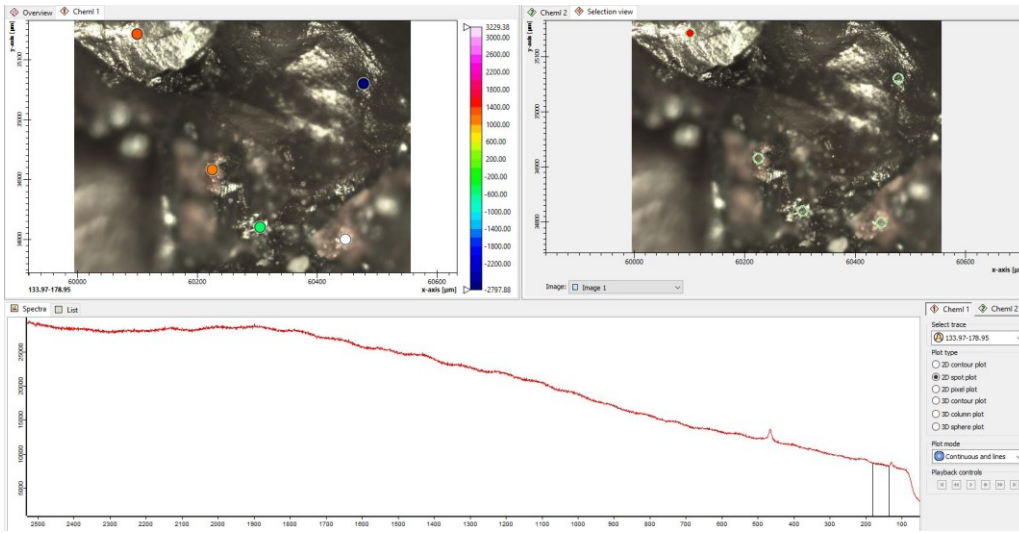


Note : This red-colored stone is from the same coherent mass of glass-like material with air-bubbles as stone 3 (previous page)

The spectrum indicates a glass-like amorph material that originally may have consisted of a mineral similar to quartz (before the impact event) as the other stones (1, 2 & 5) from this site indicate. **Note that some peaks of the bumps in the spectrum have similar frequencies like quartz.**



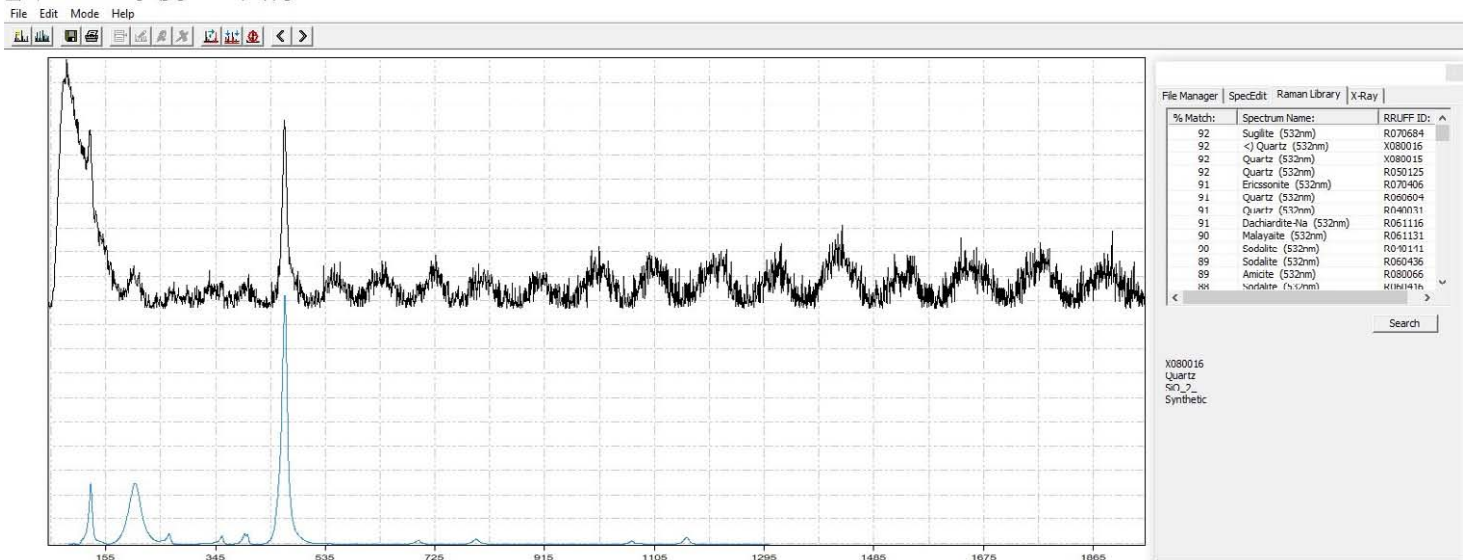
Sample Site 55 : Stone 5_spectra 1 indicates: **Quartz** (→ see RRUFF_CS results)



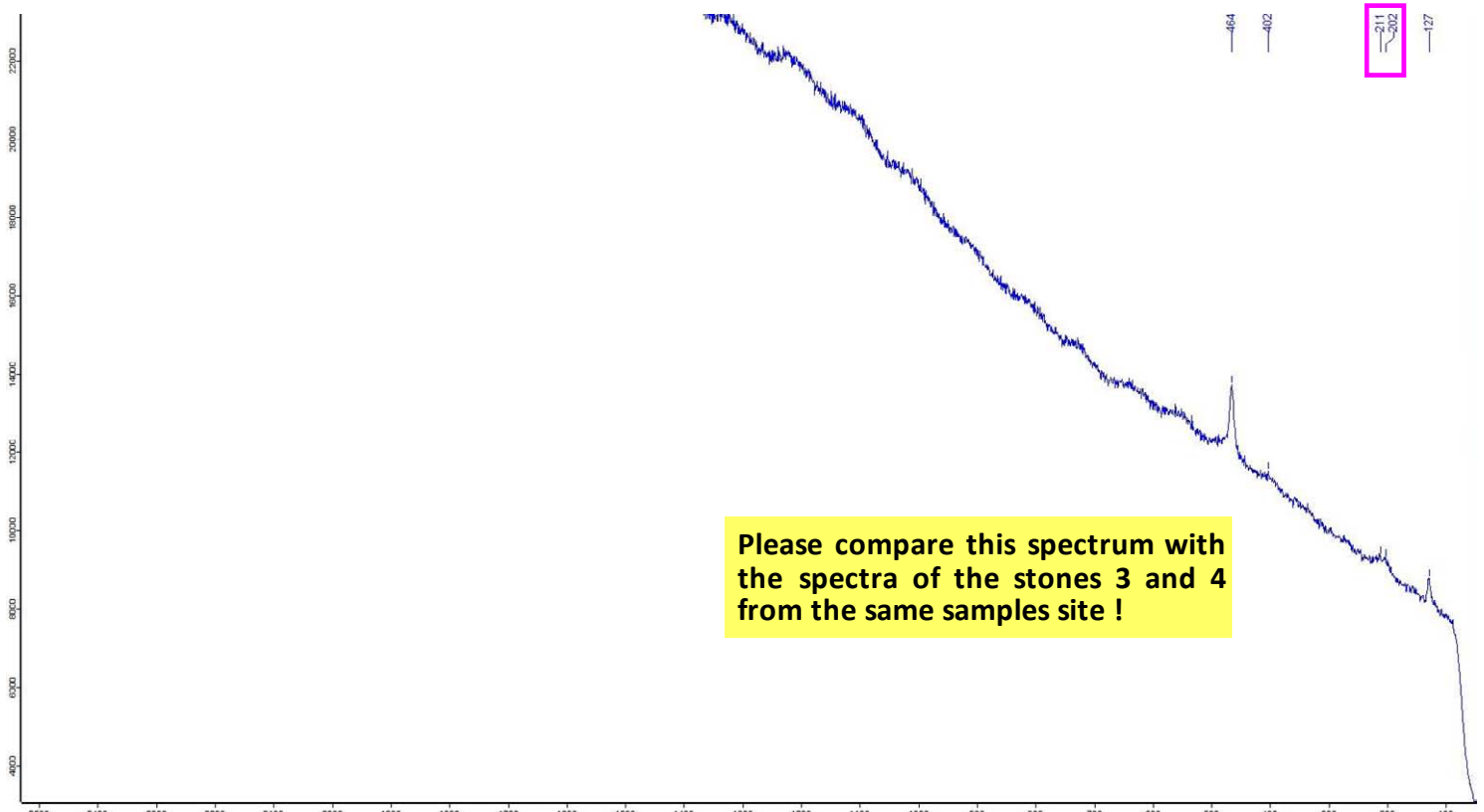
Sample :



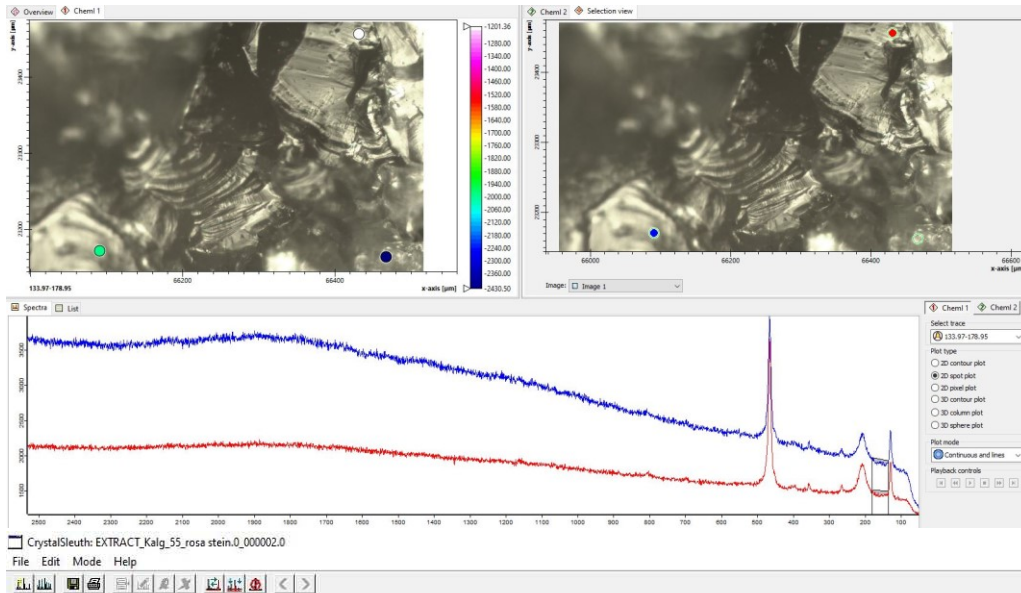
CrystalSleuth: EXTRACT_Kalq_55_black stone (rough).0_000004.0



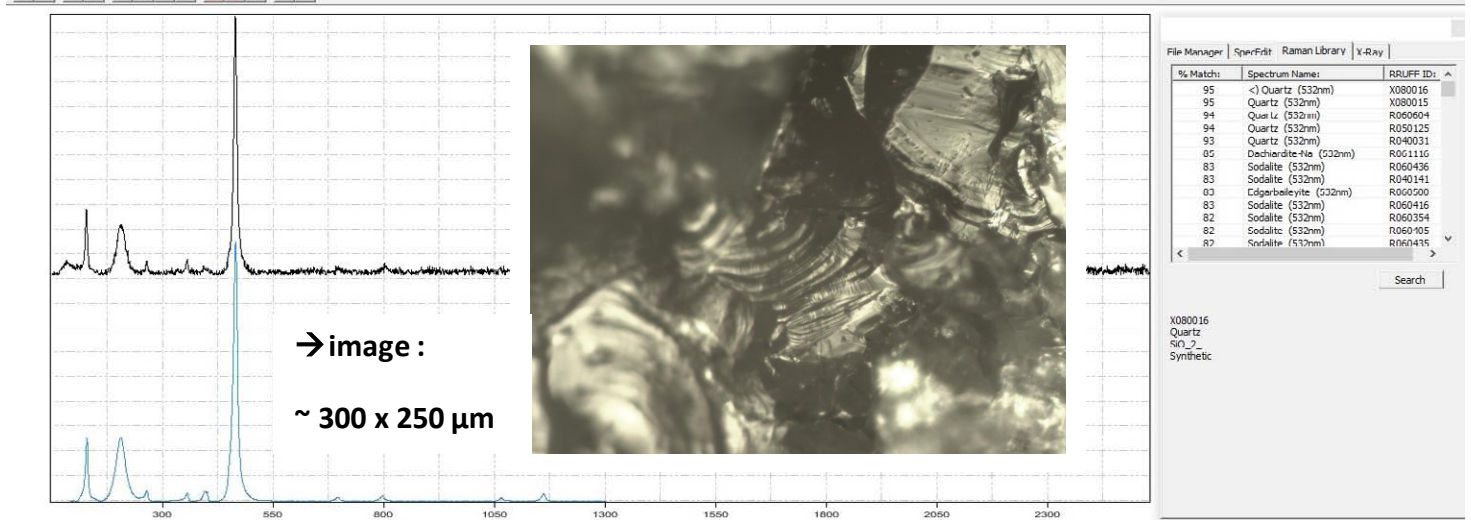
Note the nealy disappeared spectrum (→ destroyed crystal lattice ?) of the quartz → metamorphed by impact event ?



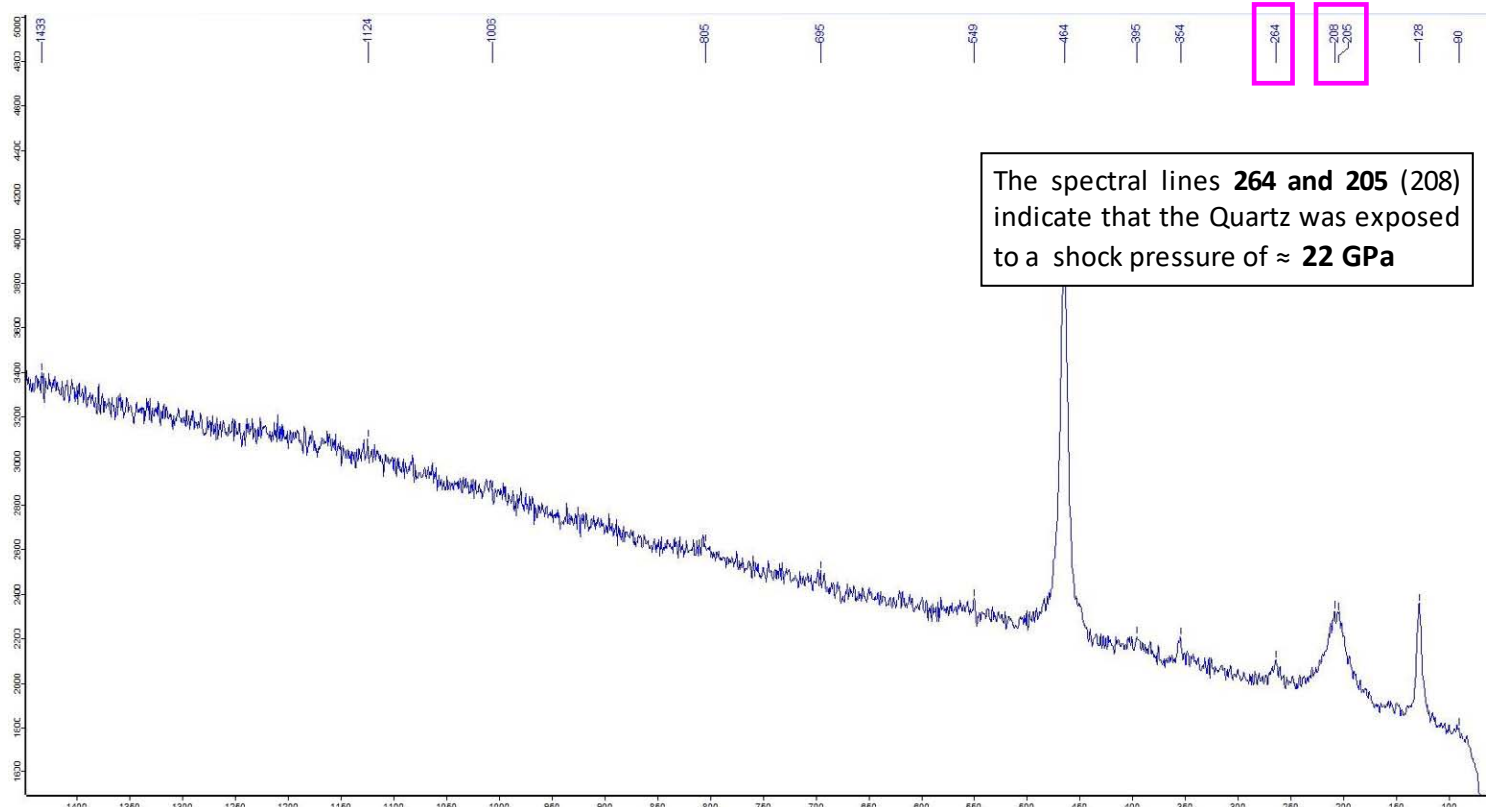
Sample Site **55**: Stone 6_spectra 1 (light pink mineral) indicates: **Quartz** (→ see RRUFF_CS results)



Sample :



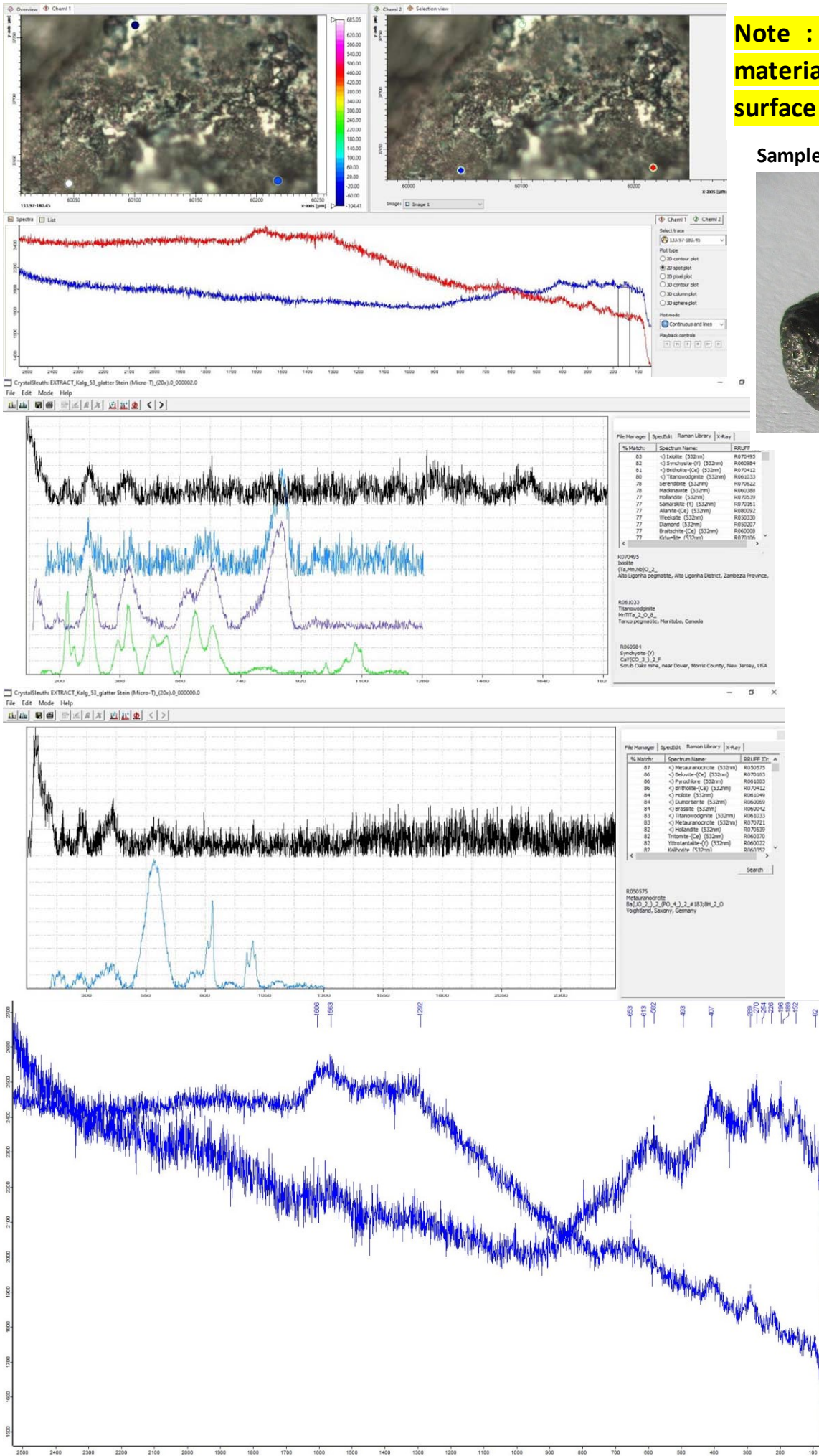
Indication for a shock event are the shifts of the marked Quartz spectral lines towards 264 and 205 (208)



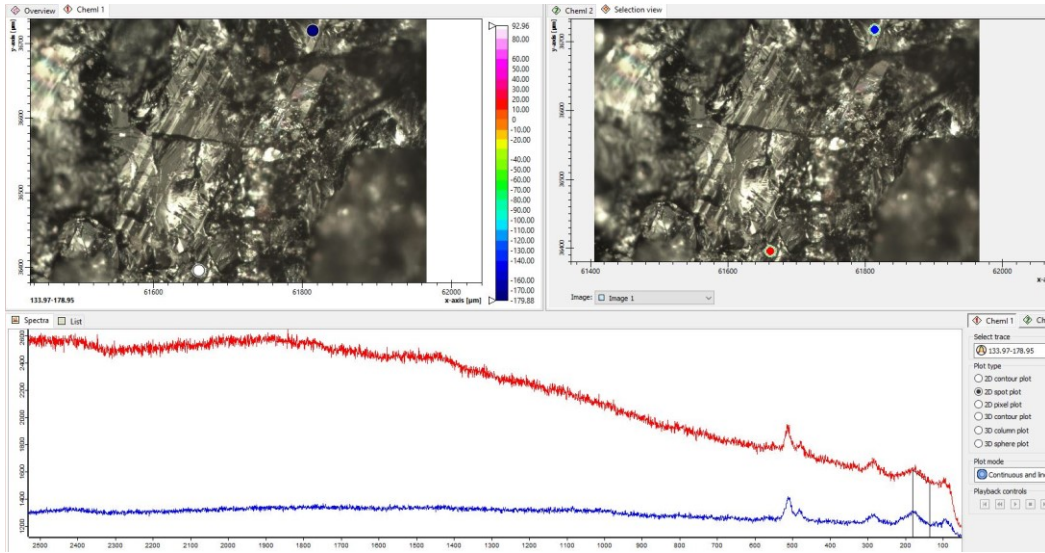
Sample Site 53 : Stone 1_spectra 1 indicates : **Ixiolite, Titanowodginite, Synchysite-(y) & Metauranocirite**

Note : This black glass-like material is covering the surface of sample site 53.

Sample :



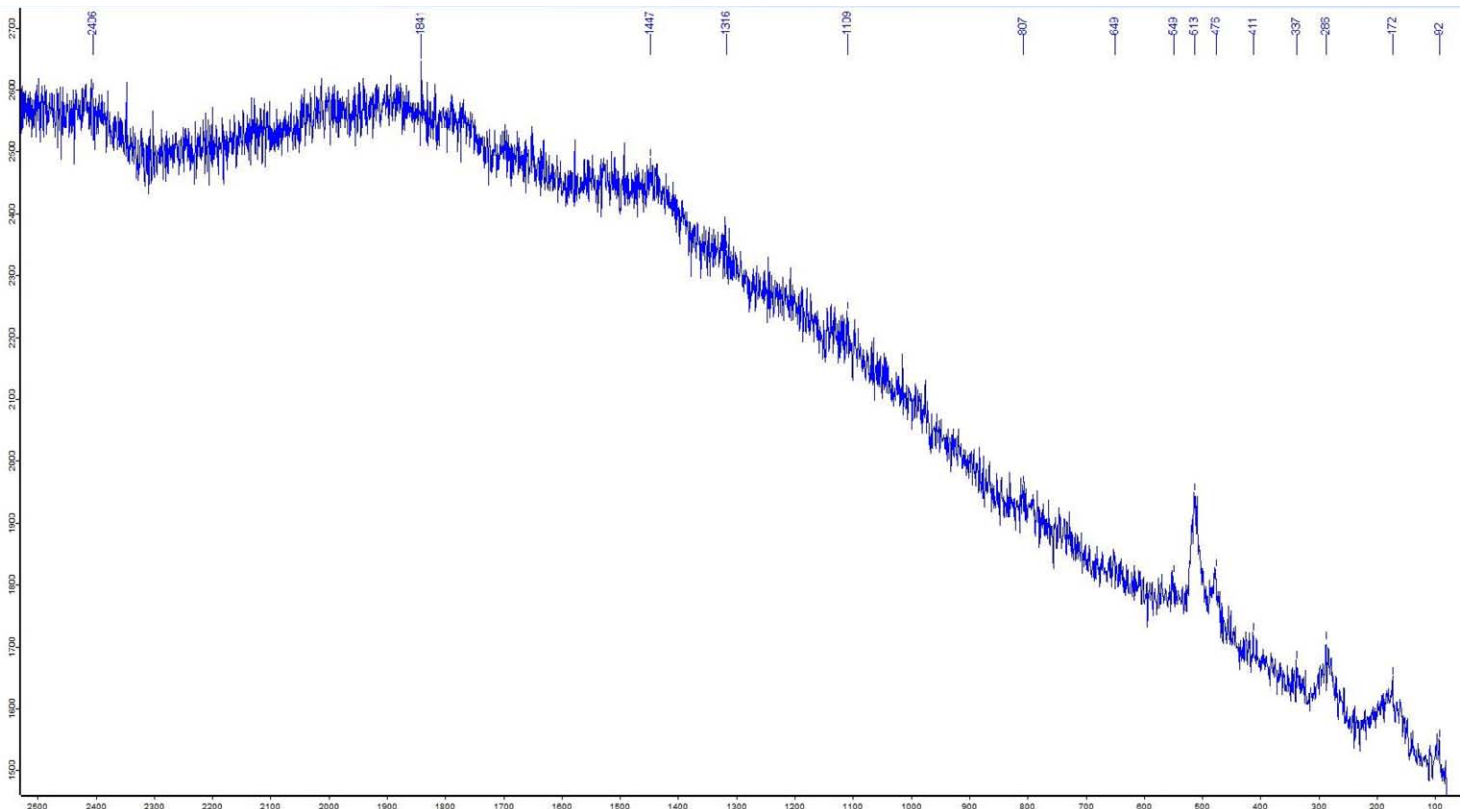
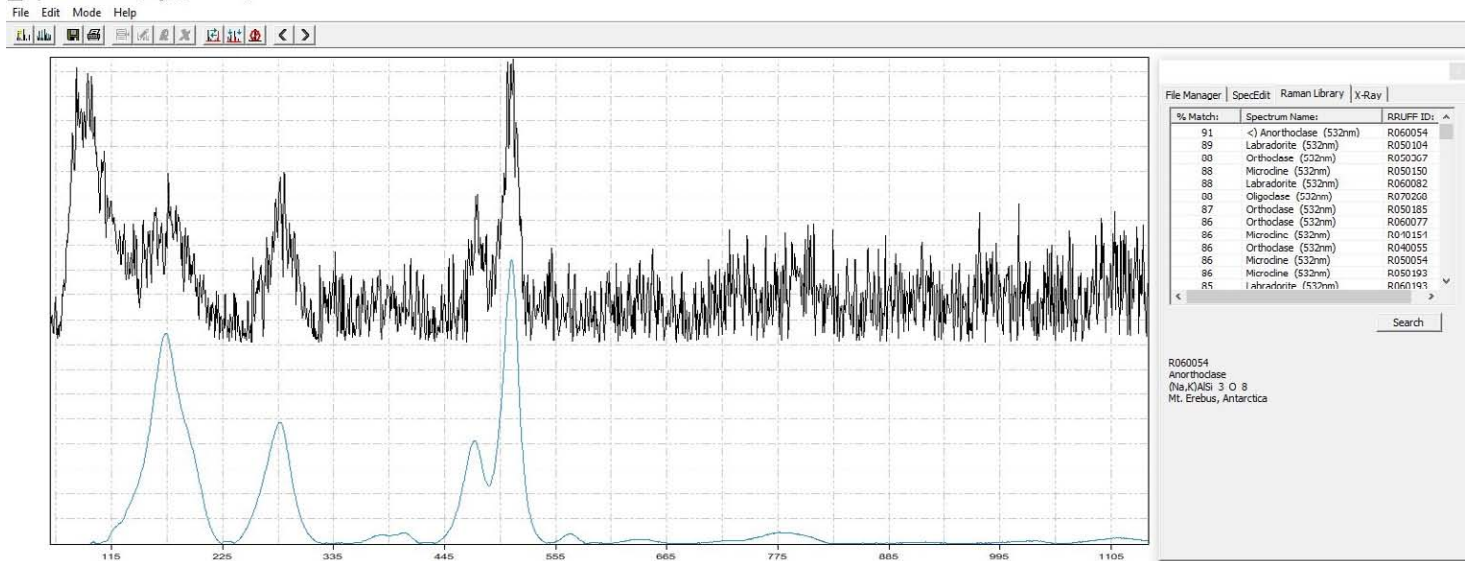
Sample-Site **53** : Stone 2_spectra 1 indicates: **Anorthoclase** (→ see RRUFF_CS results)



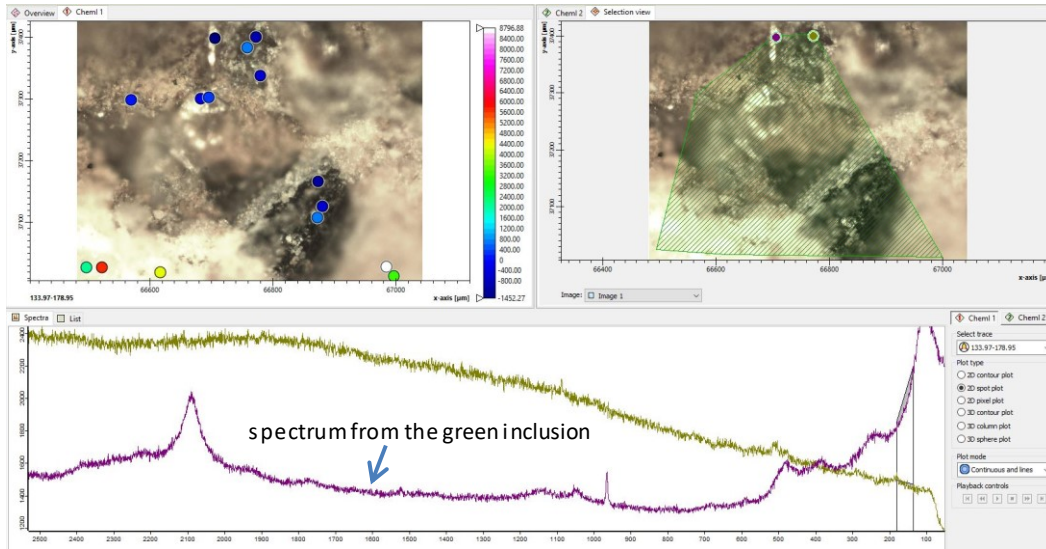
Sample :



CrystalSleuth: EXTRACT_Kalg_53_rauerStein_1_000001.0

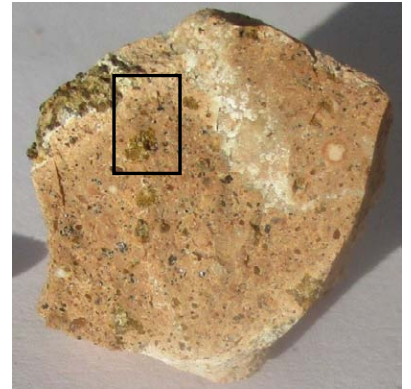


Sample-Site 53 : Stone 3_spectra 1 indicates : **Jamesonite, Apatite-(CaF)** (→ see RRUFF_CS results)



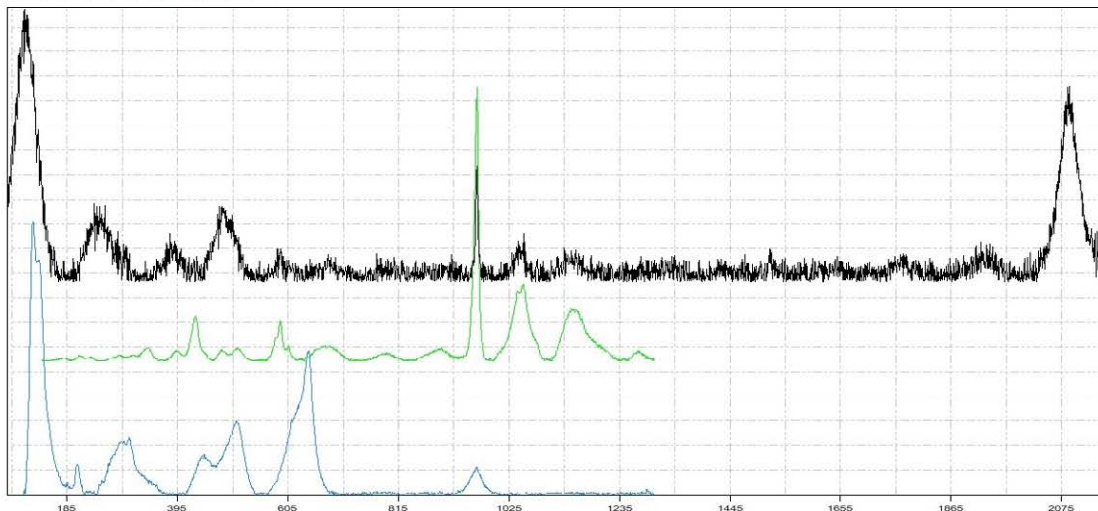
Note : the red matrix of the stone didn't provide a usable spectrum. Only the green inclusion provided a usable spectrum

Sample :



CrystalSleuth: EXTRACT_Kalg_53_red Stone (randzone einschluss)_0_000008.0

File Edit Mode Help

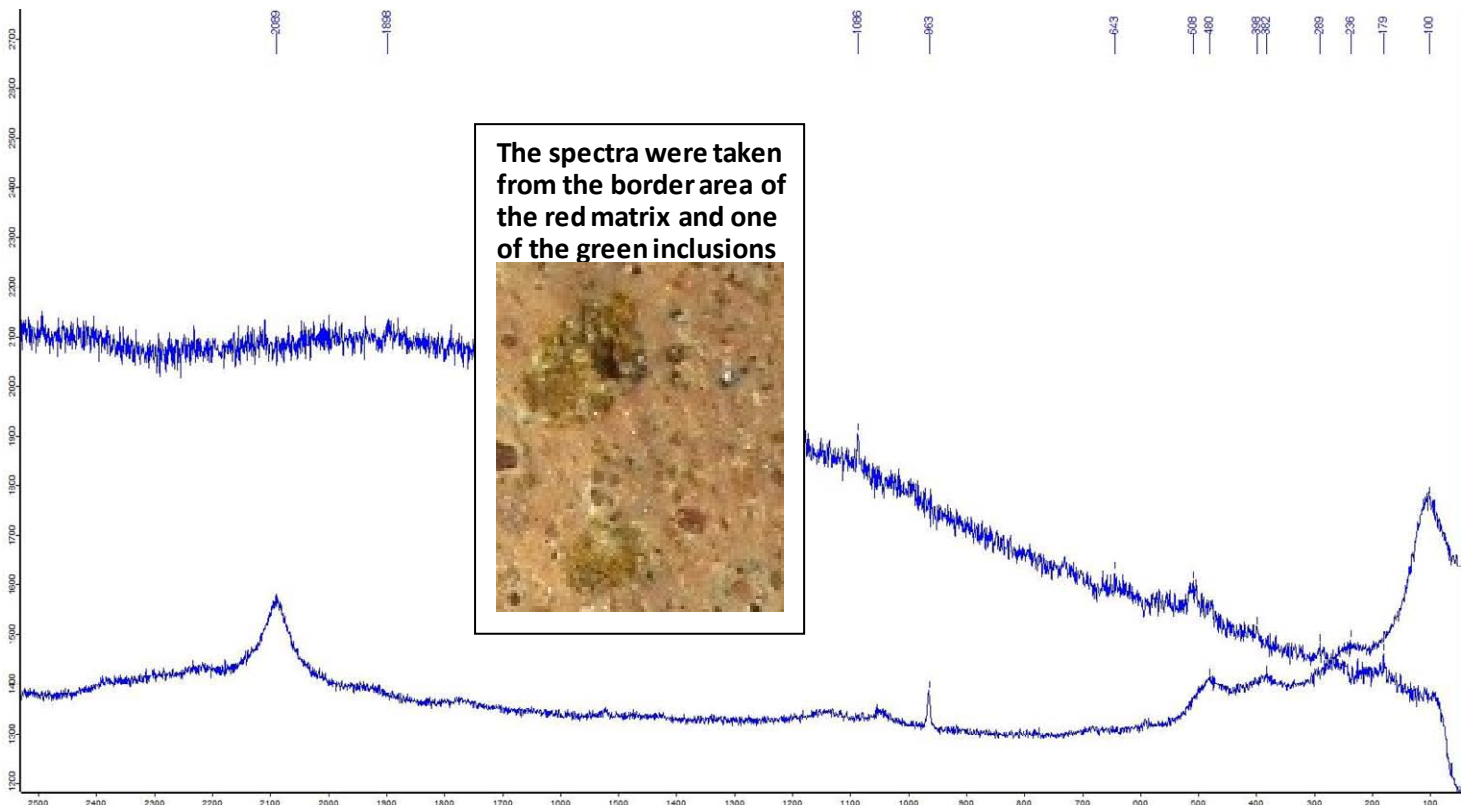


% Match:	Spectrum Name:	RRUFF ID:
47	< Jamesonite (532nm)	R050430
45	< Kermite (701nm)	R050661
43	Breithauptite (532nm)	R060928
42	Chlorovaphite (532nm)	R060267
42	Hessite (532nm)	R060226
40	Petersite-(?) (741nm)	R050941
38	Nissanite (724nm)	R050418
37	Aramayotte (532nm)	R061071
35	Canuillite (532nm)	R050352

% Match:	Spectrum Name:	RRUFF ID:
26	< Apatite-(Lar) (532nm)	R060184
23	< Sibirskite (532nm)	R070183
23	Morriete (532nm)	R070259
23	Morriete (532nm)	R0701529
23	Apatite-(CaF) (532nm)	R060192
23	Sillimanite (532nm)	R060787

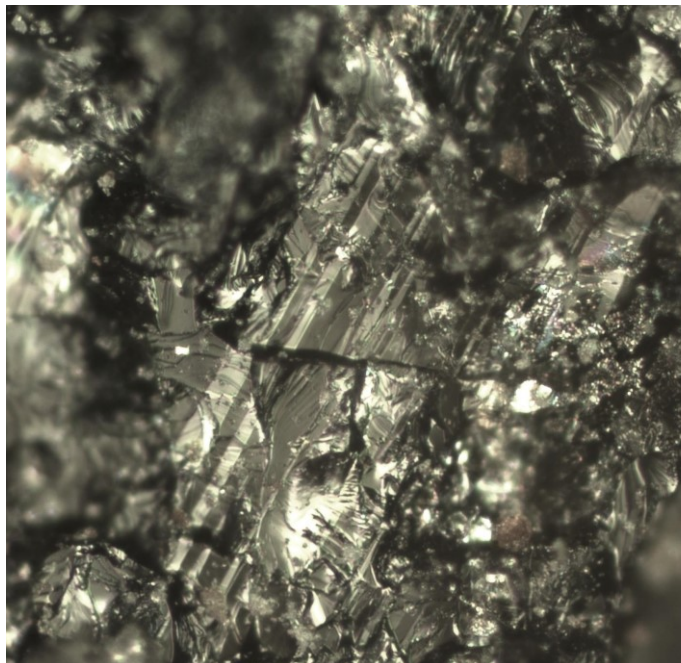
R060184
Apatite-(CaF)
Co_5_(PO_4)_3_F
Yates mine, Otter Lake, Quebec, Canada

R050430
Jamesonite
Pb_4_FeSb_6_S_14
Zacatecas, Mexico

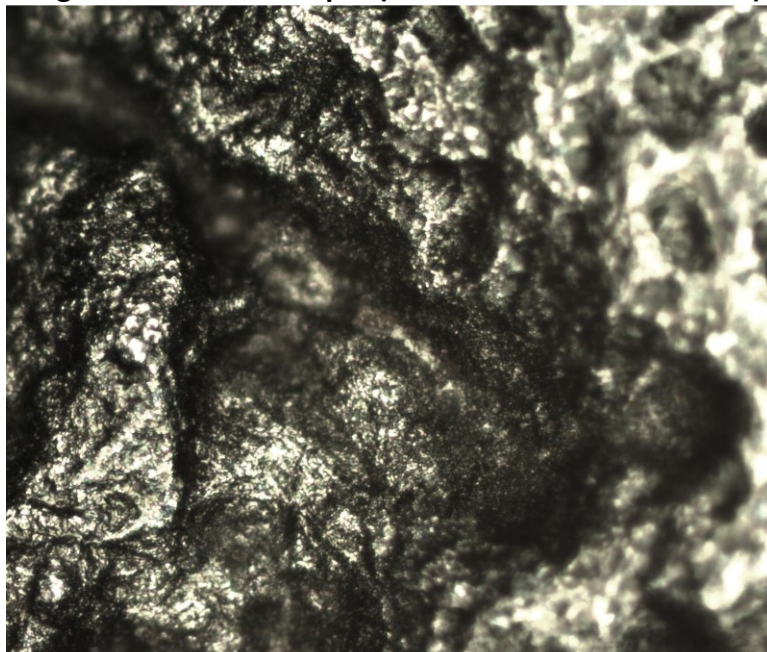


Microscopic Images : Samples from Site 53 an 55 → original state (no preparation)

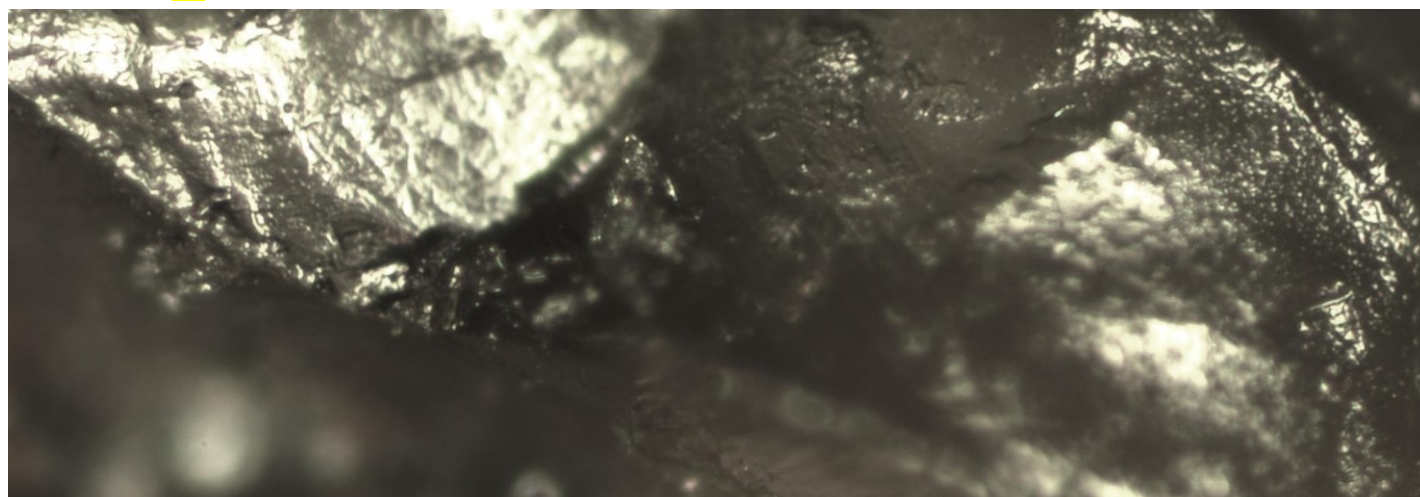
Sample Site 53 : Stone 2_spectra 1 indicates : **Anorthoclase** - Image size : ~ 300 x 300 µm



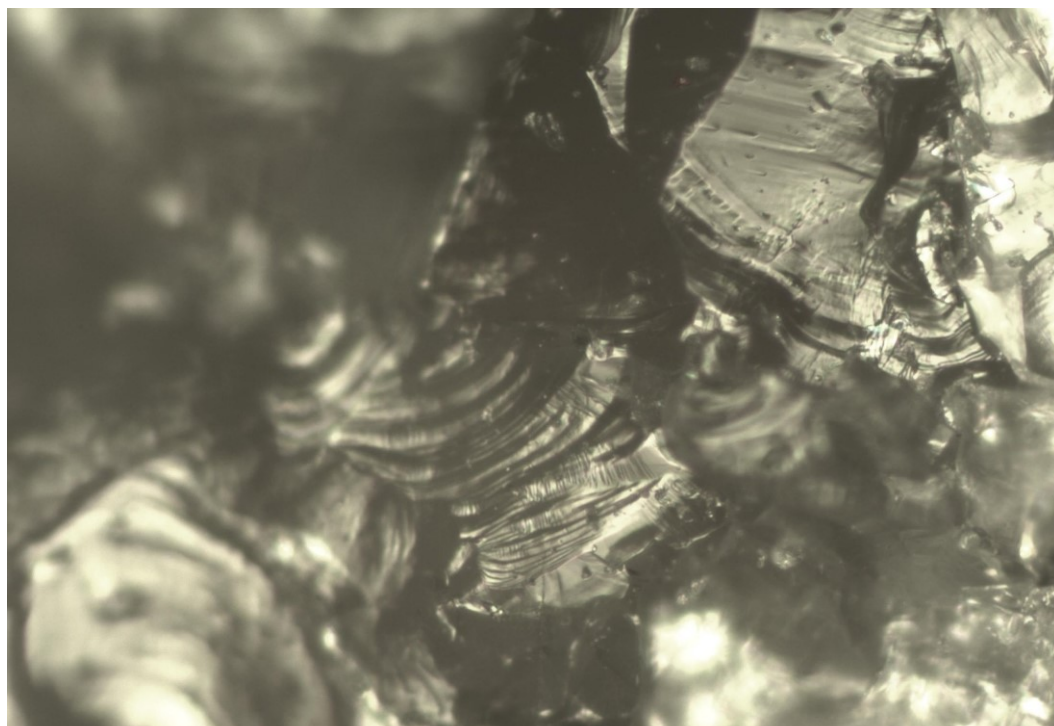
Sample Site 53 : Stone 1_spectra 1 indicates : **Ixiolite, Titanowodginite, Synchysite-(y) & Metauranocirite** Image size : ~ 350 x 300 µm (melted surface structure ?)



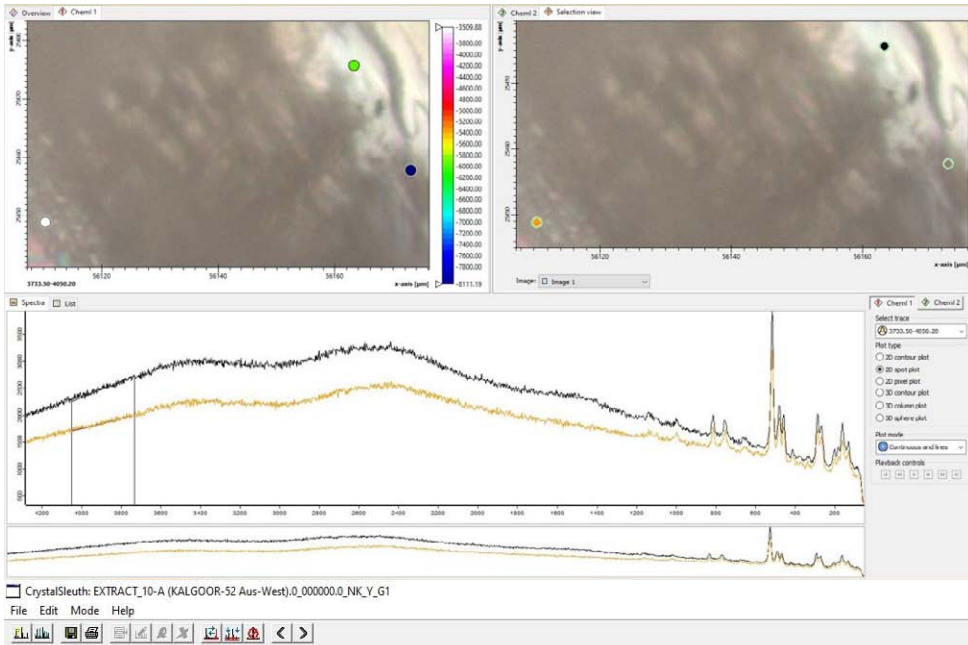
Sample Site 55 : Stone 5_spectra 1: **Quartz** - Image size : 500 x 170 µm



Sample Site 55 : Stone 6_spectra 1 indicates : **Quartz** : ~ 400 x 300 µm

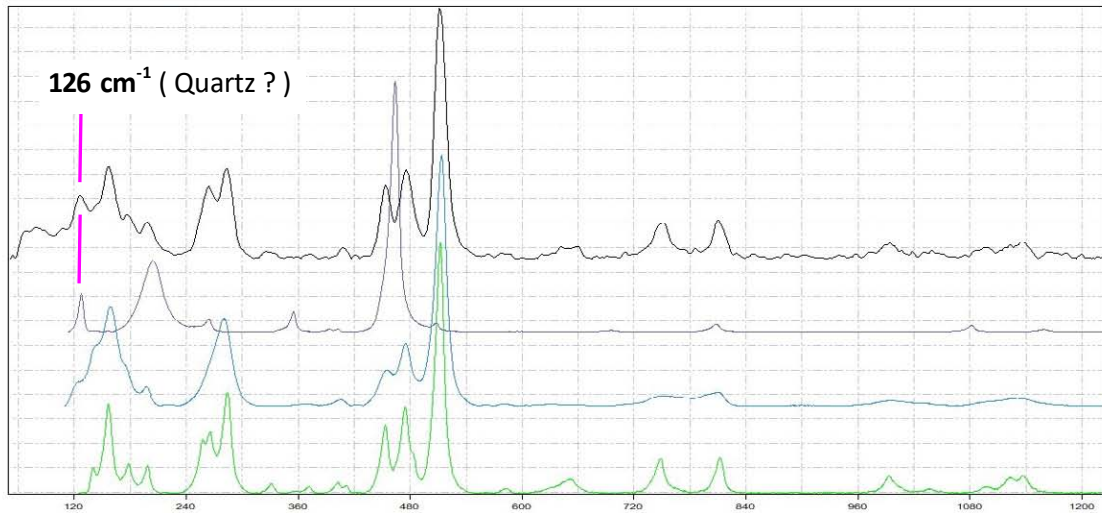


Sample Site 52 : Stone 1_spectra 1 indicates : Orthoclase / Microcline + Quartz (→ see RRUFF_CS results)



The spectral line at 126 cm^{-1} indicates that Quartz is present in the sample. (30 % match) The stone probably contains a small amount of Quartz

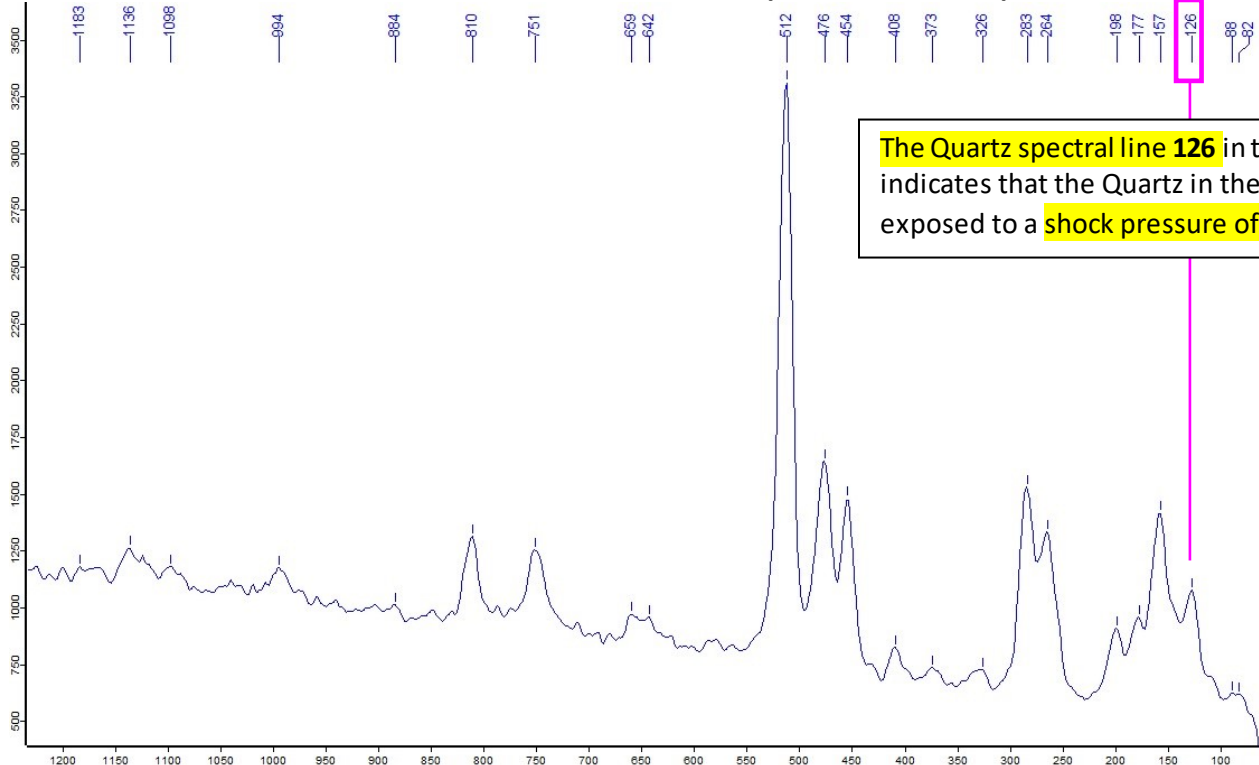
Sample :



% Match:	Spectrum Name:	RRUFF ID:
95	<) Orthoclase (532nm)	R060077
93	<) Microcline (532nm)	R050054
93	Orthoclase (532nm)	R050367
93	Orthoclase (532nm)	R050185
92	Microcline (532nm)	R04154
91	Orthoclase (532nm)	R040055
91	Microcline (532nm)	R050193
89	Orthoclase (532nm)	R070001
88	Microcline (532nm)	R050150
86	Amphoclase (532nm)	R060054
82	Labradorite (532nm)	R050104
79	Oligoclase (532nm)	R070268
78	Labradorite (532nm)	R060087

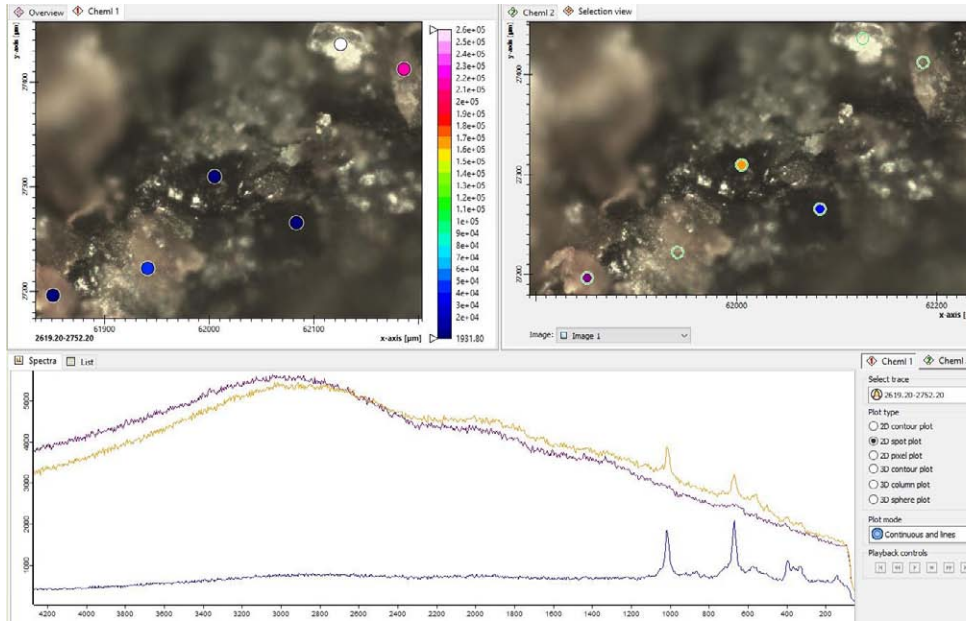
Below the table, there is a search bar and a list of results for "Quartz" (R040031) and "Orthoclase" (R060077) with their respective locations.

Indication for a shock event is the shift of the marked Quartz spectral line in the spectra towards 126



The Quartz spectral line 126 in the spectrum indicates that the Quartz in the sample was exposed to a shock pressure of $\approx 22\text{ GPa}$

Sample-Site 50 : Stone 2_spectra 2 indicates : **Ferrosilite, Kanoite, Augite** (→ see RRUFF_CS results)



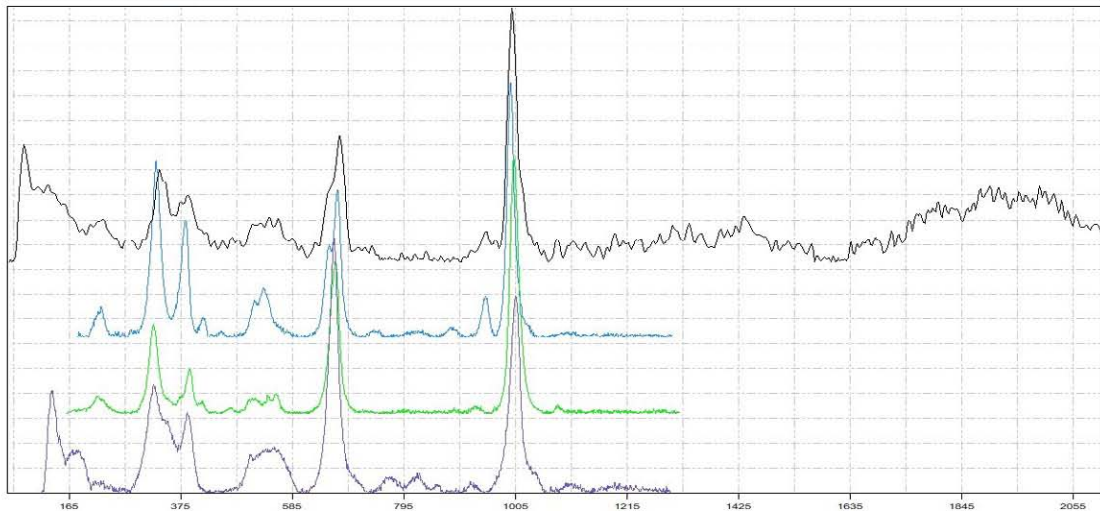
Note : Ferrosilite forms under conditions as they are in Earth's crust in ≈ 30 km depth. It contains iron and it occurs in igneous rock.
 → An indication for an origin in ejecta of a big secondary impact crater.

Sample :



CrystalSleuth: EXTRACT_KALG-50--S2 (2)_1_000004.0

File Edit Mode Help



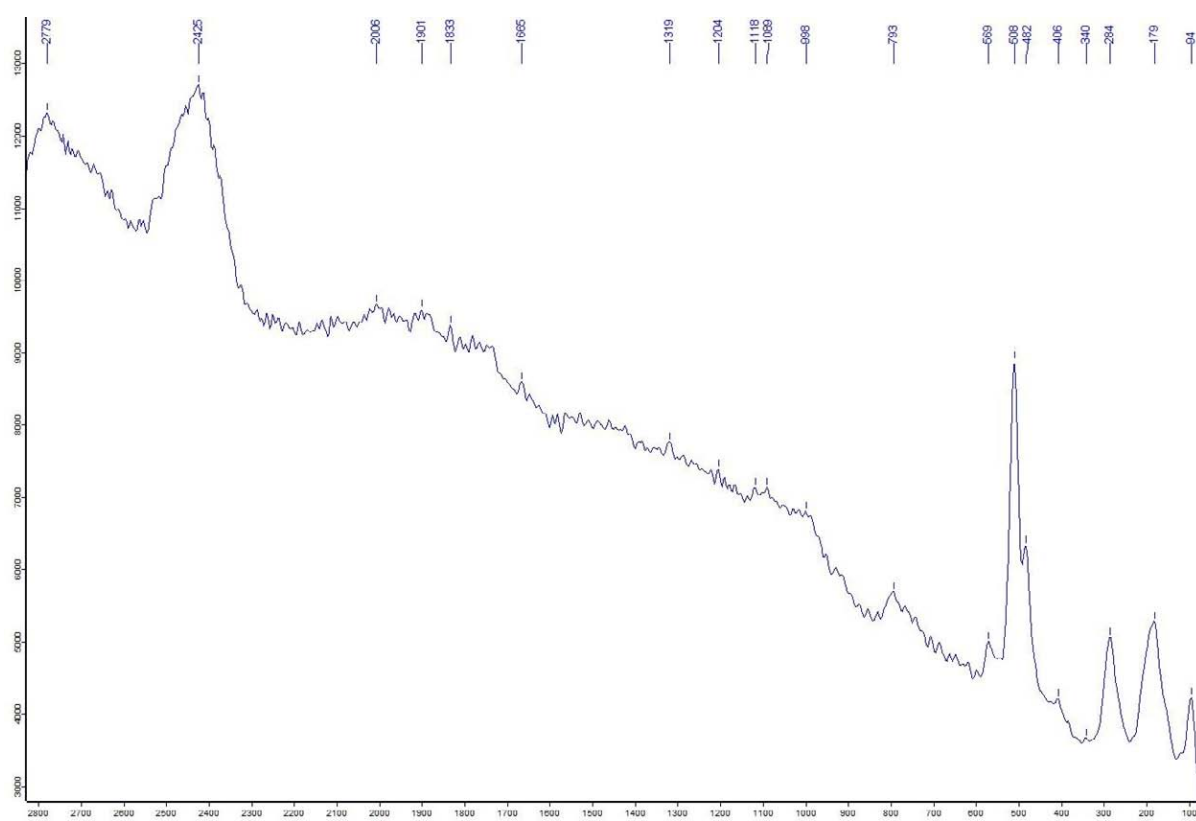
% Match	Spectrum Name	RRUFF ID
88	<-> Ferrosilite (532nm)	R070387
86	<-> Kanoite (532nm)	R061134
85	<-> Augite (532nm)	R061108
82	Diopside (532nm)	R060861
81	Augite (532nm)	R070231
80	Rhodonite (532nm)	R040041
79	Rhodonite (532nm)	X080001
79	Augite (532nm)	R061086
78	Rhodonite (532nm)	R060949
78	Enstatite (532nm)	R040053
77	Enstatite (532nm)	R060744
76	Diopside (532nm)	R040097
76	Schwinzite (532nm)	R050738

Search

R070387
 Ferrosilite
 Fe₂(SiO₃)₂
 Central Gneissic Complex (Ktada Lake), British Columbia, Canada

R061134
 Kanoite
 MnMgSi₂O₇F₆
 Balmat, St. Lawrence County, New York, USA

R061108
 Augite
 (Ca,Mg,Fe)₂(Si,Al)₂O₆
 Monti Rossi, near Mt. Etna, Sicily, Italy



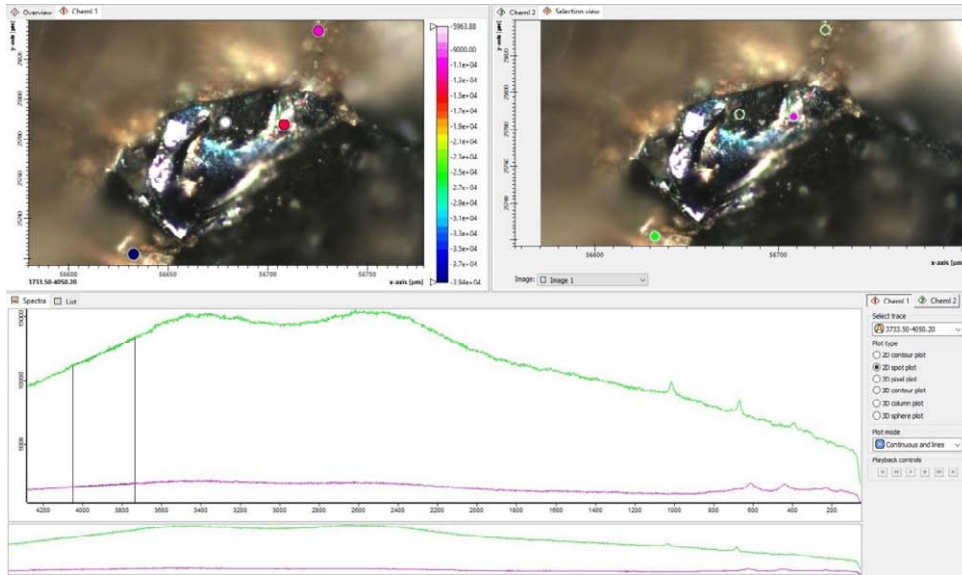
Sample Site 52 : Stone 3-A_spectra 1 indicates : **Rutile (Titandioxid)**

(→ see RRUFF_CS results)

Note : Rutile forms under high-pressure or high-temperature conditions !

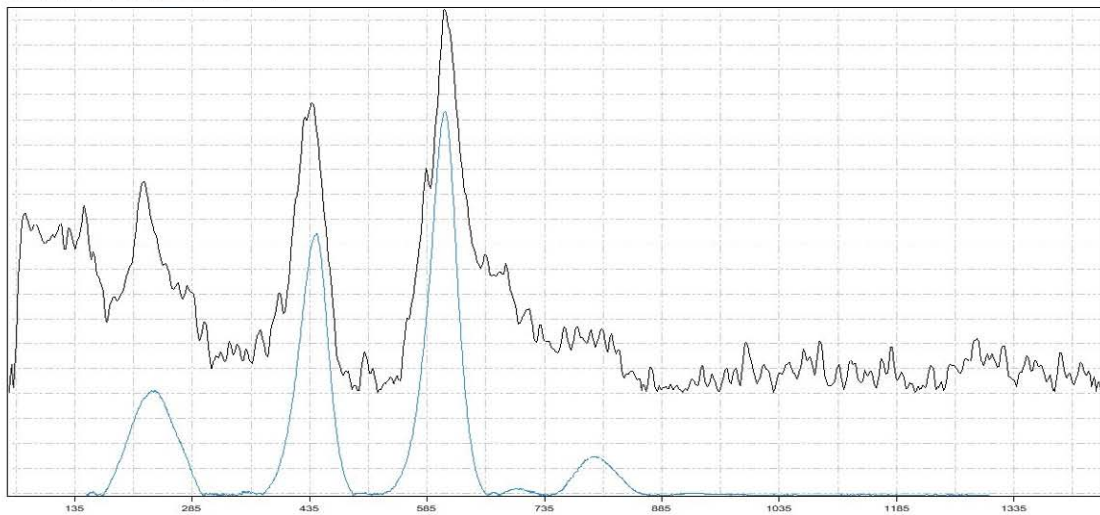
(below 500°C > 10 GPa is needed for its formation out of Anatase , above 600°C it forms under atmospheric Pressure)

sample .



CrystalSleuth: EXTRACT_10-C-1 (KALGOOR-52 Aus-West)_0_000000_0_NK_G1

File Edit Mode Help

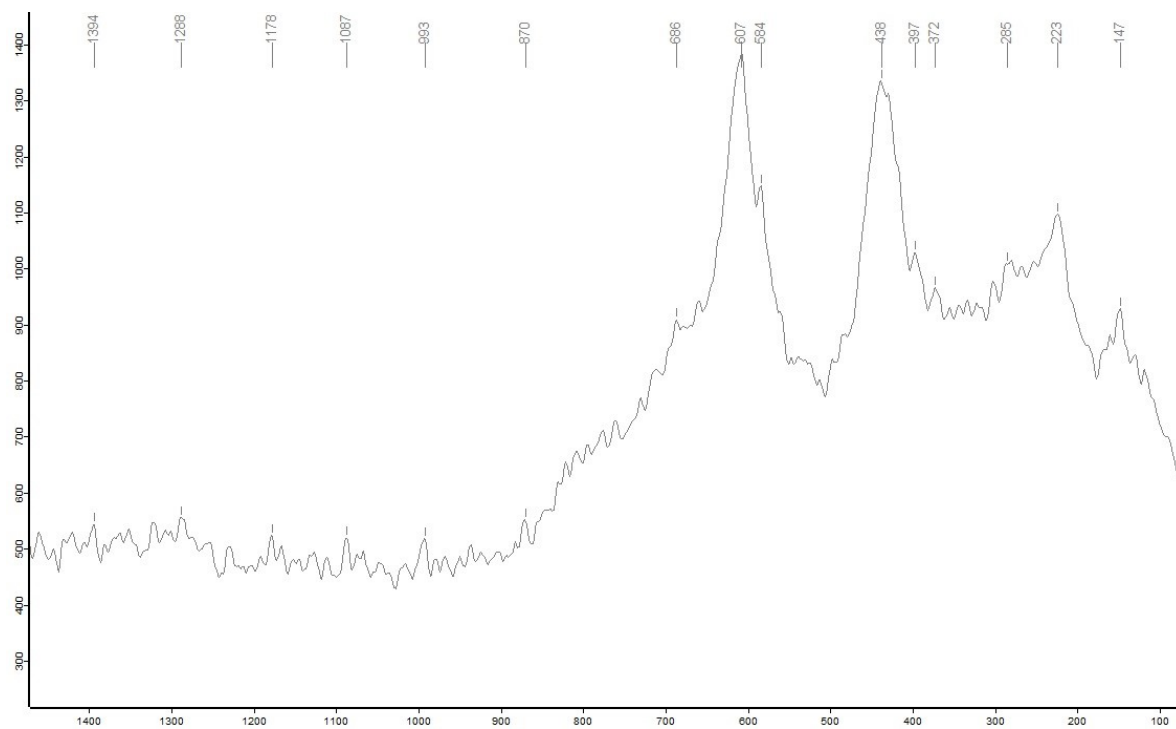


File Manager | SpecFit | Raman Library | X-Ray

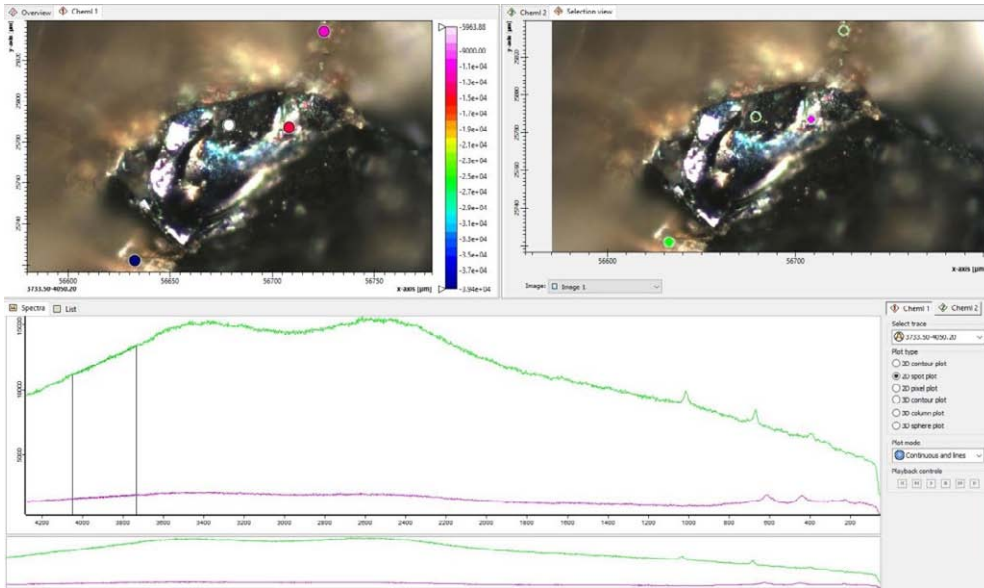
% Match:	Spectrum Name:	RRUFF ID:
81	< Rutile (532nm)	R050417
78	Rutile (532nm)	R040049
76	Rutile (532nm)	R050031
73	Rutile (532nm)	R060493
73	Zunyite (532nm)	R050263
71	Rutile (532nm)	R060745
70	Titanite (532nm)	R050114
69	Pyrochlore (532nm)	R061003
69	Teusonite (532nm)	X090004
69	Titanite (532nm)	R050124
69	Krauskopfite (532nm)	R070657
69	Titanite (532nm)	R010033
69	Vonsenite (532nm)	R050477

Search

R050417
Rutile
TR_2
Champion mine, Mono County, California, USA



Sample Site 52 : Stone 3-A_spectra 2 indicates : **Augite , Diopside** (→ see RRUFF_CS results)

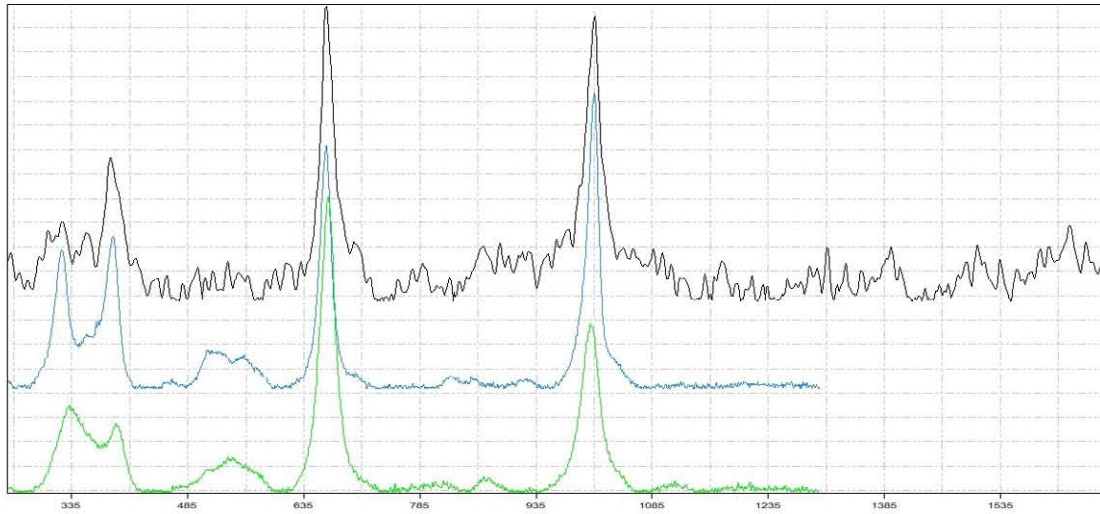


Sample :



CrystalSleuth: EXTRACT_10-C-1 (KALGOOR-52 Aus-West)_0_000003_0_NK_Y_G1

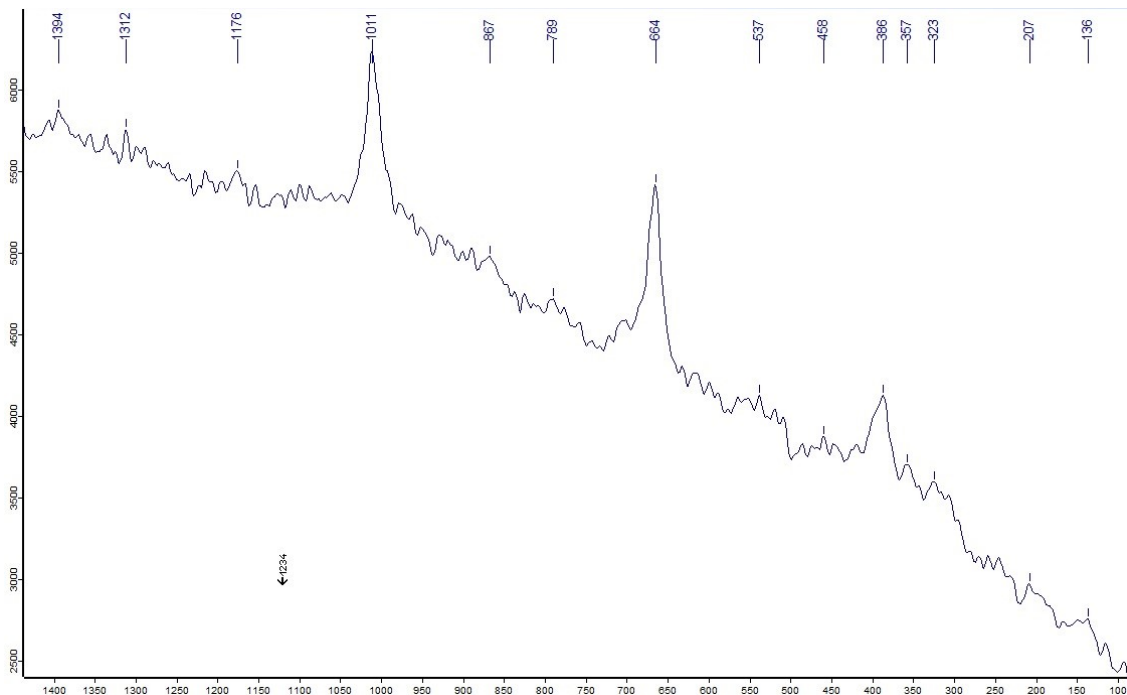
File Edit Mode Help



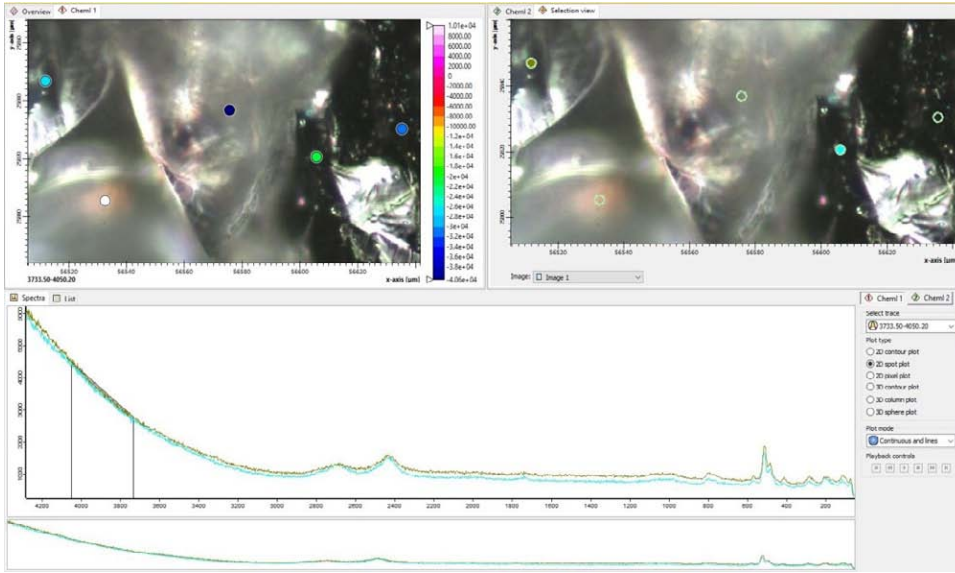
% Match	Spectrum Name	RRUFF ID
87	<1> Augite (532nm)	R070231
86	<1> Diopside (532nm)	R060861
86	Diopside (532nm)	R060865
85	Augite (532nm)	R061108
85	Diopside (532nm)	R050496
85	Augite (532nm)	R061086
84	Diopside (532nm)	R070123
84	Diopside (532nm)	R060661
83	Diopside (532nm)	R090046
81	Pectolite (532nm)	R070207
80	Pectolite (532nm)	R060616
80	Nephelite (532nm)	R060616

R070231
 Augite
 $(Ca,Mg,Fe)_2(Si,Al)_2O_6$
 Old Goose Creek Quarry (Arlington Stone Company Quarry); Belm

R060861
 Diopside
 $CaMgSi_2O_6$
 Red Mountain Volcano, NW of Flagstaff, Arizona, USA



Sample Site 52 : Stone 3-B_spectra 1 indicates : **Labradorite** (→ see RRUFF_CS results)

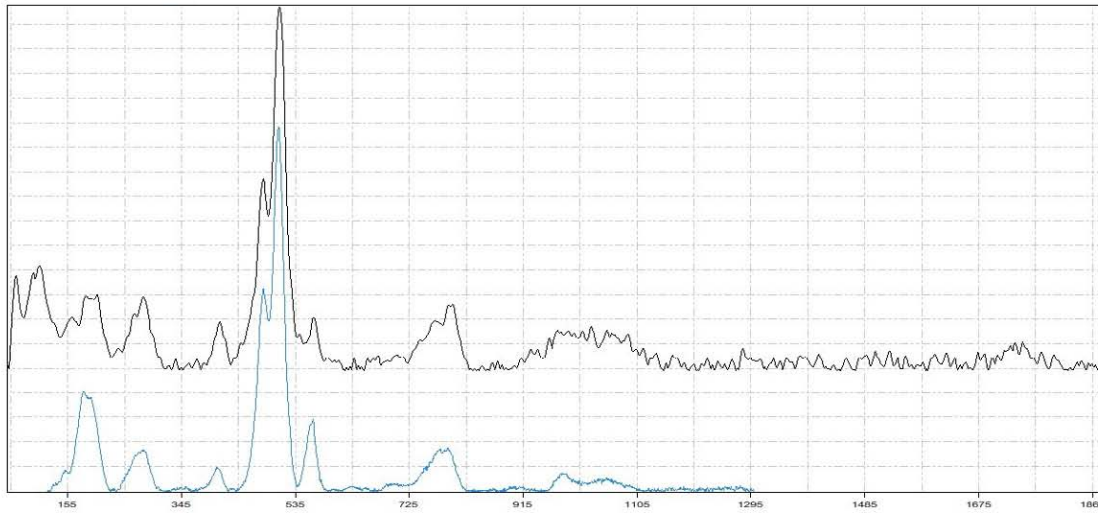


Sample :



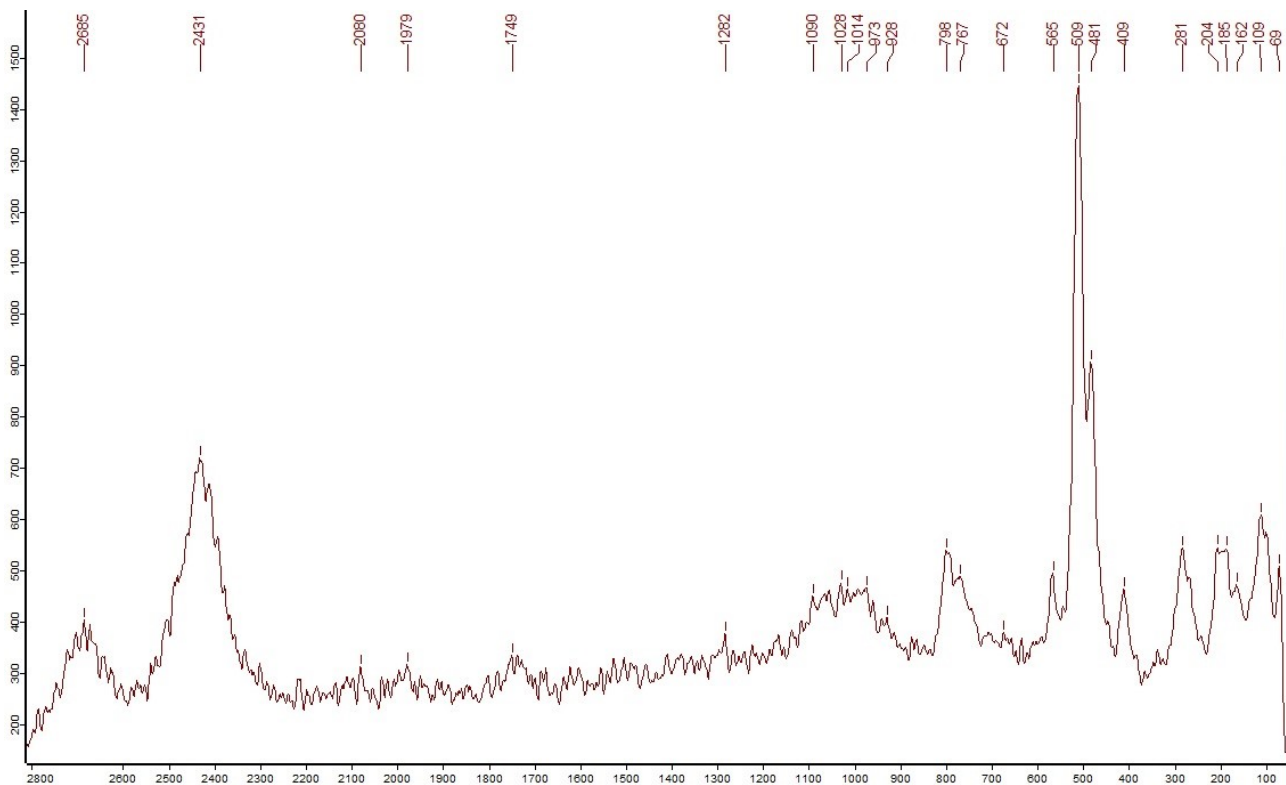
CrystalSleuth: EXTRACT_10-C-2 (KALGOOR-52 Aus-West)_0_000004_0_NK_Y_G1

File Edit Mode Help

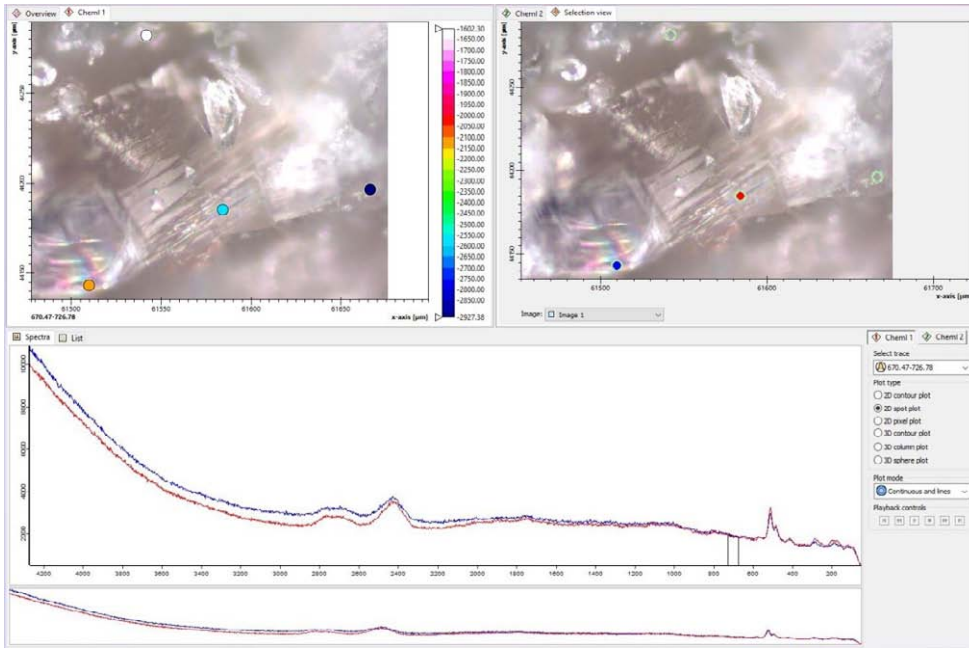


% Match:	Spectrum Name:	RRUFF ID:
90	< \ Labradorite (532nm)	R060221
89	Labradorite (532nm)	R050104
88	Labradovite (532nm)	R050193
86	Orthoclase (532nm)	R070268
85	Labradorite (532nm)	R060082
04	Faugesite-Ca (532nm)	R070402
83	Orthoclase (532nm)	R040055
82	Anorthite (532nm)	R040059
02	Perite (532nm)	R060760
82	Bytownite (532nm)	R070510
82	Orthoclase (532nm)	R050185
81	Romelite (532nm)	R060736
81	Orthorhombic (532nm)	R070901

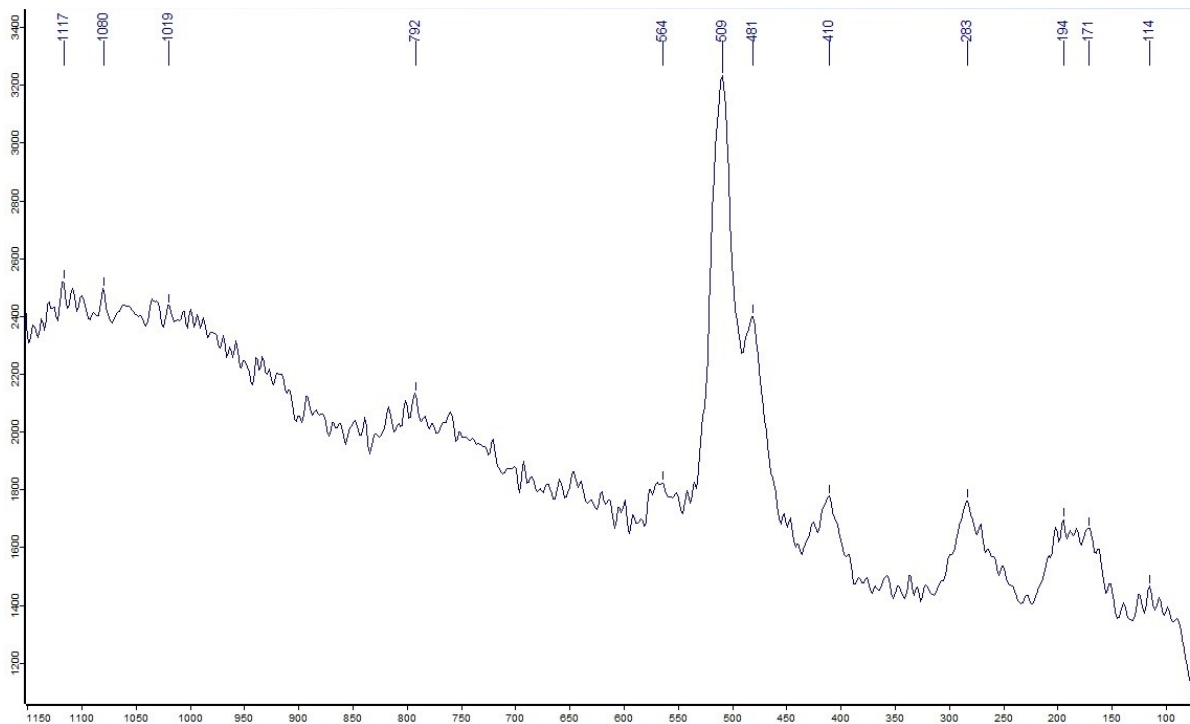
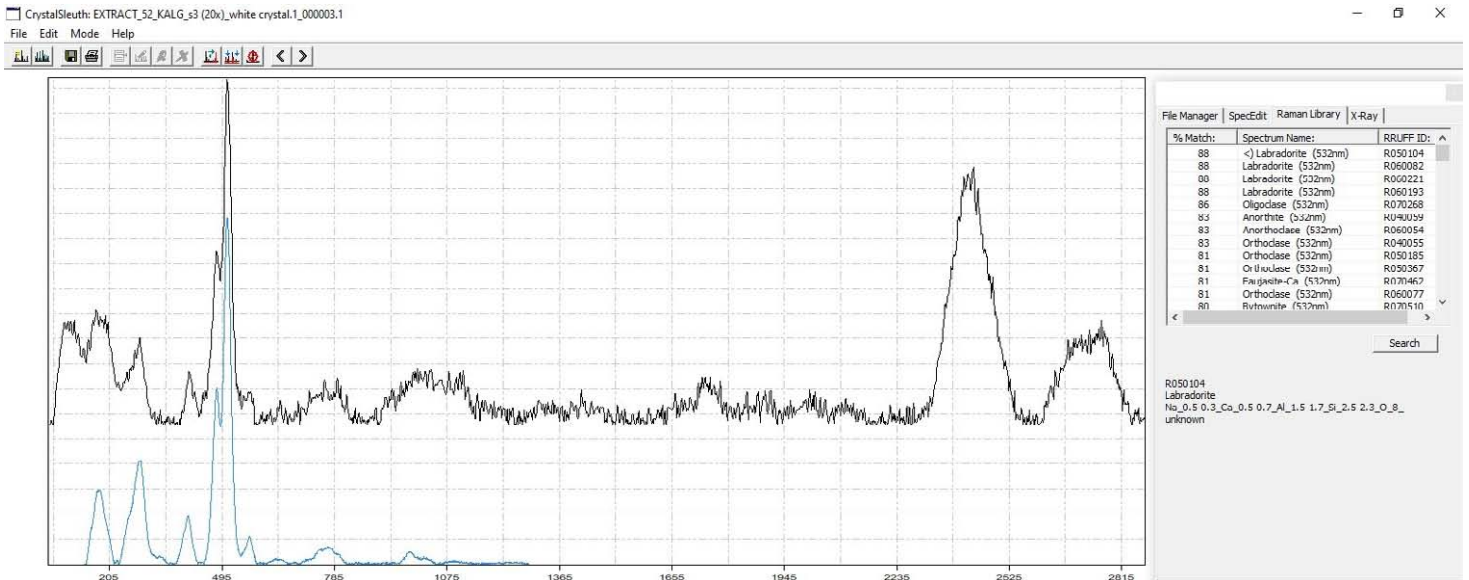
R060221
Labradorite
Na₀5-0.3Ca₀5-0.7Al₁5-1.7Si₂5-2.3O₈
Pinnacle lavafeld, Sonora, Mexico



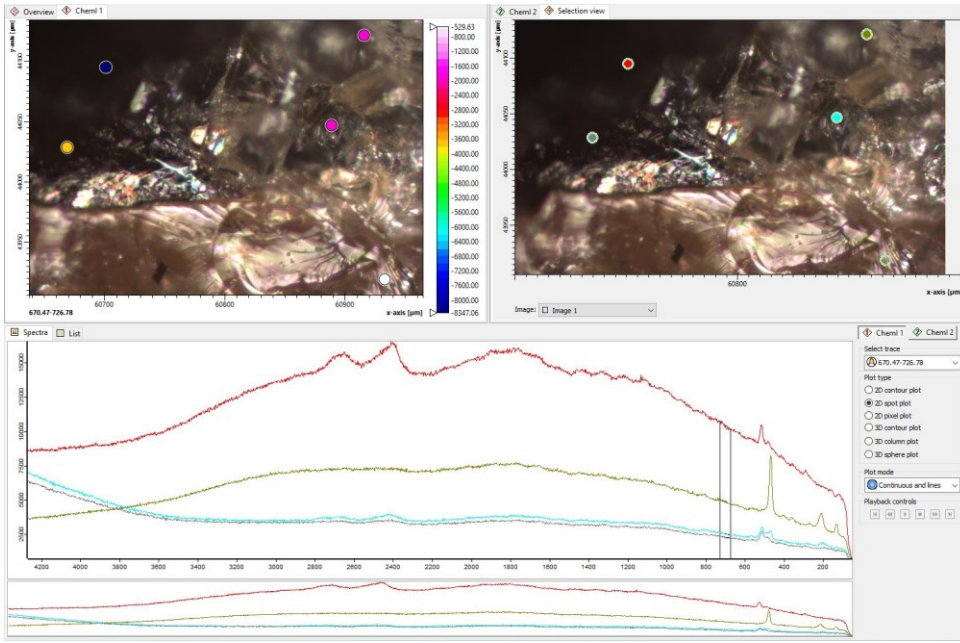
Sample Site 52 : Stone 3-B_spectra 2 indicates : **Labradorite** (→ see RRUFF_CS results)



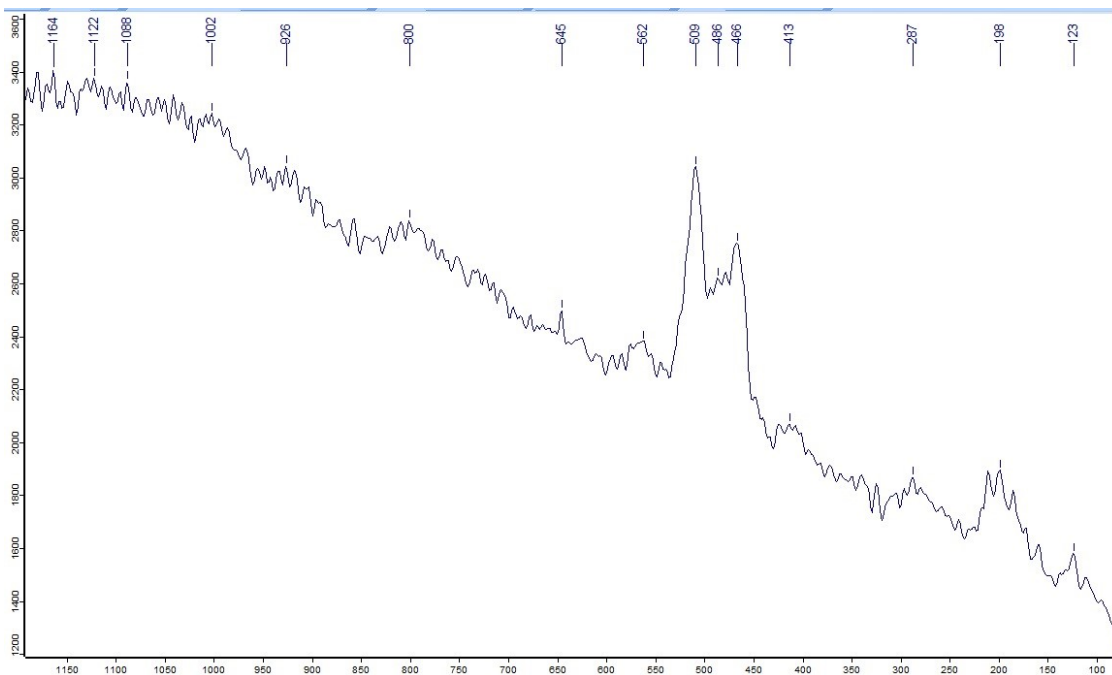
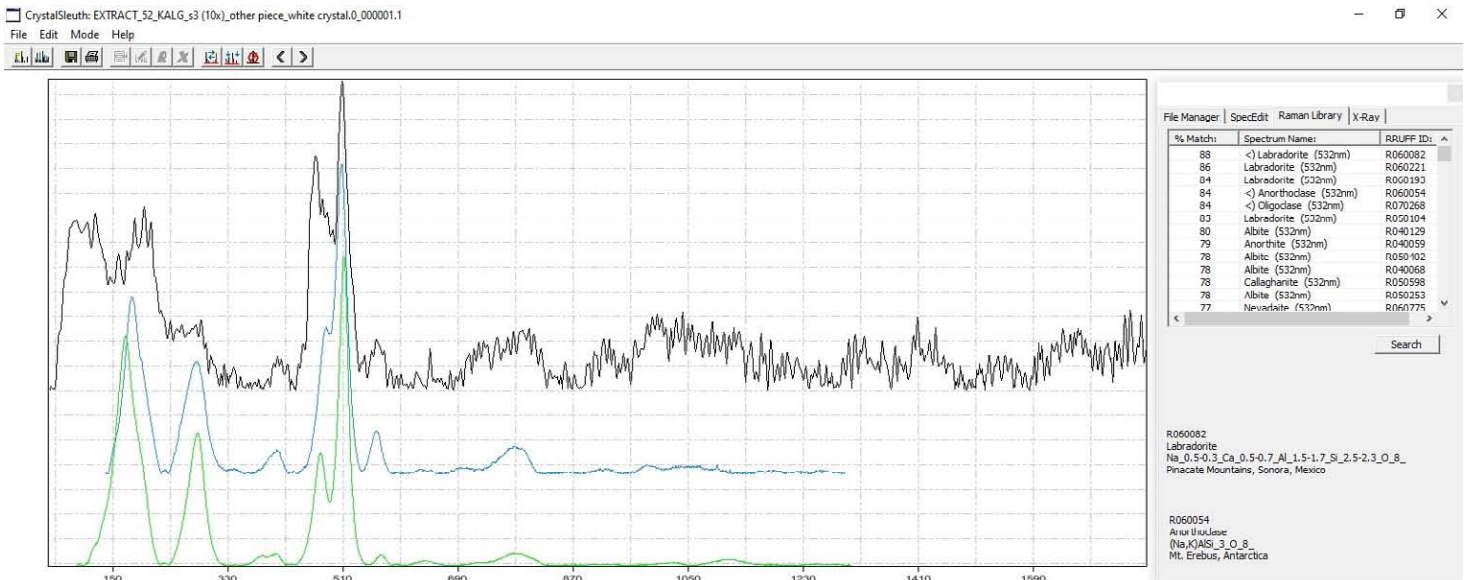
Sample :



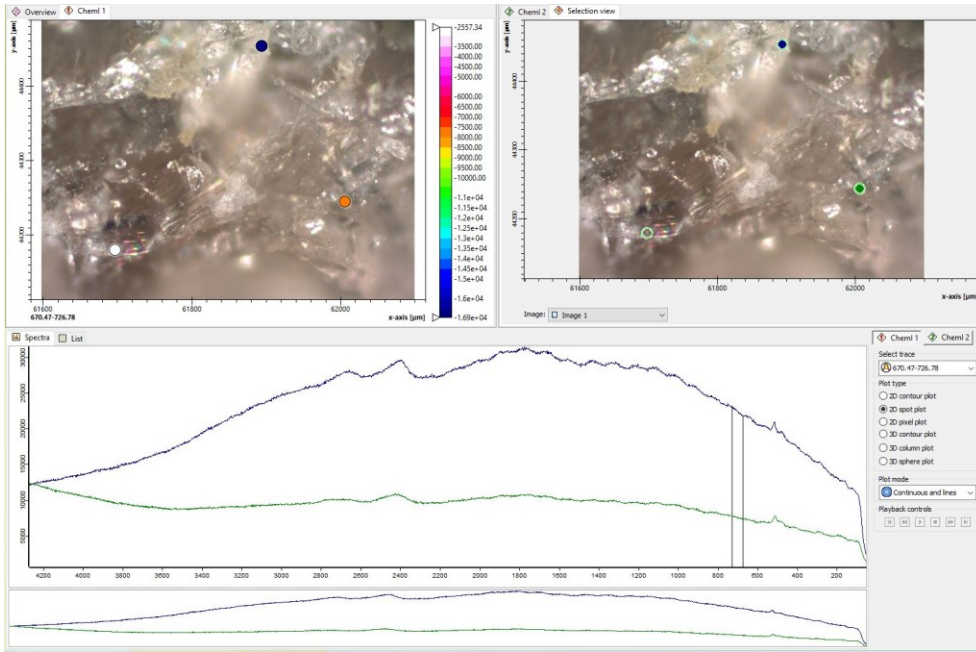
Sample Site 52 : Stone 3-B_spectra 4 (white mineral) indicates : Labradorite_Anorthoclase (→ RRUFF_CS)



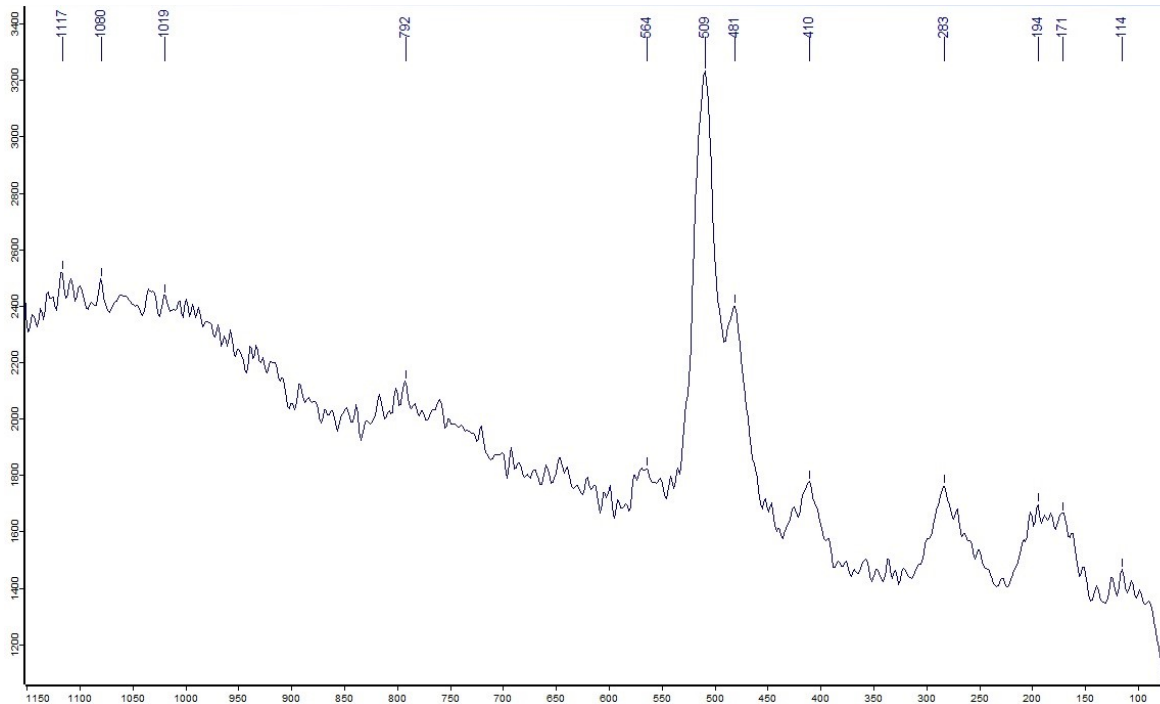
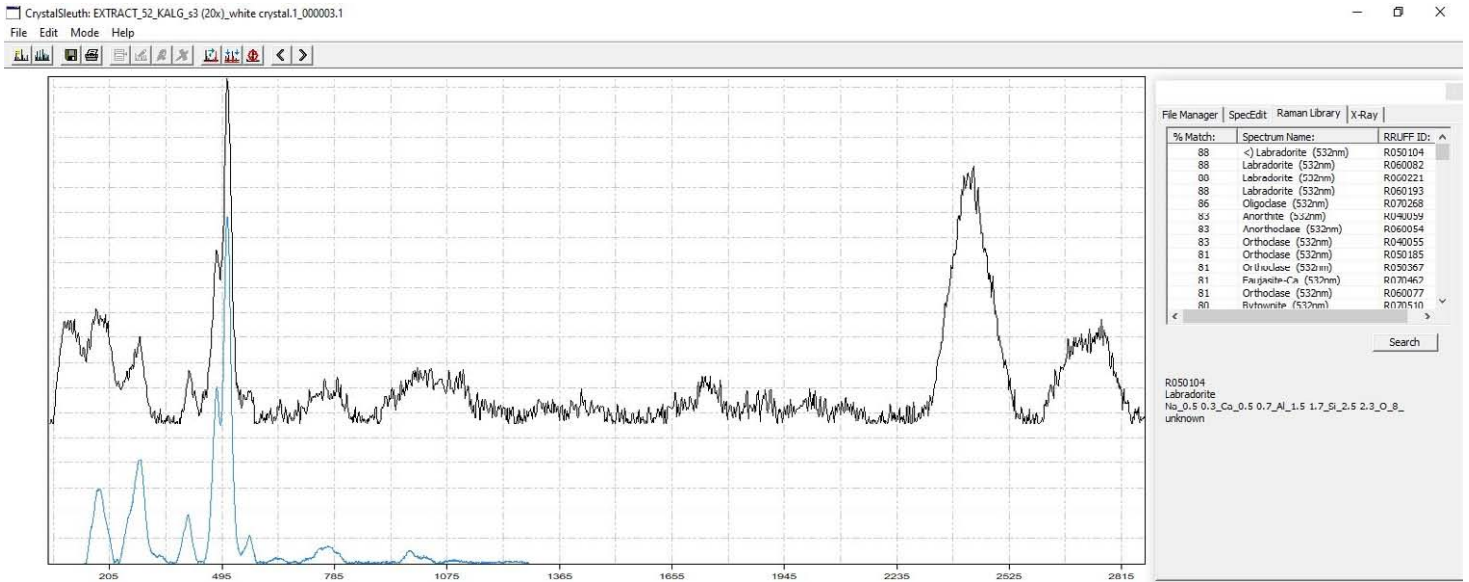
Sample :



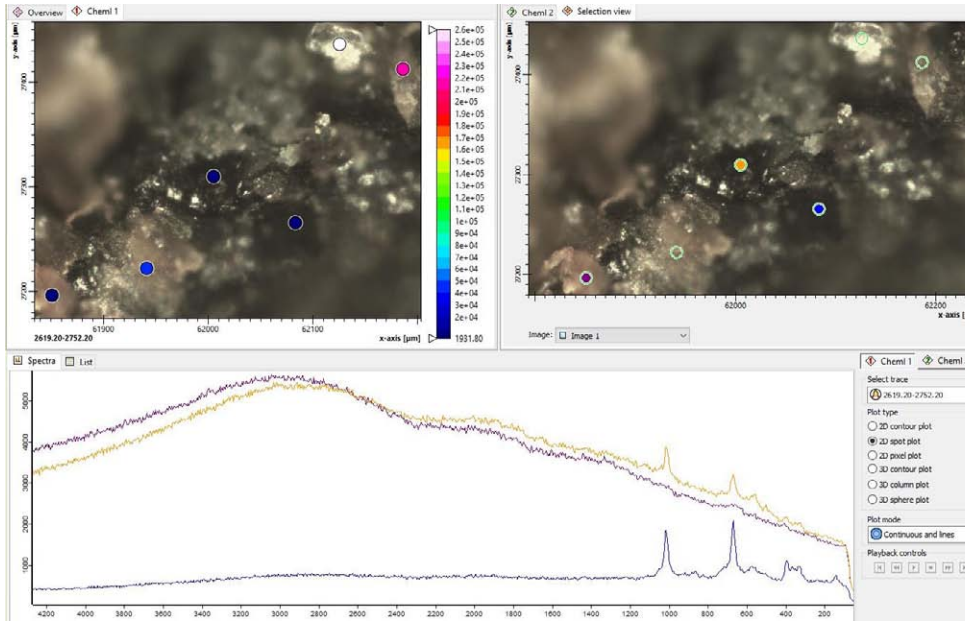
Sample-Site 52 : Stone 3-B_spectra 5 (white mineral) indicates : Labradorite (→ RRUFF_CS)



Sample :



Sample-Site 50 : Stone 2_spectra 3 indicates : **Augite, Diopside, Johannsenite** (→ see RRUFF_CS results)

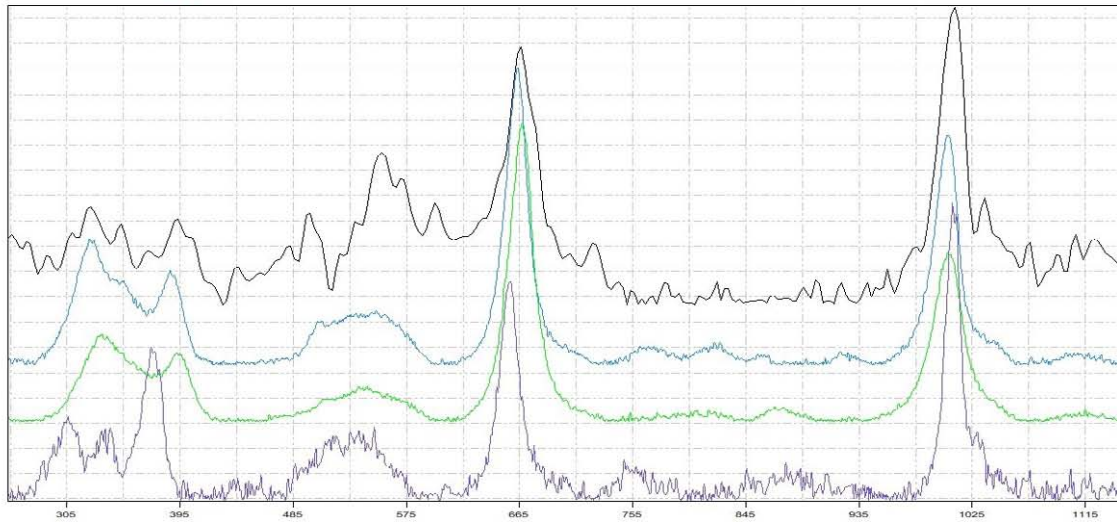


Sample :



CrystalSleuth: EXTRACT_KALG-50-51 (1)_2_000003.0

File Edit Mode Help

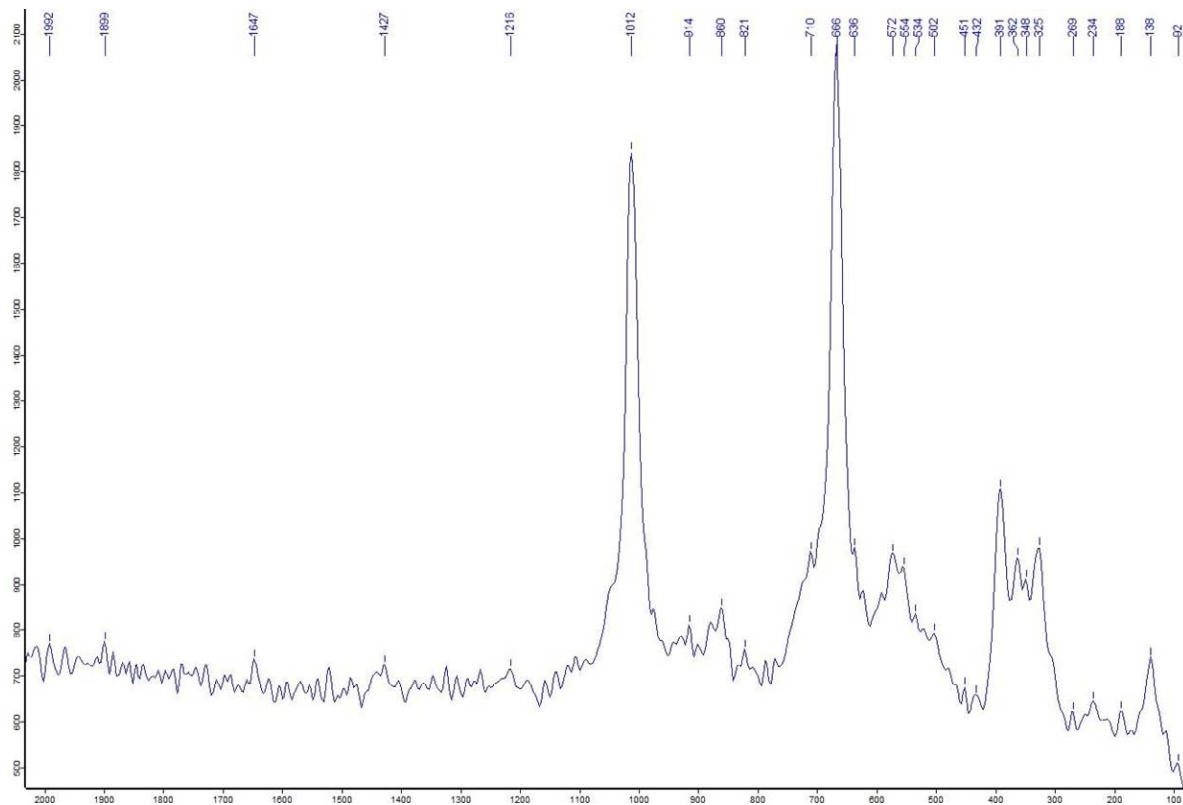


% Matrix	Spectrum Name	RRUFF ID
85	<1> Augite (532nm)	R061108
85	<1> Diopside (532nm)	R060861
83	Augite (532nm)	R070231
83	Diopside (532nm)	R060085
82	Augite (532nm)	R061086
82	Diopside (532nm)	R050496
81	<1> Johannsenite (532nm)	R070521
79	Diopside (532nm)	R070123
79	Pargasite (532nm)	RU40097
78	Pargasite (532nm)	R060632
78	Pectolite (532nm)	R070207
77	Diopside (532nm)	R060646
77	Kanite (532nm)	R061134

R061108
 Augite
 Ca₂Mg₅Fe₂(Si₈Al)₂O₂₂F₂
 Monti Rossa, near Mt. Etna, Sicily, Italy

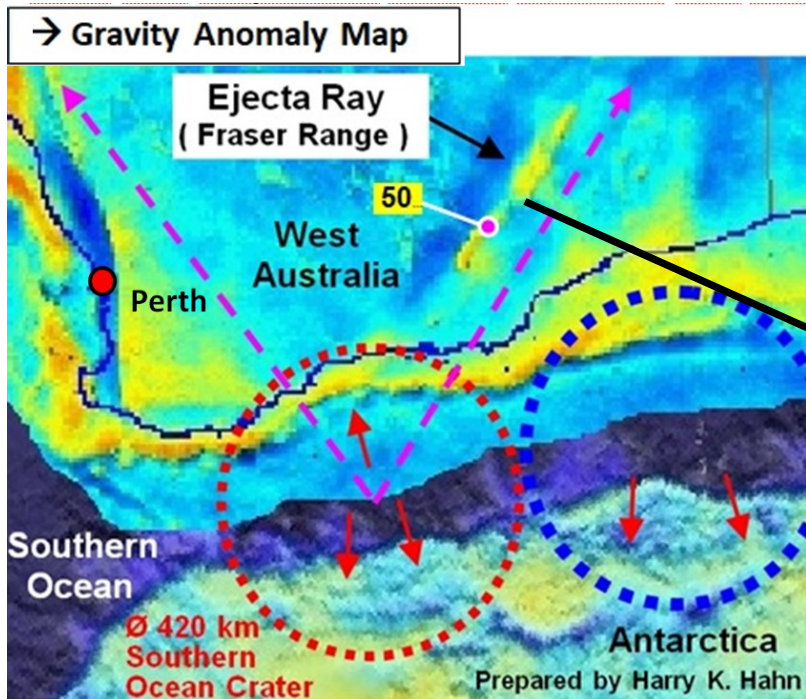
R060861
 Diopside
 CaMgSi₂O₆
 Red Mountain Volcano, NW of Flagstaff, Arizona, USA

R070521
 Johannsenite
 CaMnSi₂O₆
 Campiglia, near Siena, Tuscany, Italy



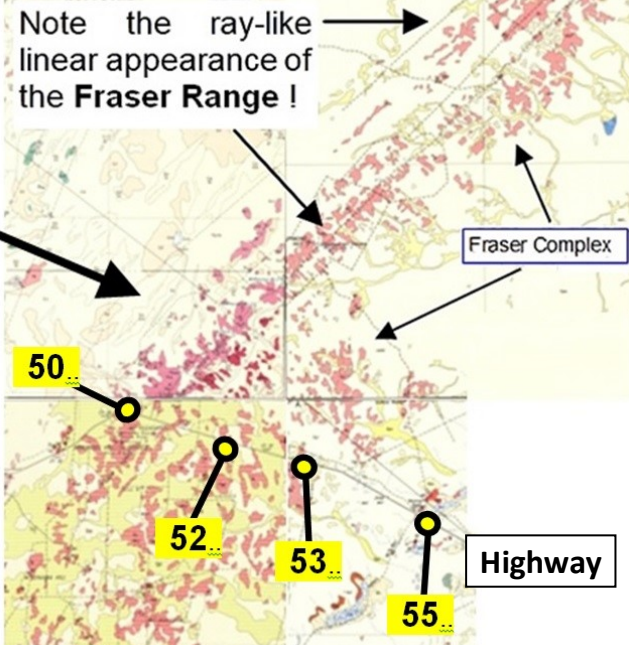
Appendix 1 : Photos of rock samples from sample sites 50 to 55 → see next page !

Note : Photos of all Samples Sites **50, 52, 53** and **55** and other sample sites are available on my website. → see : [Sample Sites - Ejecta Ray of the 420 km SOC](#)



Geological Map with Sample Sites 50 to 55

→ 4 Geological Maps joined together



Geological Maps :
→ go to : "Geology" – 1:250K maps
then select : Norseman / Balladonia

Sample site 50 is accessible from the Highway. It is part of the Fraser Range and it is elevated ≈ 30 m above the sediment area. It seems to consist of one coherent mass of solidified material (ejecta from the SOC ?) It consists of onion-like layers of rock. Similar areas like this can be found in the Cooktown-area near the Cape York Crater ! Note : site 50 lies on a fenced pasture. Permission may be required !



Photos of all Samples Sites **50, 52, 53** & **55** and other sites are available here : [Sample Sites - Ejecta Ray of the 420 km SOC](#)



50

50 32° 0.712 S | 122° 47.863 E | 20 m | West-Australia (SW)_Kalgoorlie area

Sample site 52 → a big (ejecta?) boulder →



52

52 32° 2.532 S | 122° 55.818 E | West-Australia (SW)_Kalgoorlie area



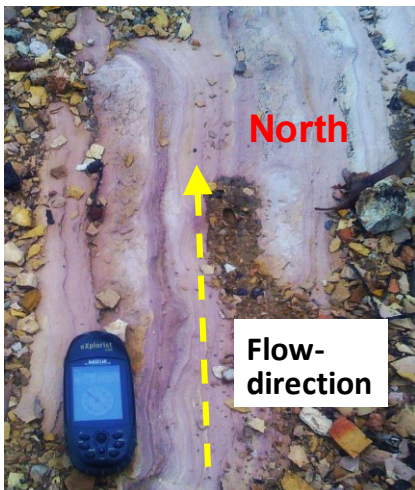
55 (1)

The ground on sample site 55 seems to mainly consist of one coherent mass of ceramic-like material with linear flow-texture and a low density like wood ! Flow direction along Center Line of Fraser Range !

Please read the analysis to this material on page 14 & 15



55 (2)



Appendix 2 : A short overview : The Raman bands (peaks) of Quartz shocked with 22-26 GPa

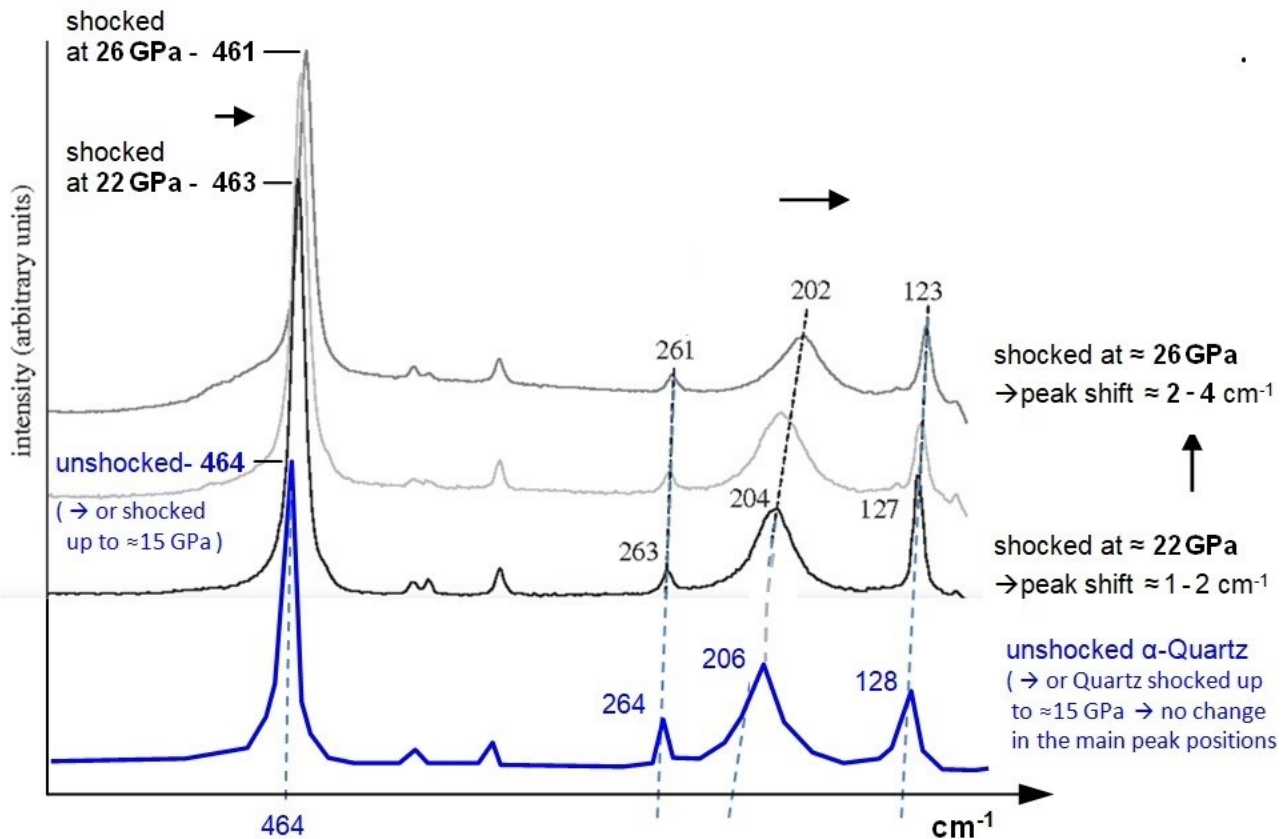
In order to verify a sample site as an impact site or impact structure, [shock-metamorphic effects](#) must be discovered in the rocks of the sample site. This can be done by different methods.

For example with the help of PDFs (planar deformation features) which are visible in the quartz with the help of a microscope. However this requires careful preparation of the samples and expertise.

Another, easier method, is the use of a RAMAN microscope. Micro-RAMAN Spectroscopy on quartz grains in the samples can provide the first evidence for a shock event, that was caused by an impact.

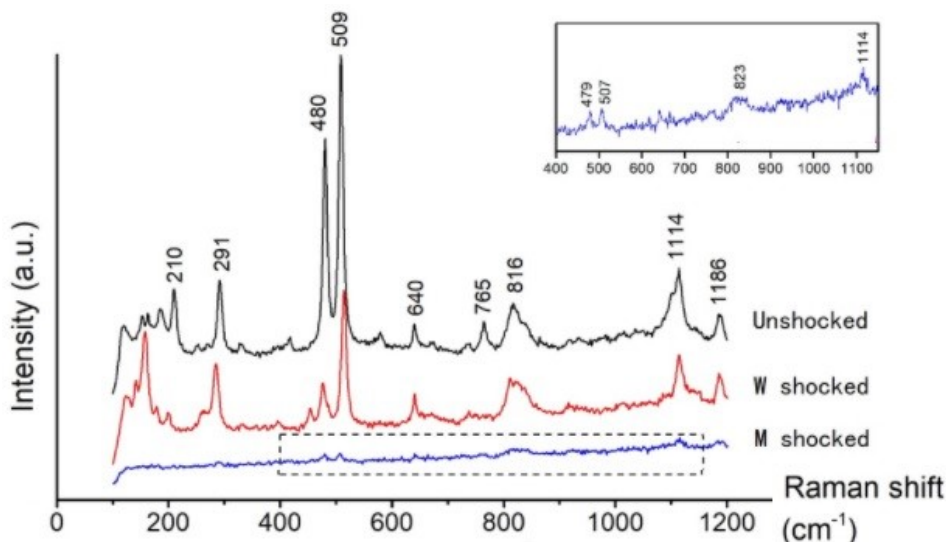
Mc Millan et al. (1992) and others have shown that the main RAMAN-peaks of Quartz shift towards lower frequencies if the Quartz was exposed the a shock-pressure > 15 GPa. → see diagram below

The shift of the main quartz RAMAN-peaks can be used to identify quartz that was shocked by an impact



Quartz shocked with 22 GPa and 26 GPa shows shifts of the main RAMAN-peaks of 1 - 4 cm⁻¹ to lower frequencies

Appendix 3 : Raman spectra of (W) weakly-shocked & (M) moderately-shocked Alkali-Feldspar



Weakly shocked alkali feldspar mainly developed irregular fractures and undulatory extinction. Note that the Raman-lines 210 and 765 are missing in the w-shocked feldspar, and an additional line at ≈ 150 appears.

The shock pressure for the w-shocked feldspar was estimated to be between 5 and 14 GPa

References :

Photos of all Sample Sites & Rock Samples: → weblink: [Sample Sites - Ejecta Ray of the 420 km SOC](#) (or: [here](#))

The Permian-Triassic (PT) Impact hypothesis - by Harry K. Hahn - 8. July 2017 :

Part 1: [The 1270 X 950 km Permian-Triassic Impact Crater caused Earth's Plate Tectonics of the Last 250 Ma](#)

Part 2: [The Permian-Triassic Impact Event caused Secondary-Craters and Impact Structures in Europe, Africa & Australia](#)

Part 3: [The PT-Impact Event caused Secondary-Craters and Impact Structures in India, South-America & Australia](#)

Part 4: [The PT-Impact Event and its Importance for the World Economy and for the Exploration- and Mining-Industry](#)

Part 5: [Global Impact Events are the cause for Plate Tectonics and the formation of Continents and Oceans \(Part 5\)](#)

Part 6: [Mineralogical- and Geological Evidence for the Permian-Triassic Impact Event](#)

Alternative weblinks for my Study **Parts 1 - 6 with slightly higher resolution** : [Part 1](#), [Part 2](#), [Part 3](#), [Part 4](#), [Part 5](#), [Part 6](#)

Parts 1 – 6 of my PTI-hypothesis are also available on my website : www.permiantriassic.de or www.permiantriassic.at

The geological framework of the Albany-Fraser (Range) Orogen - weblink to lecture → : [Slide 1 \(dmp.wa.gov.au\)](http://Slide1(dmp.wa.gov.au))

Information about a mining project for the mining of Nickel, Copper and Gold in the Fraser Range:

1.) [Australian exploration - Orion Minerals](#)

2.) [Fraser Range Project | Orion Minerals | Nickel-copper & gold project, Australia](#)

Shock-metamorphic effects in rocks and minerals - <https://www.lpi.usra.edu/publications/books/CB-954/chapter4.pdf>

Shock metamorphism of planetary silicate rocks and sediments: Proposal for an updated classification system

Stöffler - 2018 - Meteoritics & Planetary Science – Wiley: <https://onlinelibrary.wiley.com/doi/epdf/10.1111/maps.12912>

A Raman spectroscopic study of shocked single crystalline quartz - by P. McMillan, G. Wolf, Phillippe Lambert, 1992

<https://asu.pure.elsevier.com/en/publications/a-raman-spectroscopic-study-of-shocked-single-crystalline-quartz>

alternative : <https://www.semanticscholar.org/paper/A-Raman-spectroscopic-study-of-shocked-single-McMillan-Wolf/cfaaf6eb3e46fbd2912fb91c7acf40e88e721132>

Raman spectroscopy of natural silica in Chicxulub impactite, Mexico - by M. Ostroumov, E. Faulques, E. Lounejeva

https://www.academia.edu/8003100/Raman_spectroscopy_of_natural_silica_in_Chicxulub_impactite_Mexico

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