

The Ø 20 x 15 km Tejada Crater on Gran Canaria (Canary Islands)

- RAMAN Spectra of selected Rock Samples -

by Harry K. Hahn / Germany - 16.3.2022

Summary :

Here a summary of the Raman-spectroscopic analysis a of rock-samples which I have collected near the Ø 20 x 15 km "Tejada Impact Crater" on Gran Canaria, and on other interesting sites on the Island.

The Gravity Anomaly Map of the Canarian Islands indicates a large scale Impact Event. This impact event probably was the result of Ejecta from the PTI (Permian Triassic Impact) which formed a large secondary crater, the hypothetical Ø 430 x 290 km Gibraltar Crater (GIC). (see gravity anomaly map on the next page). The smaller elliptical impact craters indicated on this Gravity Anomaly map, as negative anomalies offshore of the Islands Fuerteventura, Teneriffa and Lanzarote, belong to this impact event and are located along the hypothetical crater-wall (-rim) of the GIC. A magnetic anomaly map of the Atlantic Ocean-floor south-west of Spain provides indication for this Ø 430 x 290 km Gibraltar Crater. (→ explanation on pages 28 & 29 of my PT Impact Hypothesis: Part 2 (or here: P2))

The hot spots which caused the Canary Islands originally were impact sites of large ejecta fragments, which were ejected from the Permian Triassic Impact (PTI) Crater in the Arctic Sea.

And I am sure that these impact sites (hot spots) were produced by the same large-scale secondary impact event (caused by the PTI), which also has formed the Bay of Lyon Crater (or BLC) and other impact structures in Spain (or L2). Also read about the Ø 13,5 x 10 km Ajuy Crater on Fuerteventura.

On Gran Canaria one of the ejecta fragments of the PTI has formed an elliptical impact crater which is located nearly in the center of the island. But even if this secondary crater of the PTI is easy accessible, it will be difficult to provide proof for this impact crater, because of the relatively low impact pressure which only has caused weak shock-metamorphic effects and because the hotspot that was caused by the impact has erupted massive amounts of magma (lava) over the last ~250 Myrs and covered the original impact structures. To provide clear evidence for this impact crater it probably will be necessary to drill deep into the crater-wall of the Tejada Crater and get drill-core samples from a few km depth.

In all rock samples which I have collected no quartz was found. Therefore it will be difficult to provide first proof for this secondary impact of the PTI, with this Raman spectroscopic analysis of some samples

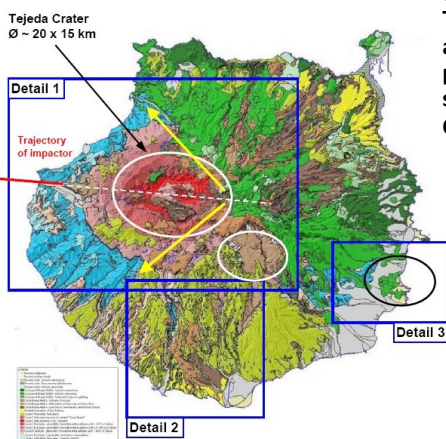
Some of the analysed feldspar-samples may show Raman-spectra which indicate (W)-weakly-shocked or (M)-moderately-shocked Feldspar. The Raman-spectra from the following sample sites No.: 15-A, 23, 28, 32 & 33 may indicate shocked feldspar-minerals. These Raman-spectra must be further analysed by experts with the experience to correctly assess such spectra. (→ explanation to Raman-spectra of shocked Feldspar : see at page 30 in the Appendix 3) Beside possible shocked feldspar minerals other minerals, e.g. a number of iron-bearer-minerals found on the island, may also indicate an impact event. Minerals found in the analyses : Albite, Anorthoclase, Augite, Corvusite, Coyoteite, Cronstedtite, Hollandite, Labradorite, Magnetite, Microcline, Oligoclase, Orthoclase, Tengerite, etc.

→ Images of the analysed rock samples and photos of the sample sites are in the Appendix at page 21

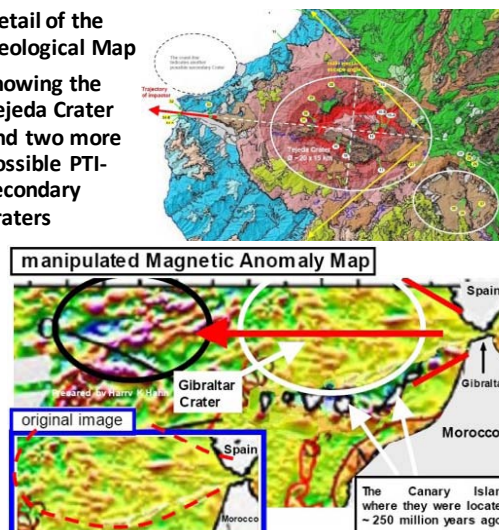
→ A general summary to all analysed samples regarding my PTI-hypothesis (P1) → in Part 6 (P6)

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

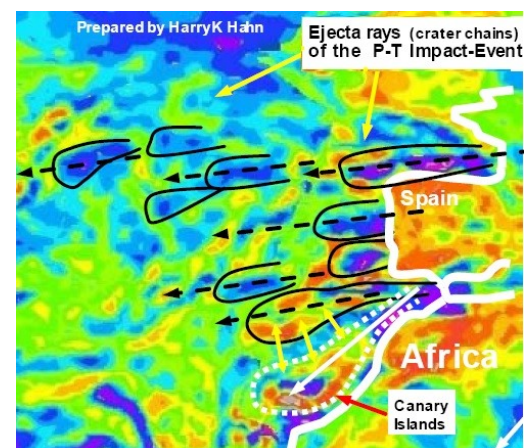
Geological Map of Gran Canaria with the possible Tejada Crater marked on the map



Detail of the Geological Map showing the Tejada Crater and two more possible PTI-secondary Craters



Gravity Anomaly Map of the Canarian-Island-area



The Ø 20 x 15 km Tejeda Crater on Gran Canaria

The geological map and the topographic map of the Island Gran Canaria indicate an Impact Event.

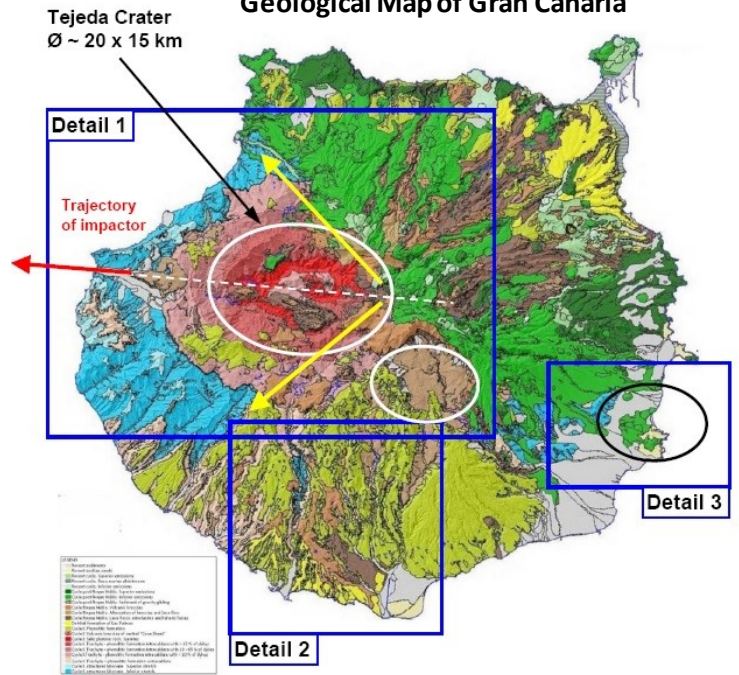
This is the Ø 20 x 15 km hypothetical **Tejeda Crater**, which is located nearly in the center of the Island. The village Tejeda is located inside this crater. The current believe that this precise elliptical crater-structure is the caldera of a large inactive volcano probably isn't correct !

I want to refer here to the other decribed elliptical impact craters on the Islands Tenerife and Fuerteventura, which in all probability were caused by ejecta-fragments from the Permian-Triassic-Impact (PTI). These elliptical crater-structures are all located offshore of these islands.

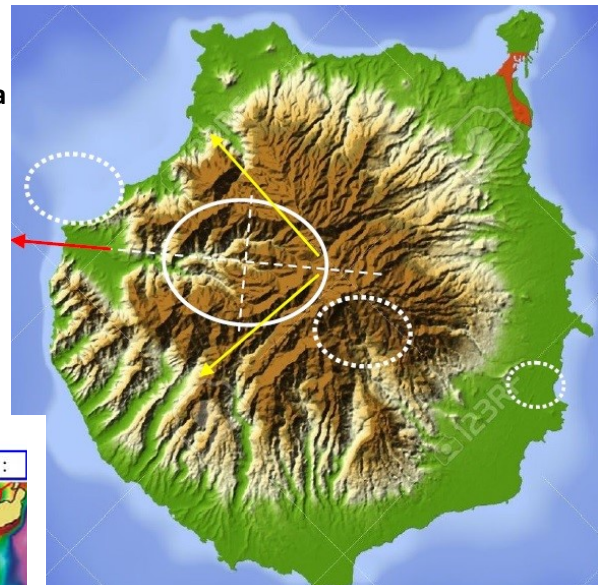
And the gravity anomaly map clearly indicates elliptical-shaped negative (blue) gravity anomalies (see map below) But even if this probable secondary-crater of the PTI is easy accessible in the center of Gran Canaria, it will be difficult to provide proof for this impact crater, because of the relatively low impact pressure which only has caused weak shock-metamorphic effects and because the hotspot that was caused by this impact has erupted massive amounts of magma (lava) over the last ~250 Myrs and covered the original impact crater with thick layers of lava. To provide clear evidence for the impact crater it probably will be necessary to get drill-core samples from deep inside the crater-walls of the Tejeda Crater.

The Raman-spectra of the analysed rock-samples may provide first indication for an impact event. Shocked feldspar may be present on the **sample sites 23, 28, 32, 33**

Geological Map of Gran Canaria

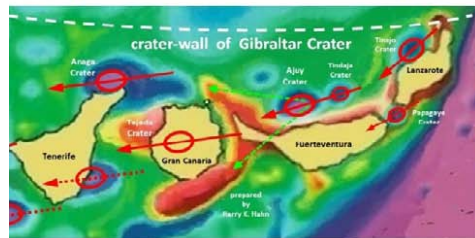


Topographic Map of Gran Canaria



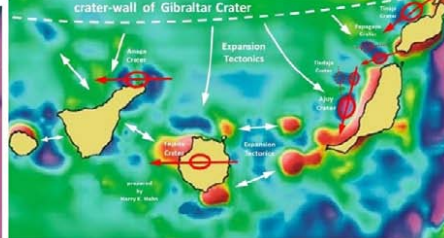
→ Islands locations shortly after the PTI - impact event :

manipulated Gravity Anomaly Map :



→ original Gravity Anomaly Map :

Gravity Anomaly Map – Canary Islands (today) :



The Gravity Anomaly Map of the Canarian Islands indicates a large scale Impact Event

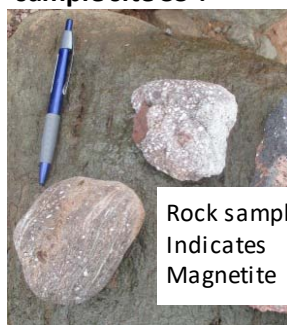
Different types of feldspar-breccia on **sample site 32** (pebbles on the beach, west of the Tejeda Crater)



Rock of the crater-wall of the Tejeda Crater on **sample site 28 :**



Rock samples from the tip of the outflow-tongue from the Tejeda Crater on **sample site 33 :**

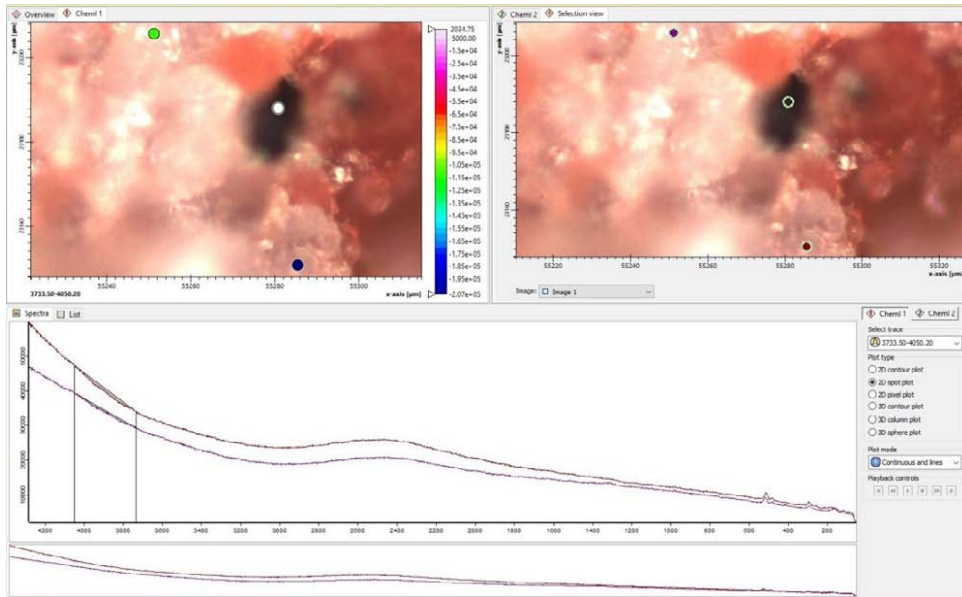


Rock sample Indicates Magnetite



Sample Site **15-A** : Stone 1_spectra 1 indicates : **Anorthoclase, Albite**

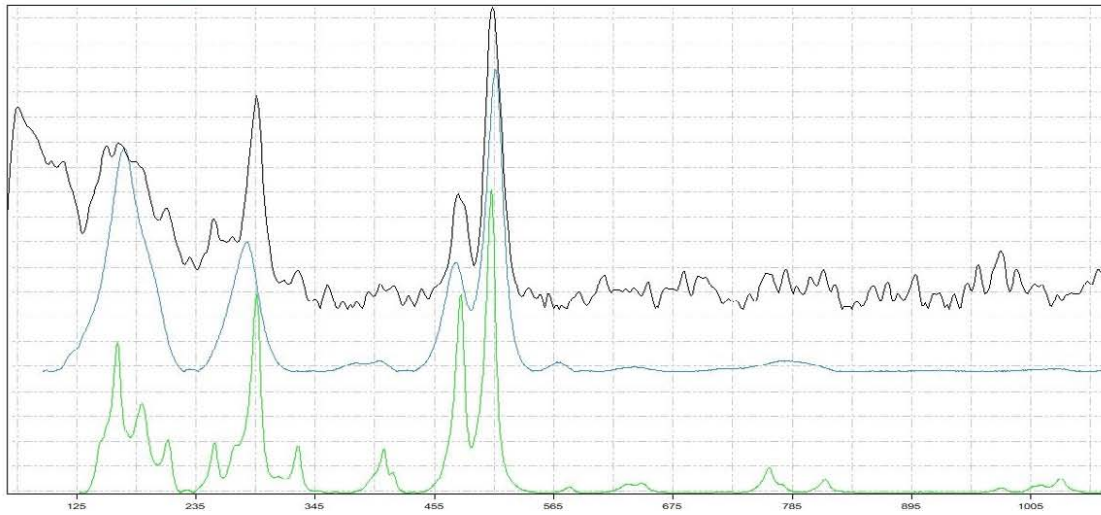
(→ see RRUFF_CS results)



Sample :



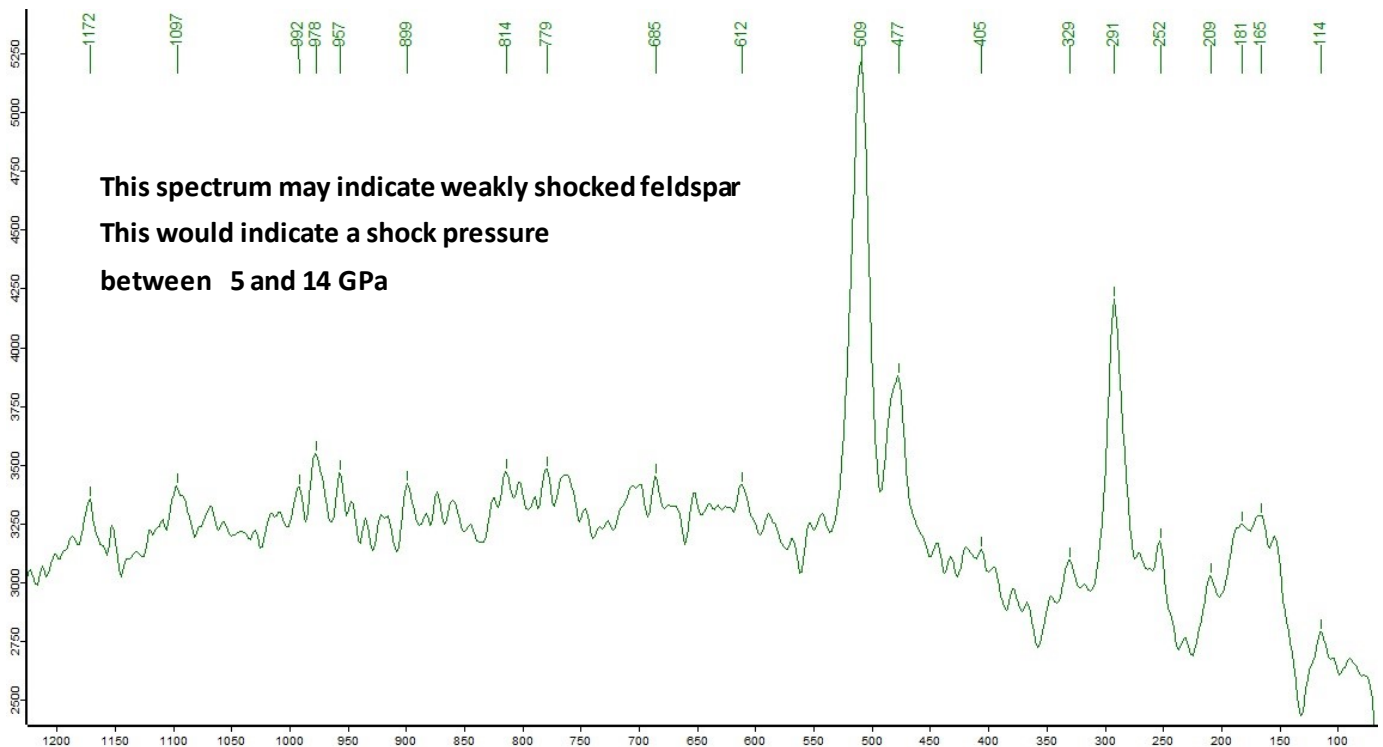
CrystalSleuth: EXTRACT_15-A-GC (Sp)_ZZ_1 (rosa Stein)_0_000000_0_NK_V_G1
File Edit Mode Help



% Match	Spectrum Name	RRUFF ID
77	Anorthoclase (532nm)	R060054
74	Albite (532nm)	R050402
73	Albite (532nm)	R010068
72	Labradorite (532nm)	R060082
71	Orthoclase (532nm)	R060077
70	Albite (532nm)	R040129
69	Oligoclase (532nm)	R070268
69	Orthoclase (532nm)	R050367
67	Labradorite (532nm)	R050104
67	Albite (532nm)	R050253
66	Labradorite (532nm)	R060193
66	Radialite (532nm)	R070044
66	Orthoclase (532nm)	R040055

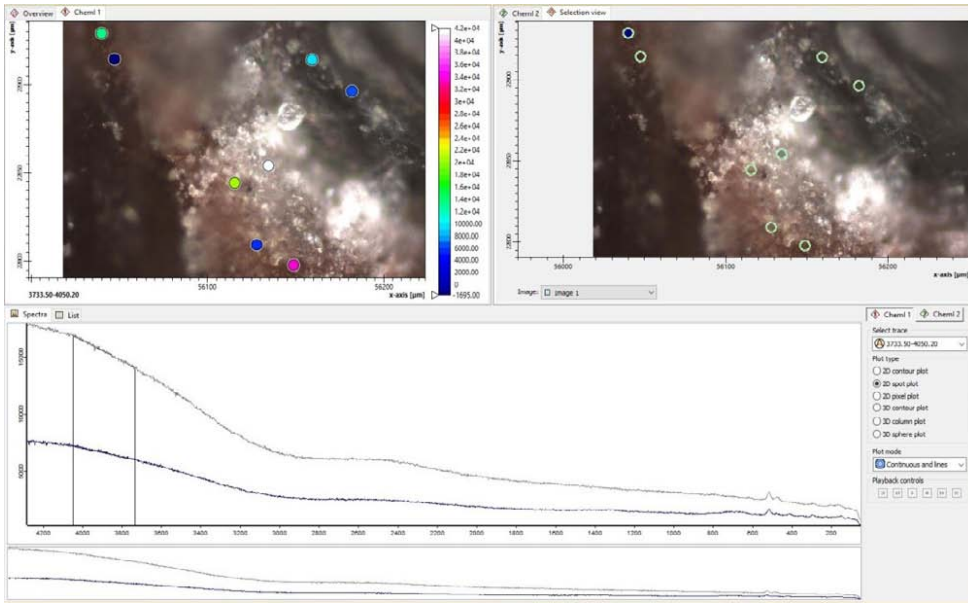
R060054
 Anorthoclase
 (Na,K)AlSi₃O₈
 Mt. Erebus, Antarctica

 R050402
 Albite
 NaAlSi₃O₈
 Urbano mine, Golconda District, Brazil

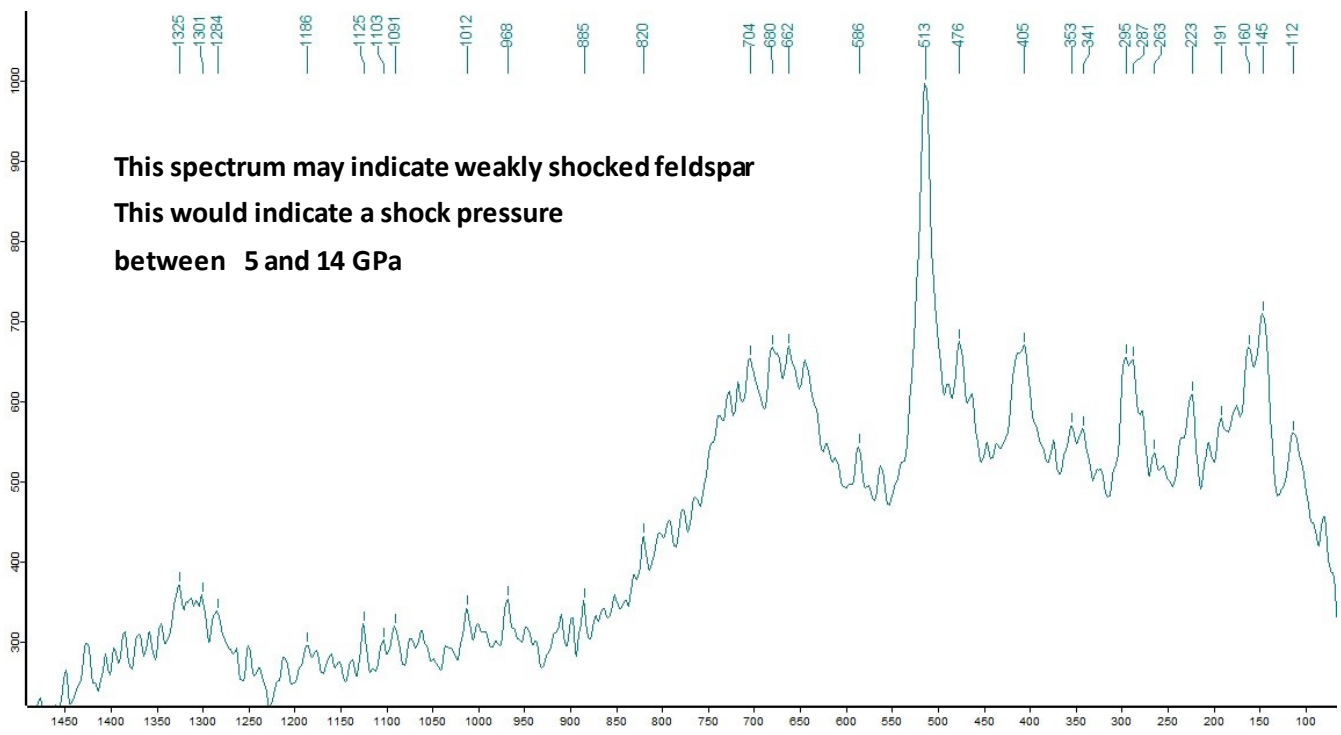
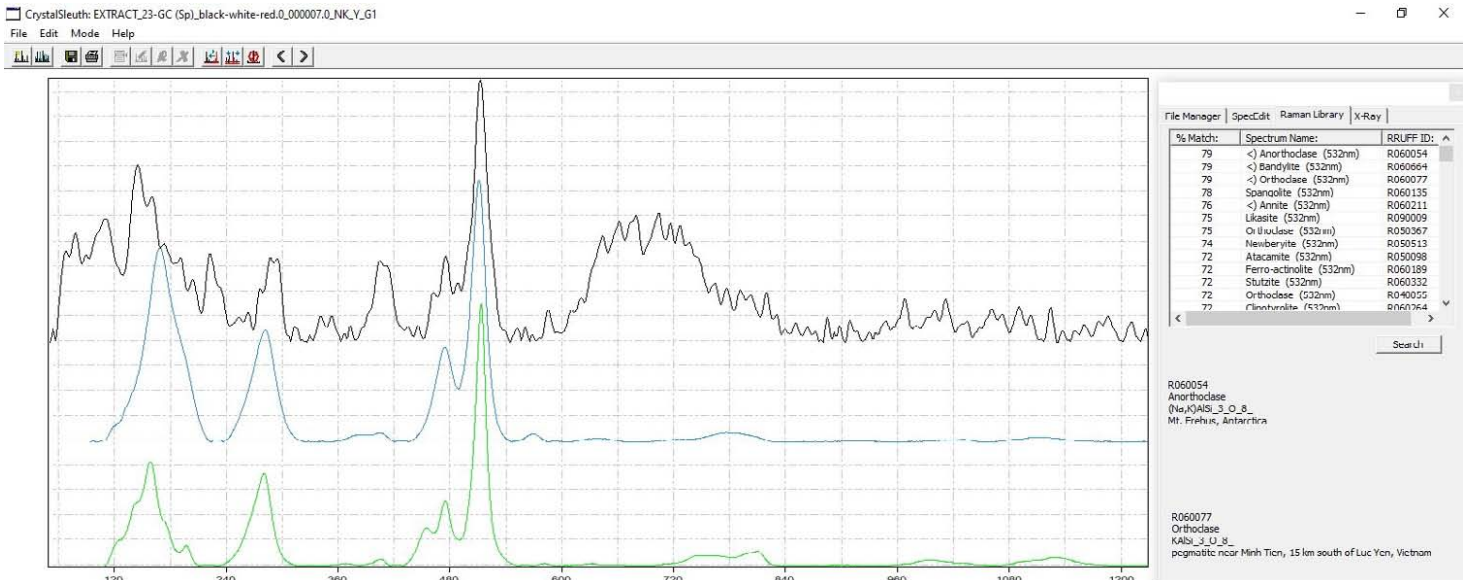


**This spectrum may indicate weakly shocked feldspar
This would indicate a shock pressure
between 5 and 14 GPa**

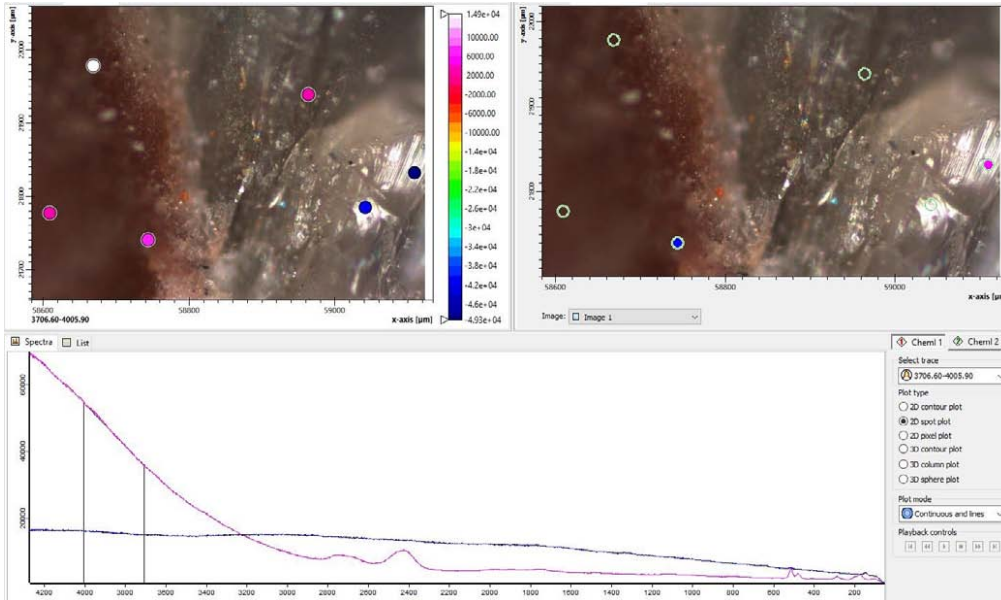
Sample Site **23** : Stone 1_spectra 1 indicates : **Anorthoclase, Orthoclase** (→ see RRUFF_CS results)



Sample :



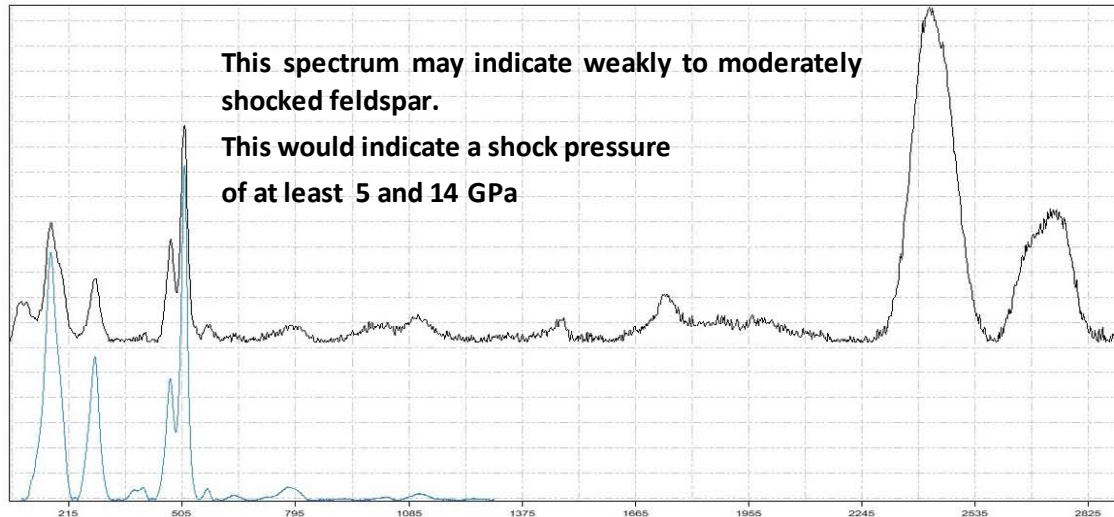
Sample Site **23** : Stone 2_spectra 1 indicates : **Anorthoclase** (→ see RRUFF_CS results)



Sample :

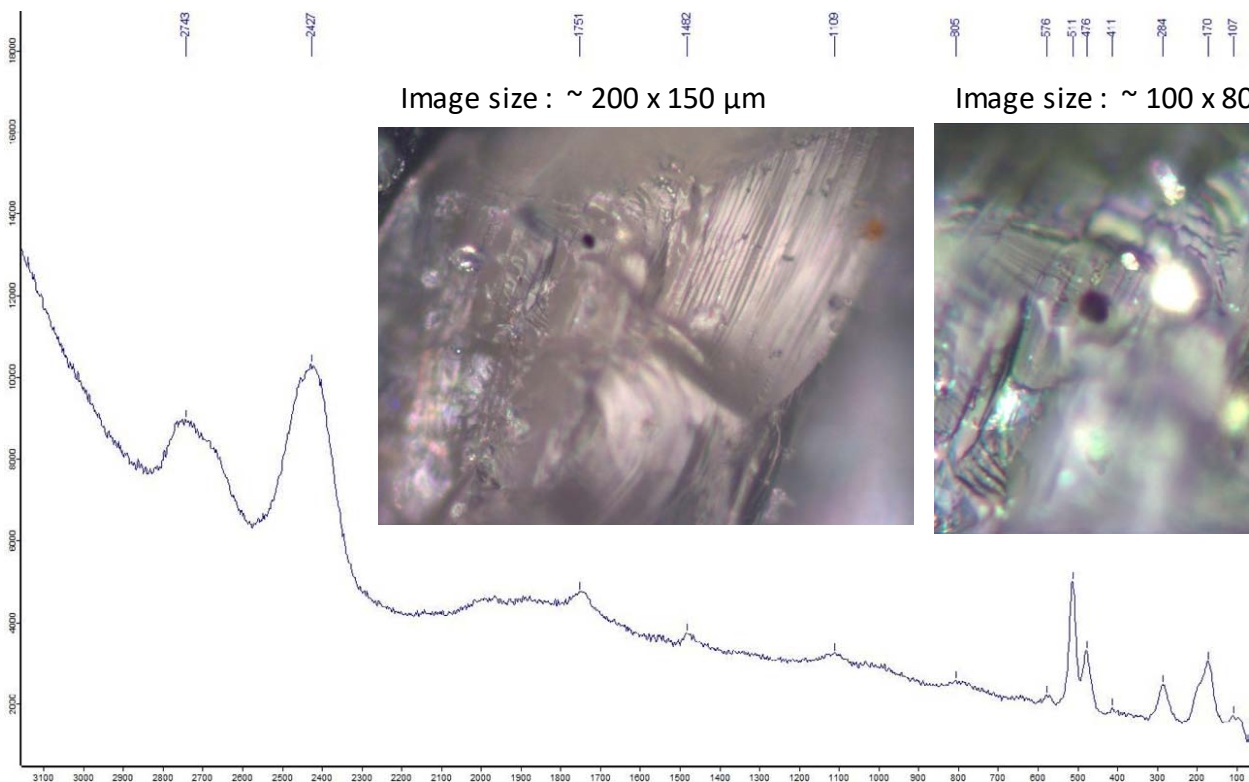


CrystalSleuth: EXTRACT_GRAN_23_weisser-rötlicher Breccia Stein_0_000000.1
File Edit Mode Help



% Match	Spectrum Name	RRUFF ID
97	Anorthoclase (532nm)	R060054
93	Labradorite (532nm)	R060082
89	Labradorite (532nm)	R050104
89	Orthoclase (532nm)	R060077
89	Oligoclase (532nm)	R070268
88	Labradorite (532nm)	R060193
87	Orthoclase (532nm)	R040055
07	Labradorite (532nm)	R060221
86	Orthoclase (532nm)	R050367
86	Albite (532nm)	R050402
85	Orthoclase (532nm)	R050185
85	Albite (532nm)	R040068
81	Albite (532nm)	R040179

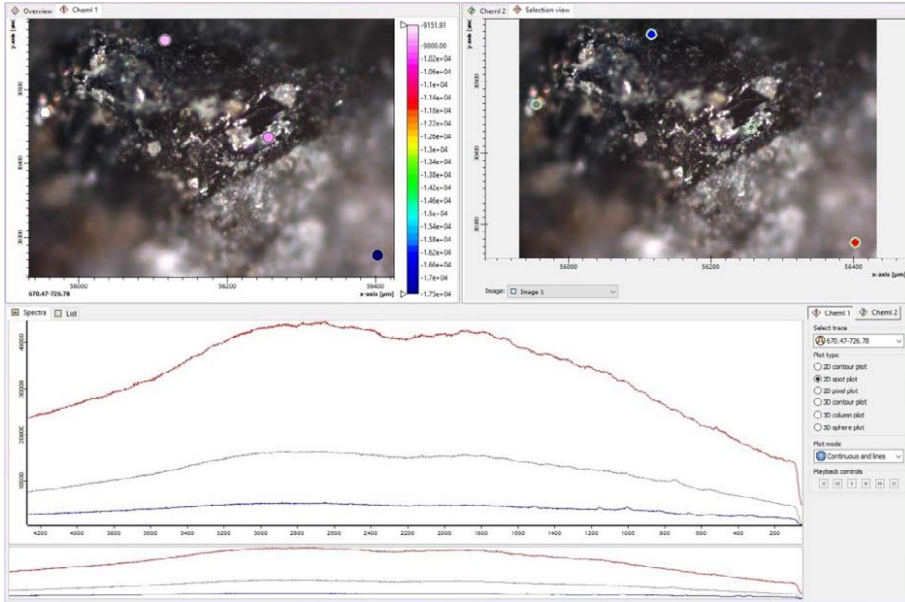
R060054
Anorthoclase
(Na,K)AlSi₃O₈
Mt. Erebus, Antarctica



Sample Site 25 : Stone 1_spectra 1 (dark mineral inclusions) indicates : **Augite** (→ see RRUFF)

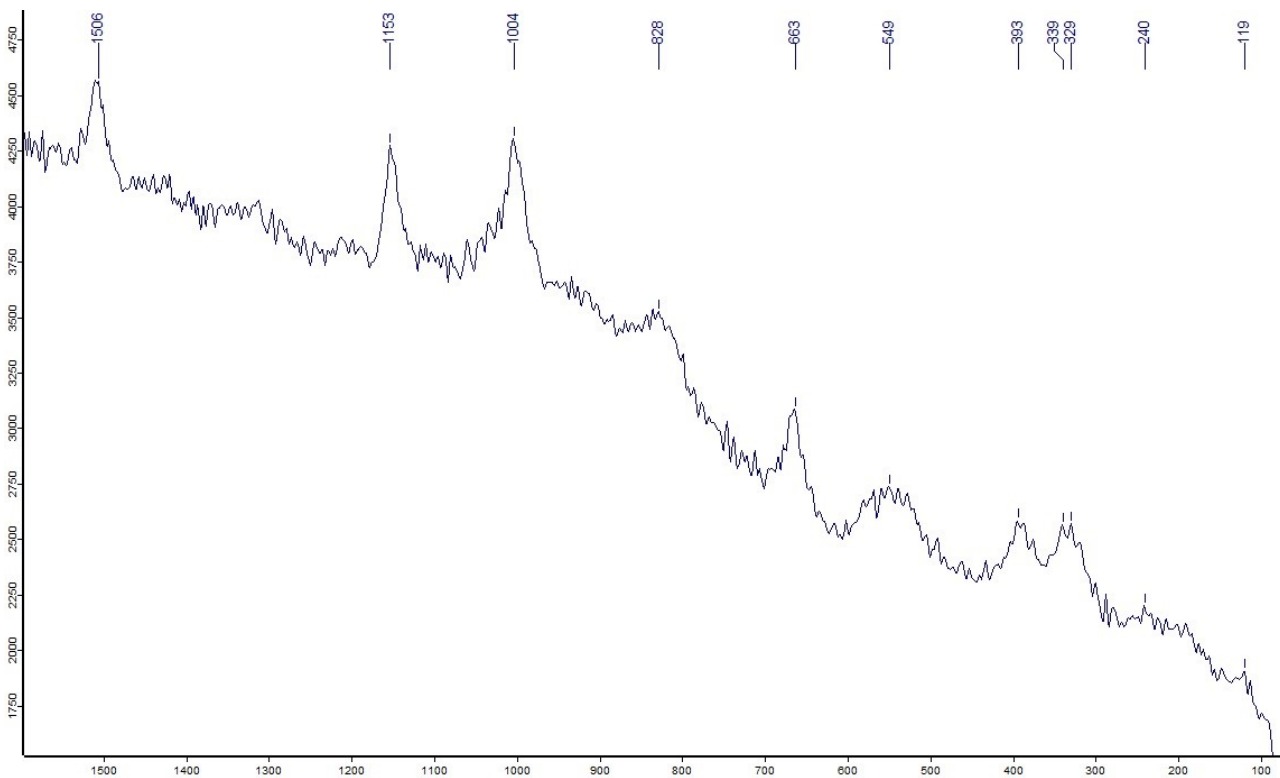
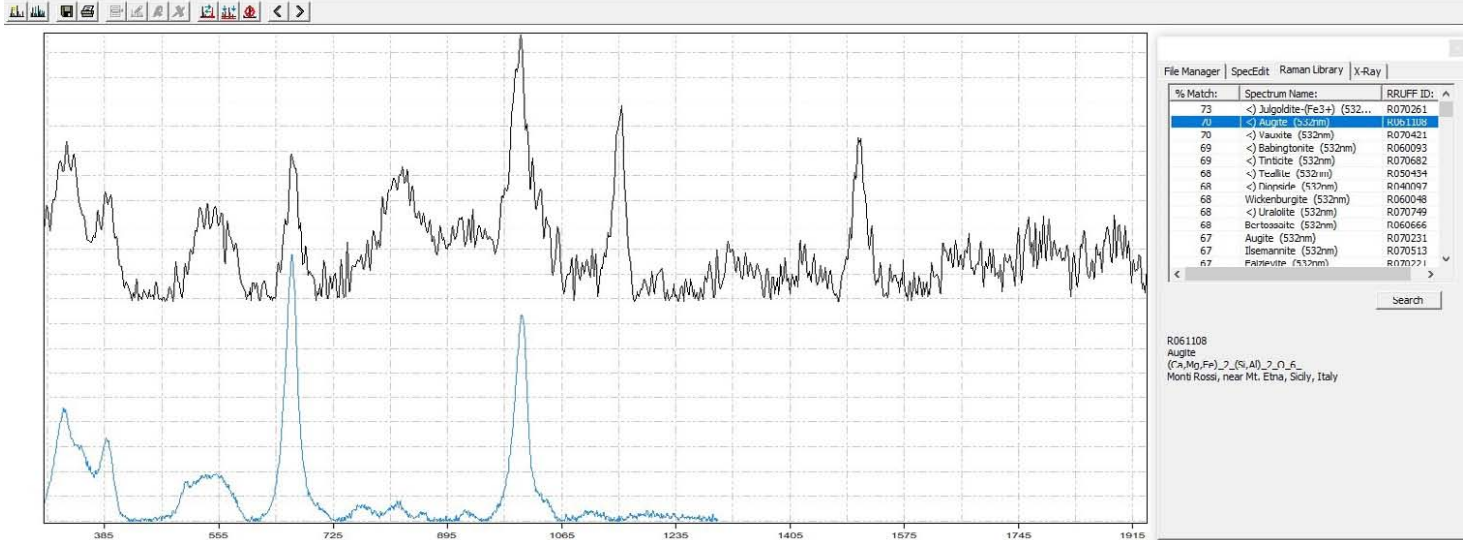
possible Iron-bearer mineral

Sample :

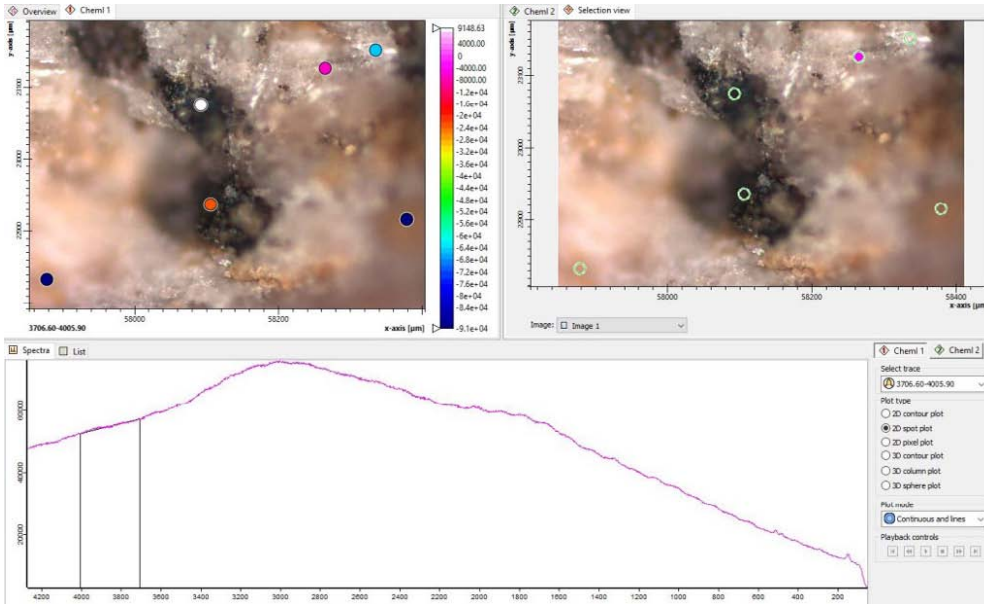


CrystalSleuth: EXTRACT_25_GRAN 2 (10x)_21_000000.0

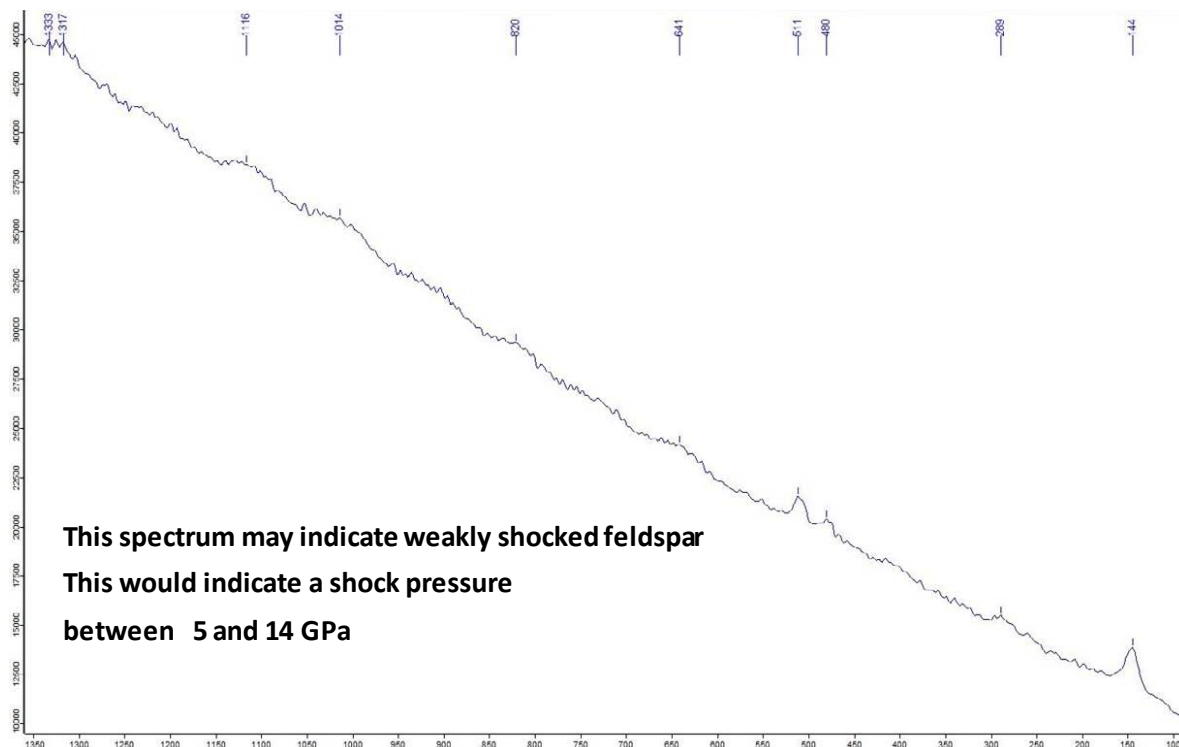
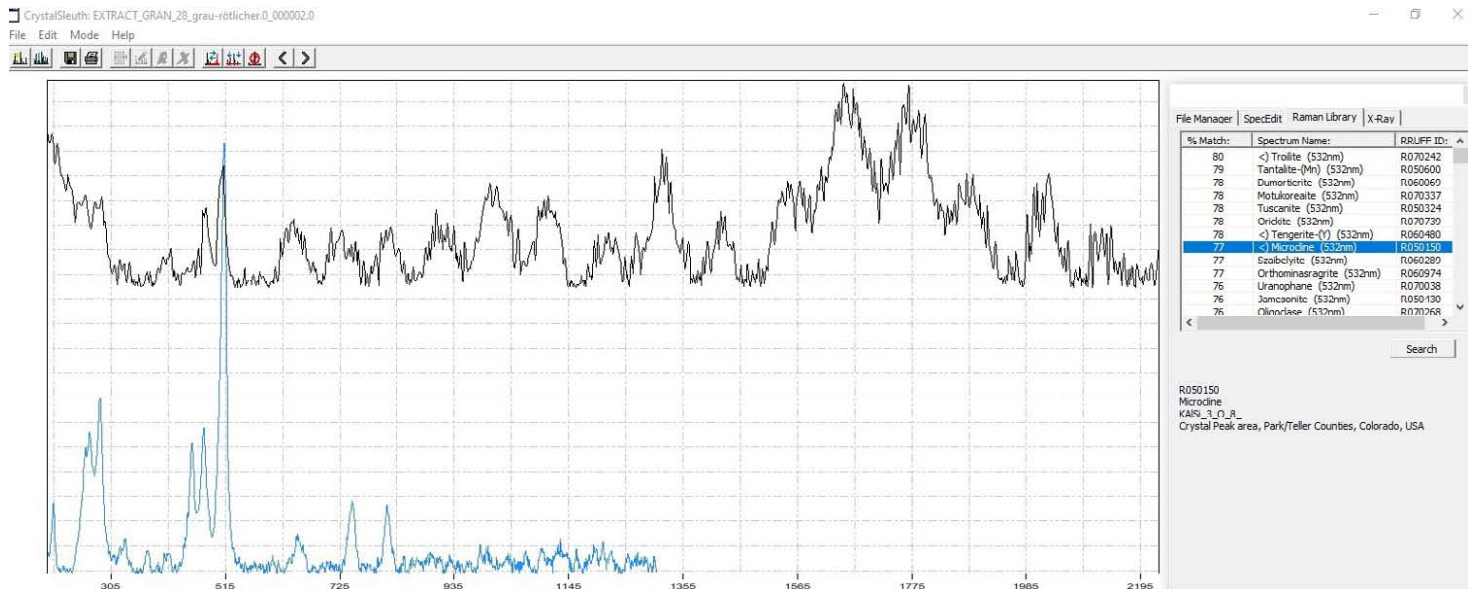
File Edit Mode Help



Sample Site **28** : Stone 1_spectra 1 indicates : **Microcline** (→ see RRUFF_CS results)



Sample :

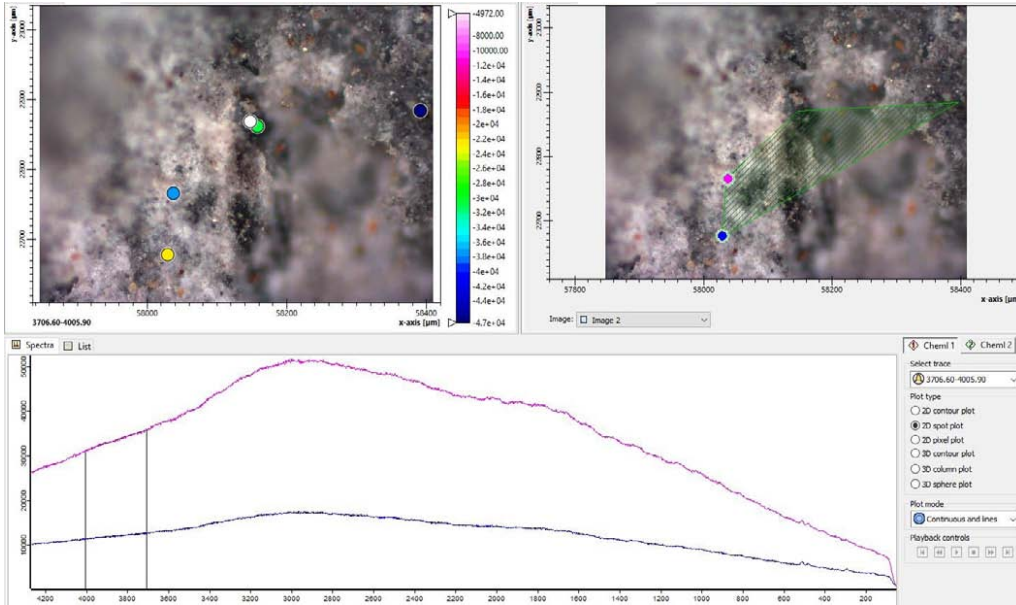


This spectrum may indicate weakly shocked feldspar

This would indicate a shock pressure

between 5 and 14 GPa

Sample Site 28 : Stone 2_spectra 1 indicates : **Albite** (→ see RRUFF_CS results)

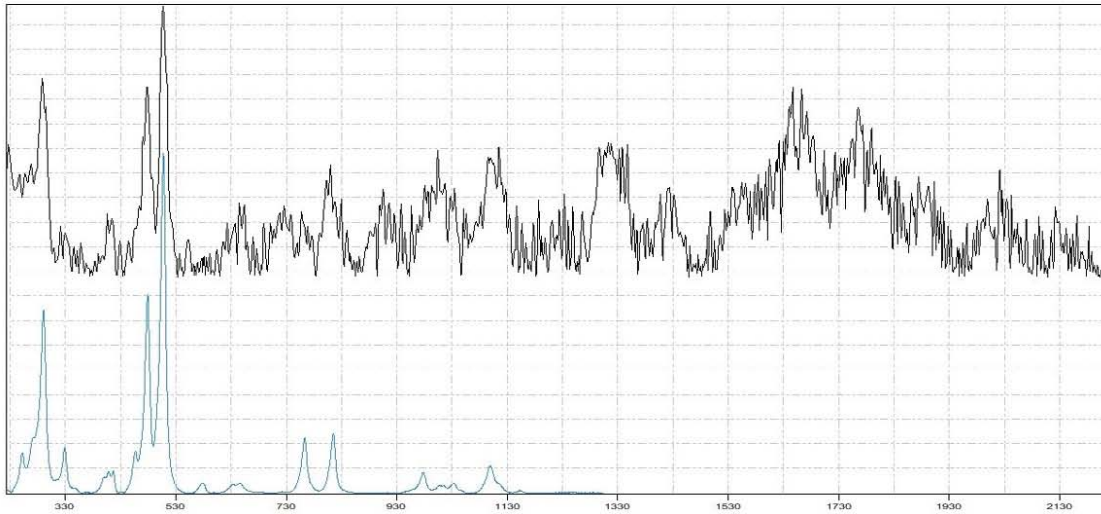


Sample :



CrystalSleuth: EXTRACT GRAN 28 grau-schwarz gestreifer.0 000001.0

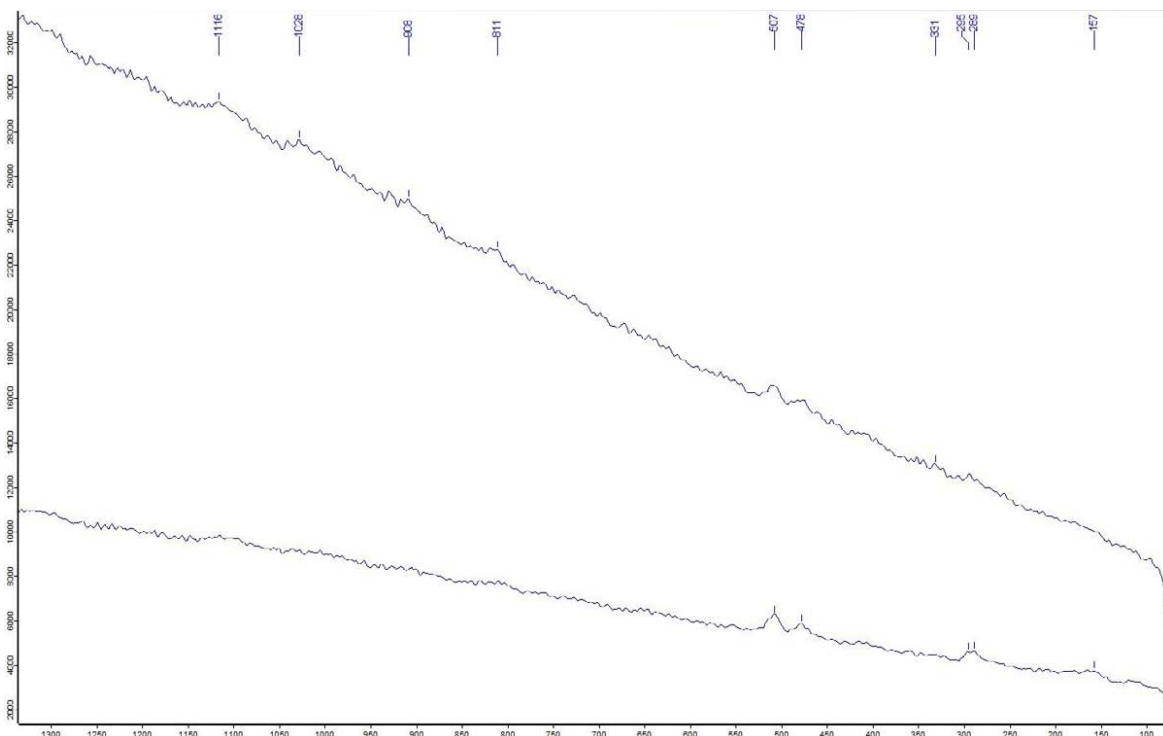
File Edit Mode Help



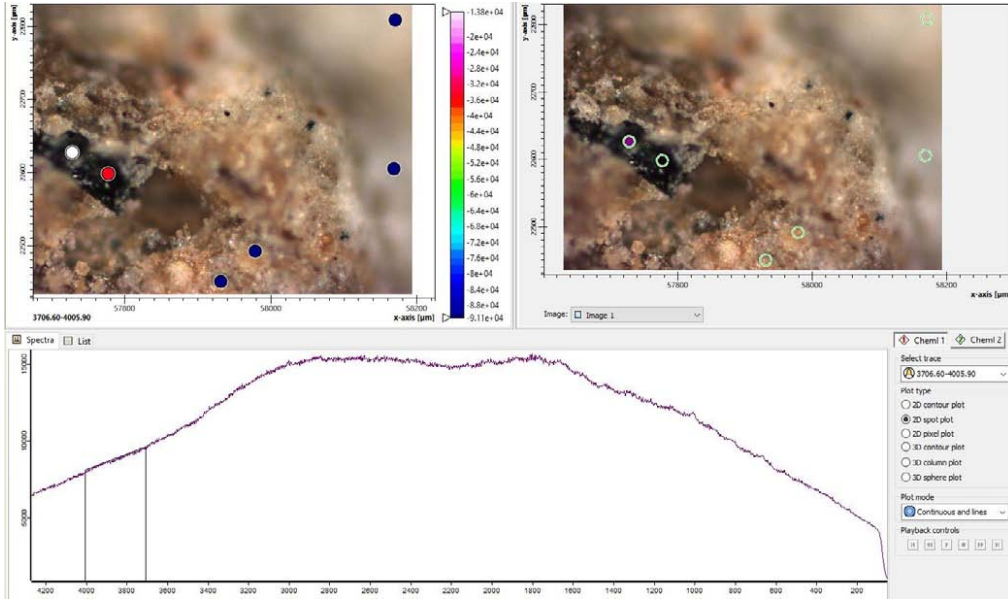
% Match:	Spectrum Name:	RRUFF ID:
84	<J> Nevadaite (532nm)	R060775
84	<J> Albite (532nm)	R050223
84	Lehrerite (532nm)	R060307
83	Albite (532nm)	R050402
83	Anorthoclase (532nm)	R060054
83	Oligoclase (532nm)	KU/028
82	Sobogalite (532nm)	R080028
82	Albite (532nm)	R040068
82	Willemite (532nm)	R060375
82	Dumortierite (532nm)	R060069
81	Albite (532nm)	R040129
81	Rubincite (532nm)	R070044
79	Anorthite (532nm)	R070199

Search

R050253
Albite
NaAlSi₃O₈
Madawaska/Paraday mine, Bancroft, Ontario, Canada



Sample Site 29 : Stone 1_spectra 1 indicates : **Augite** (→ see RRUFF_CS results)



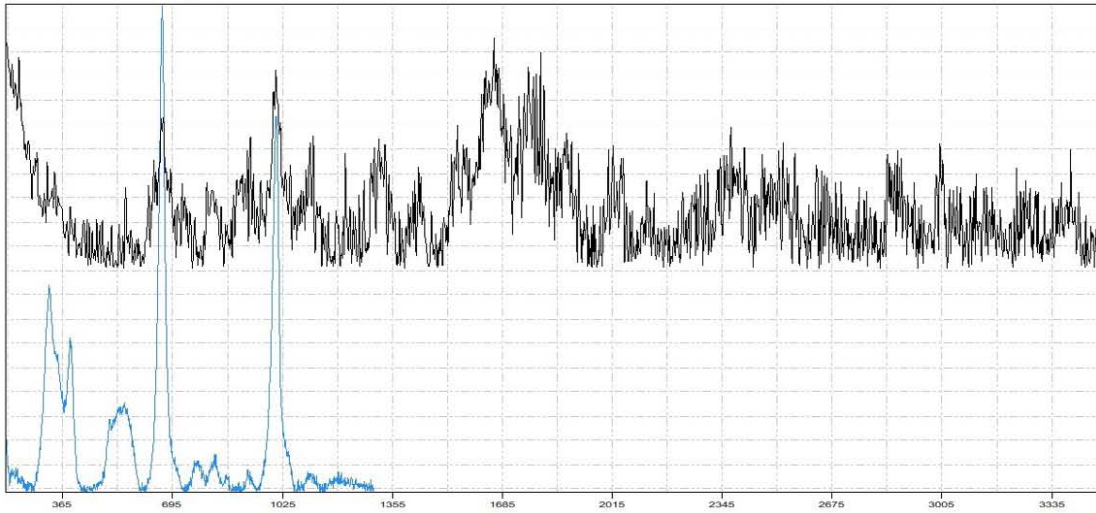
Possible Iron-bearer mineral

Sample :



CrystalSleuth: EXTRACT_GRAN_29_weiß-bräunlicher.0_000000.0

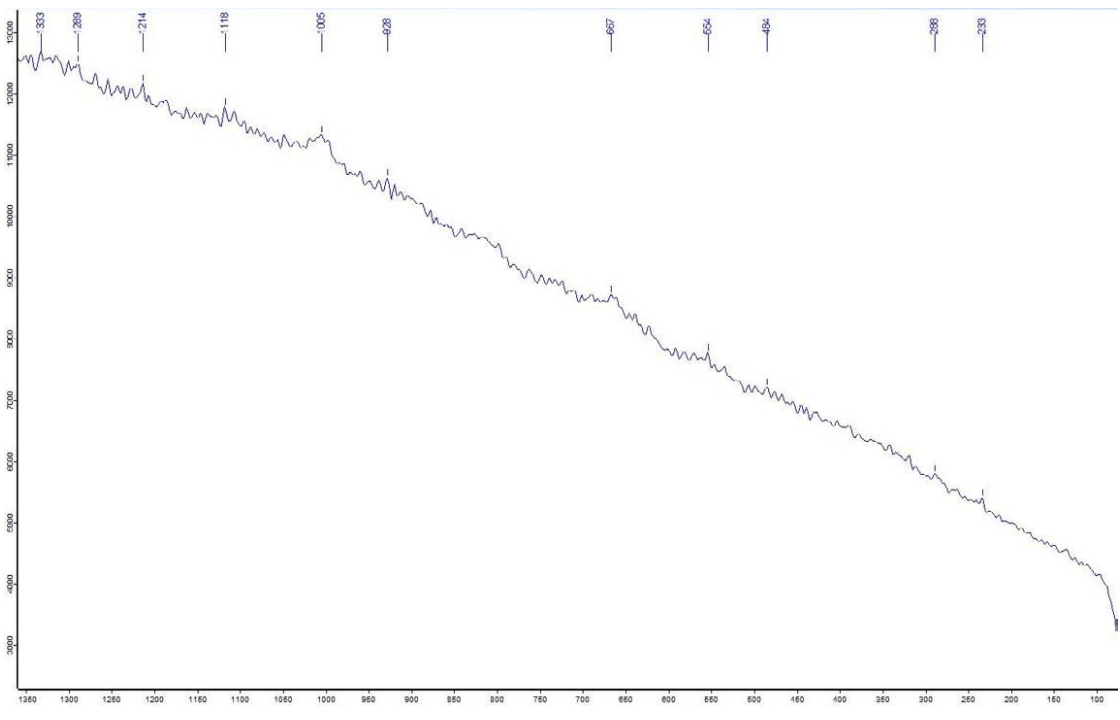
File Edit Mode Help



File Manager SpecEdit Raman library X-Ray

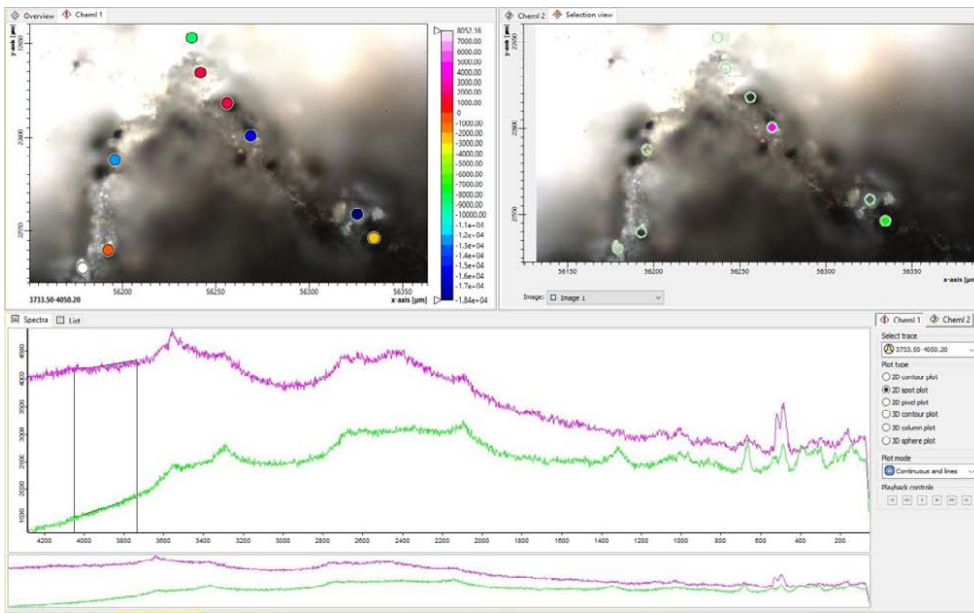
% Match:	Spectrum Name:	RRUFF ID:
79	Agite (532nm)	R060129
78	Covellite (532nm)	R070143
78	Molybdothiite (532nm)	R060785
78	Natron (532nm)	R070572
78	Magnetite (532nm)	R060222
78	Chrysocolla (532nm)	R060547
78	Renierite (532nm)	R050428
78	<1 Augite (532nm)	R061108
78	Strontiojaoquinite (532nm)	R060331
78	Motukoreaitite (532nm)	R070337
77	Wenbaite (532nm)	R050330
77	Magnetite (532nm)	R060191
77	Andalusite (532nm)	R050258

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

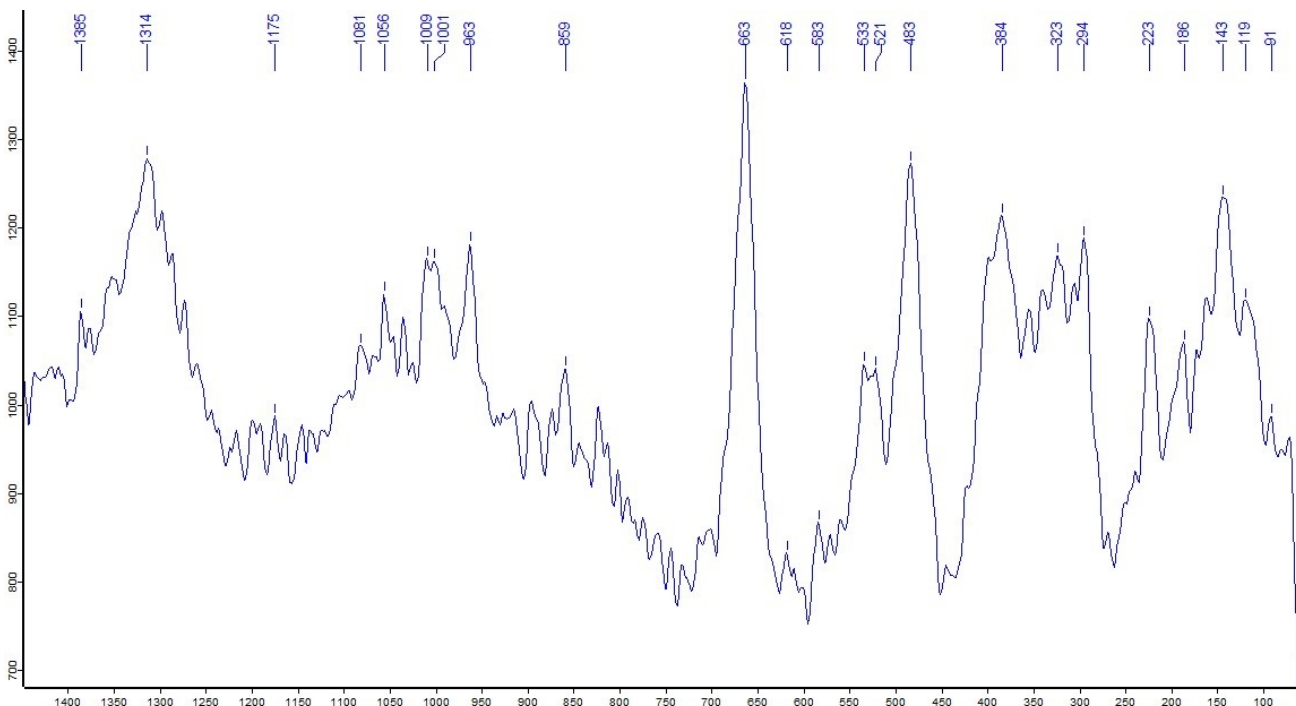
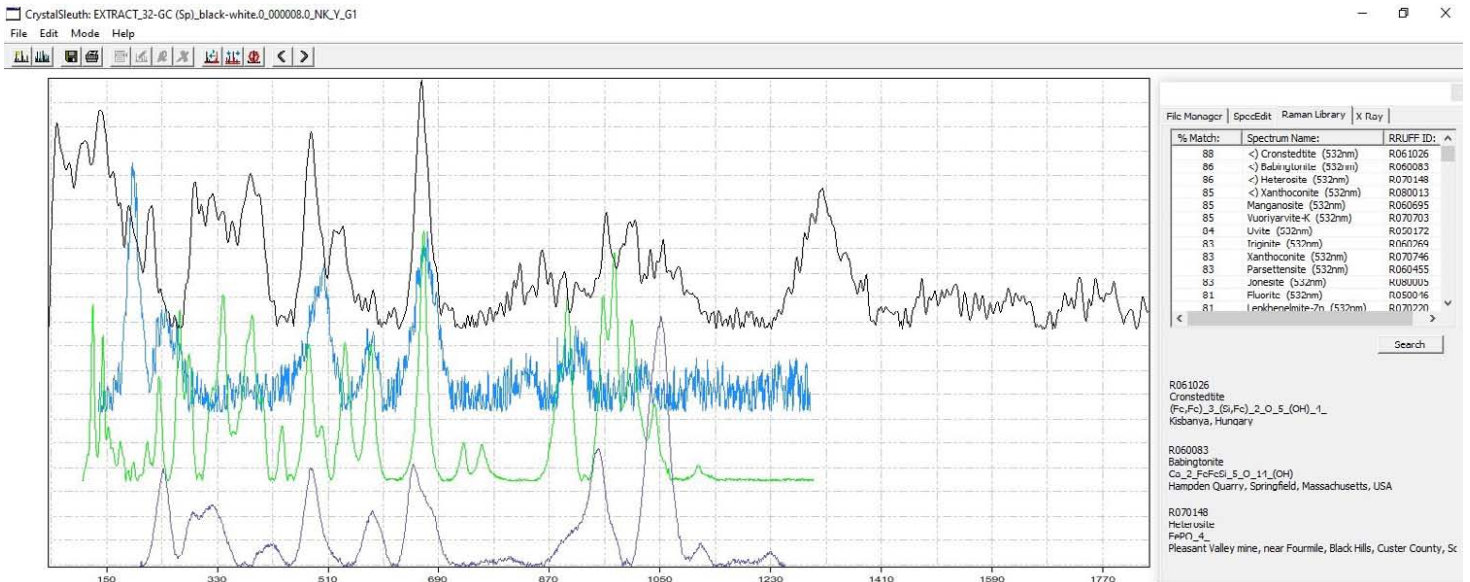


Sample Site 32 : Stone_1_spectra 1 indicates : **Cronstedtite_Babingtonite_Heterosite** (→ see RRUFF_CS)

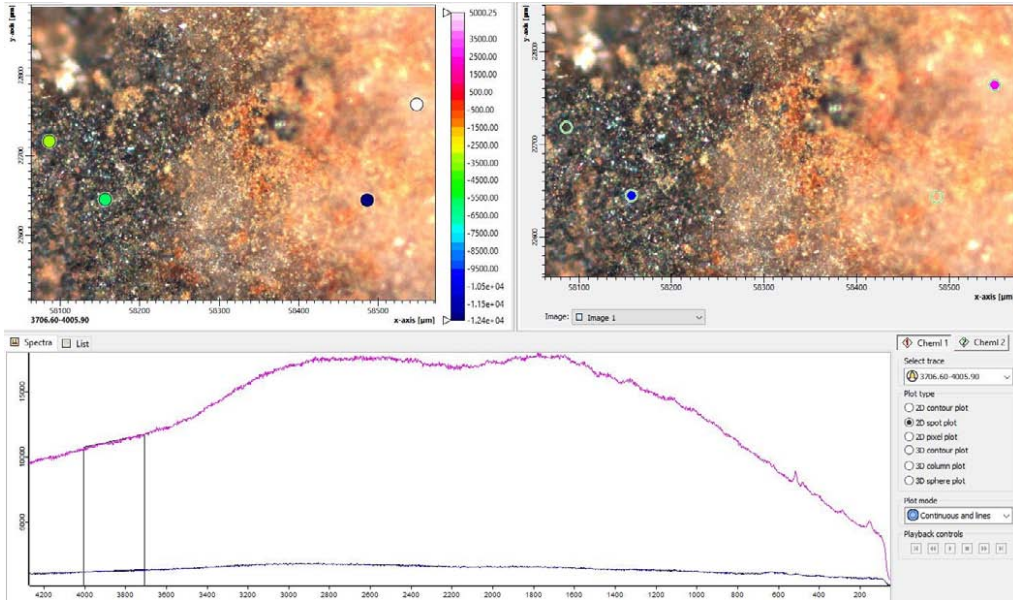
Note : → best matching minerals
all iron-bearer minerals !



Sample :



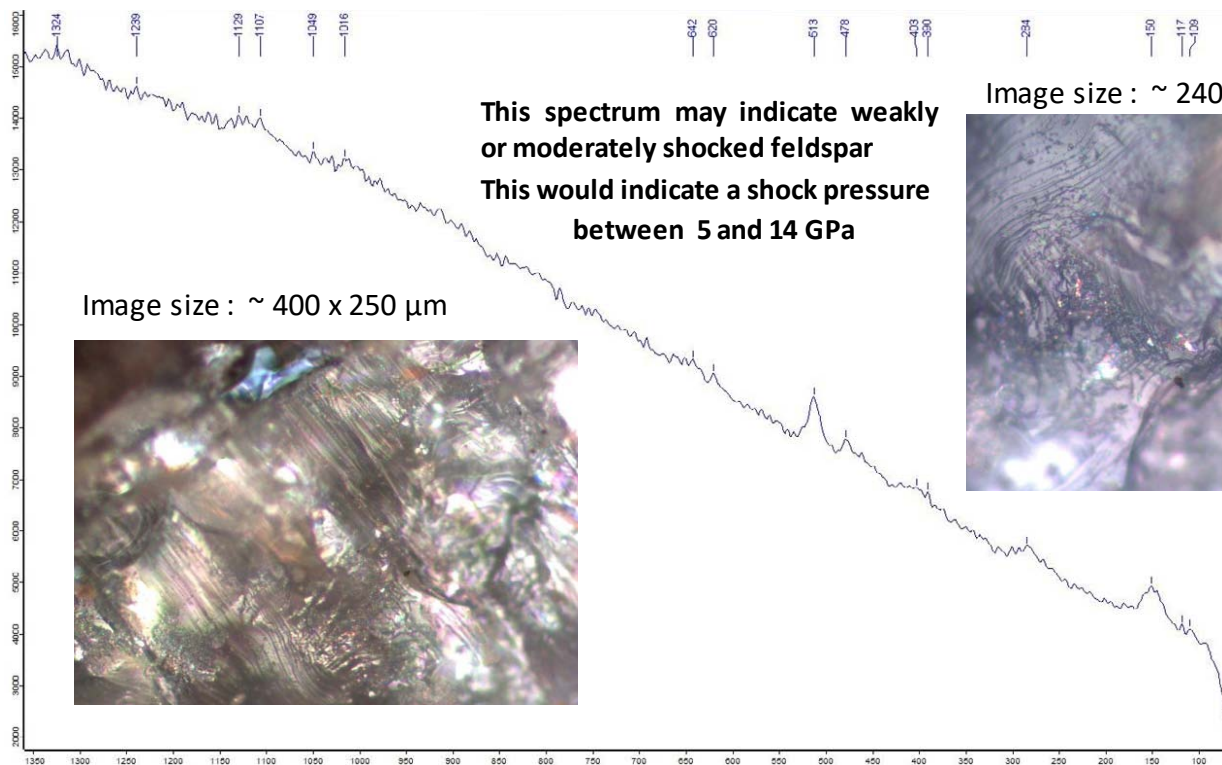
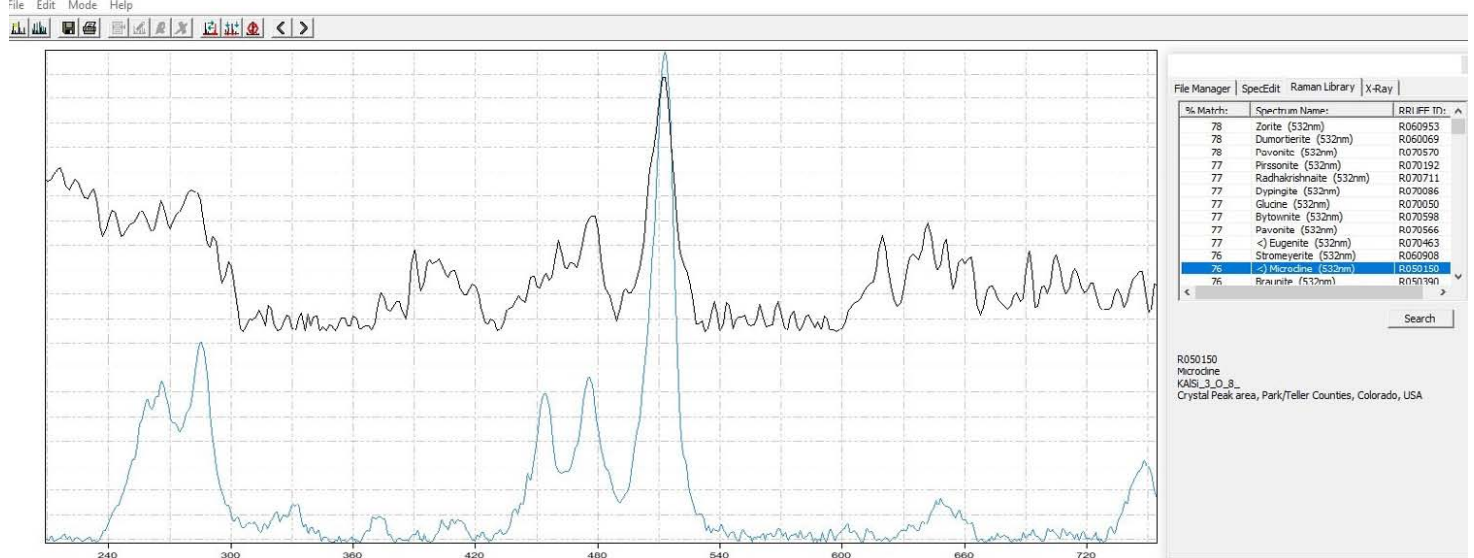
Sample Site **32** : Stone 2_spectra 1 indicates : **Microcline** (→ see RRUFF_CS results)



Sample :



CrystalSleuth: EXTRACT_GRAN_32-beige-schwarzer (Grenze)_0_000003.0



This spectrum may indicate weakly or moderately shocked feldspar
This would indicate a shock pressure between 5 and 14 GPa

Image size : ~ 240 x 180 μm

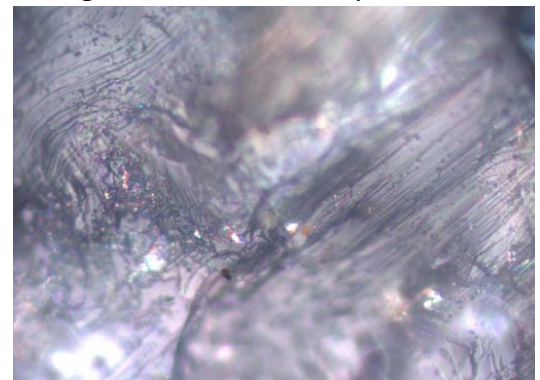
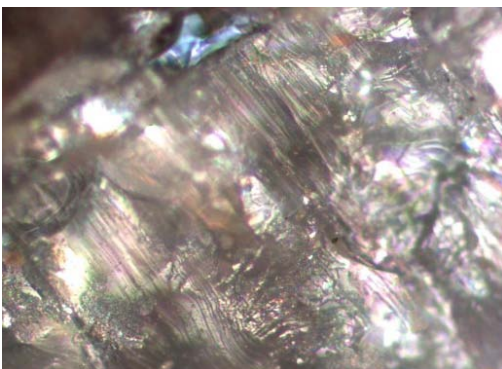
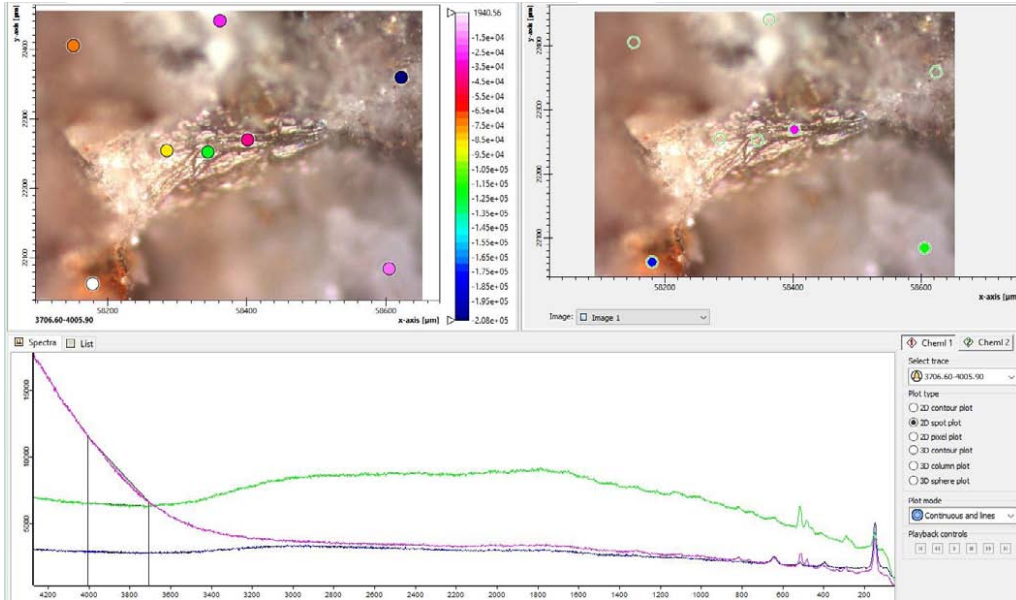


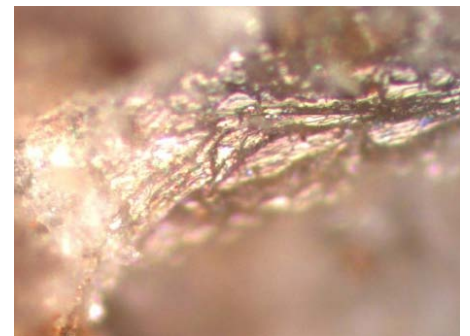
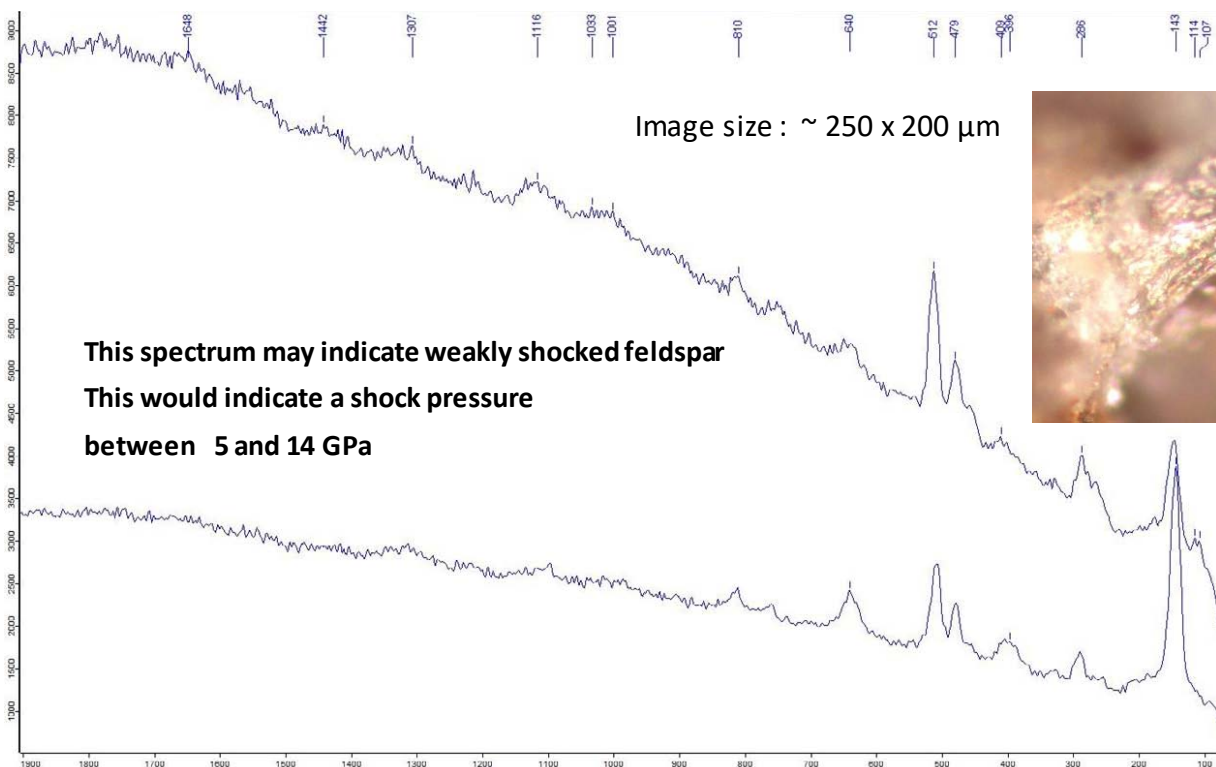
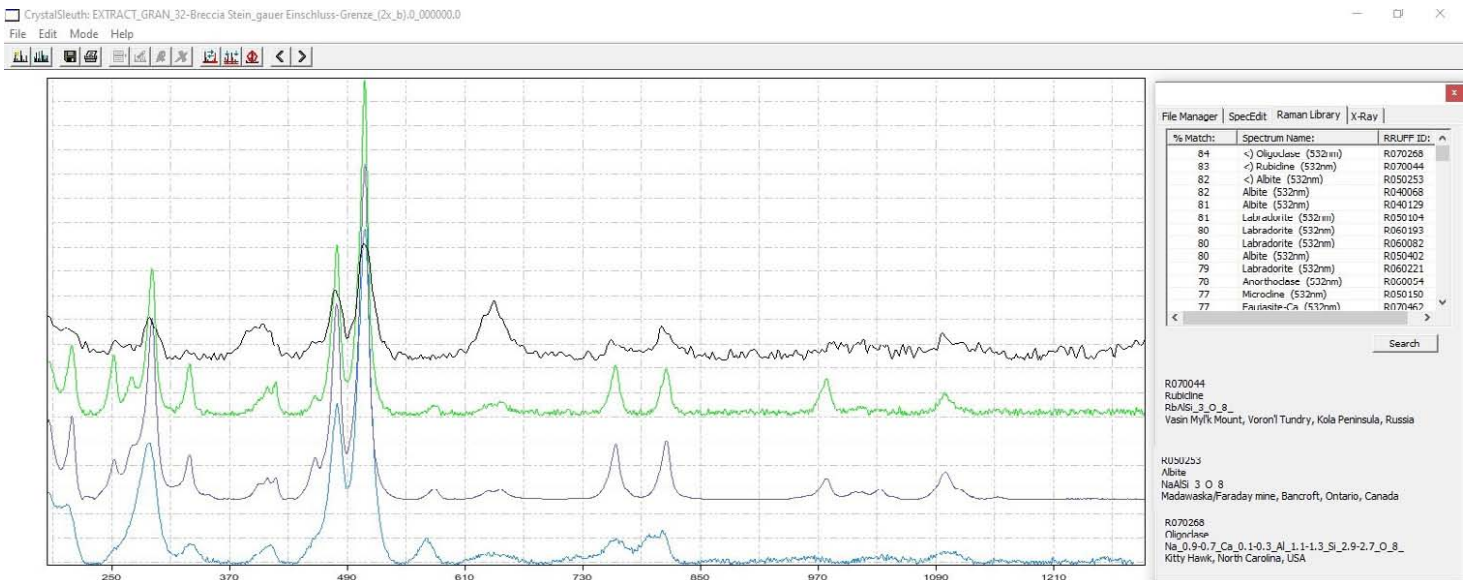
Image size : ~ 400 x 250 μm



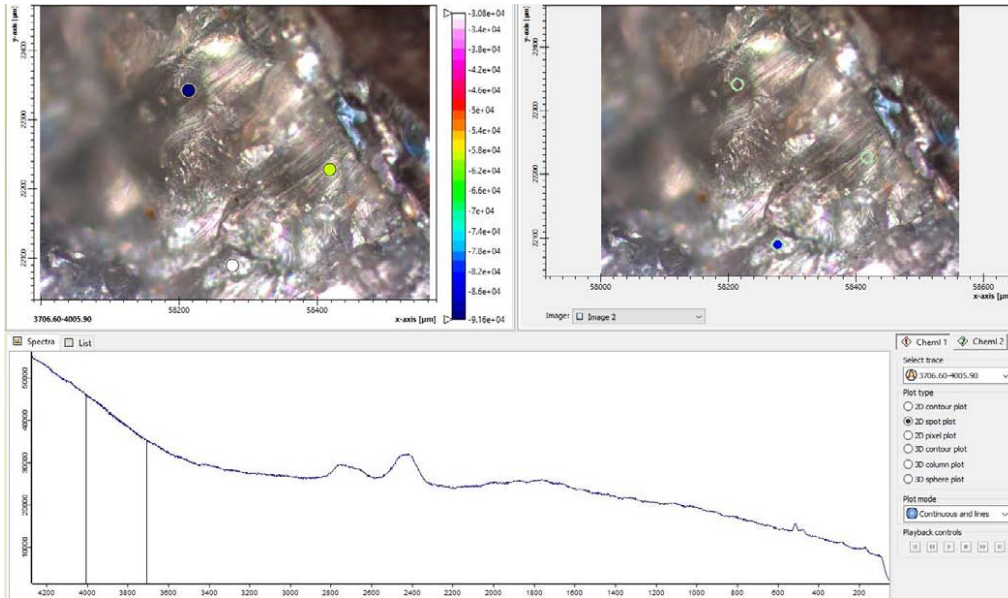
Sample Site **32** : Stone 3_spectra 1 indicates : **Oligoclase, Rubicline, Albite** (→ see RRUFF_CS results)



Sample :



Sample Site **33** : Stone 1 (crystal inclusion)_spectra 1 indicates : **Labradorite-Microcline** (→ see RRUFF_CS)

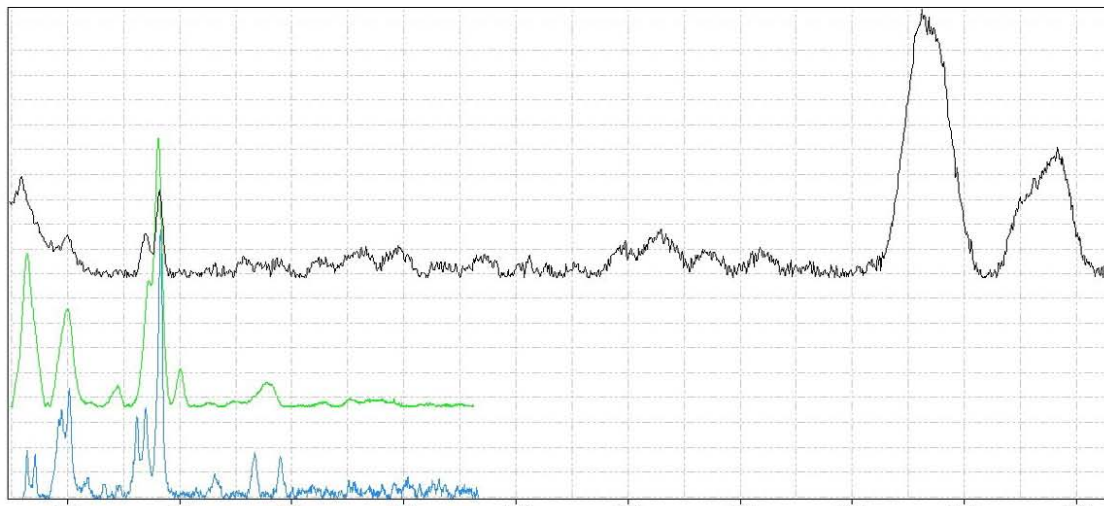


Sample :



CrystalSleuth: EXTRACT_GRAN_33_weißer-crystal-einschluss.0_000002.0

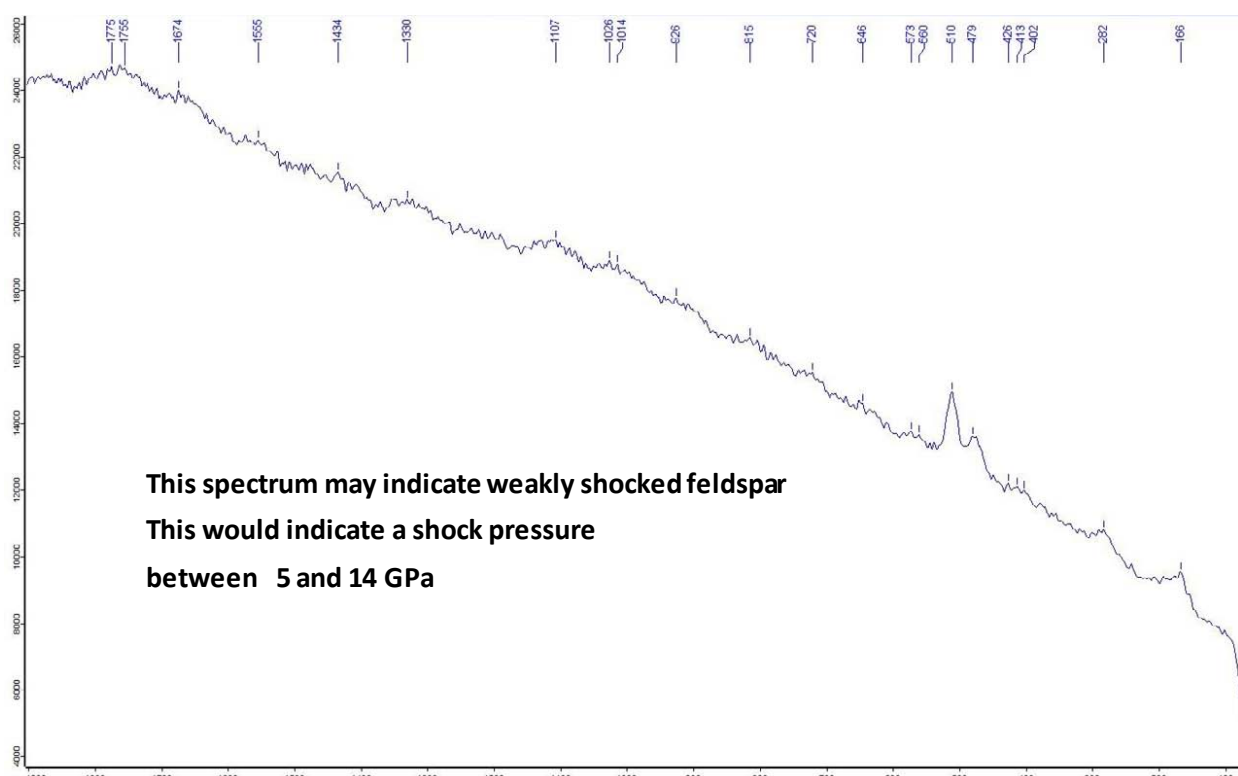
File Edit Mode Help



% Match	Spectrum Name	RRUFF ID
82	<-> Microcline (532nm)	R050150
81	<-> Labradorite (532nm)	R060082
80	Orthoclase (532nm)	R050367
80	Anorthoclase (532nm)	R060054
80	Labradorite (532nm)	R050104
79	Bytownite (532nm)	R070598
79	Oligoclase (532nm)	R070268
79	Labradorite (>52nm)	R060193
78	Corvusite (>52nm)	K000265
78	Microcline (532nm)	R040154
78	Orthoclase (532nm)	R050185
78	Orthoclase (532nm)	R040055
77	Microcline (532nm)	R050054

R060082
Labradorite
Na_{0.15}Al_{0.85}Si_{3.15}O₉Al_{1.5-1.7}Si_{2.5-2.3}O₈
Pinacate Mountains, Sonora, Mexico

R050150
Microcline
KAISI 3 O 8
Crystal Peak area, Park/Teller Counties, Colorado, USA

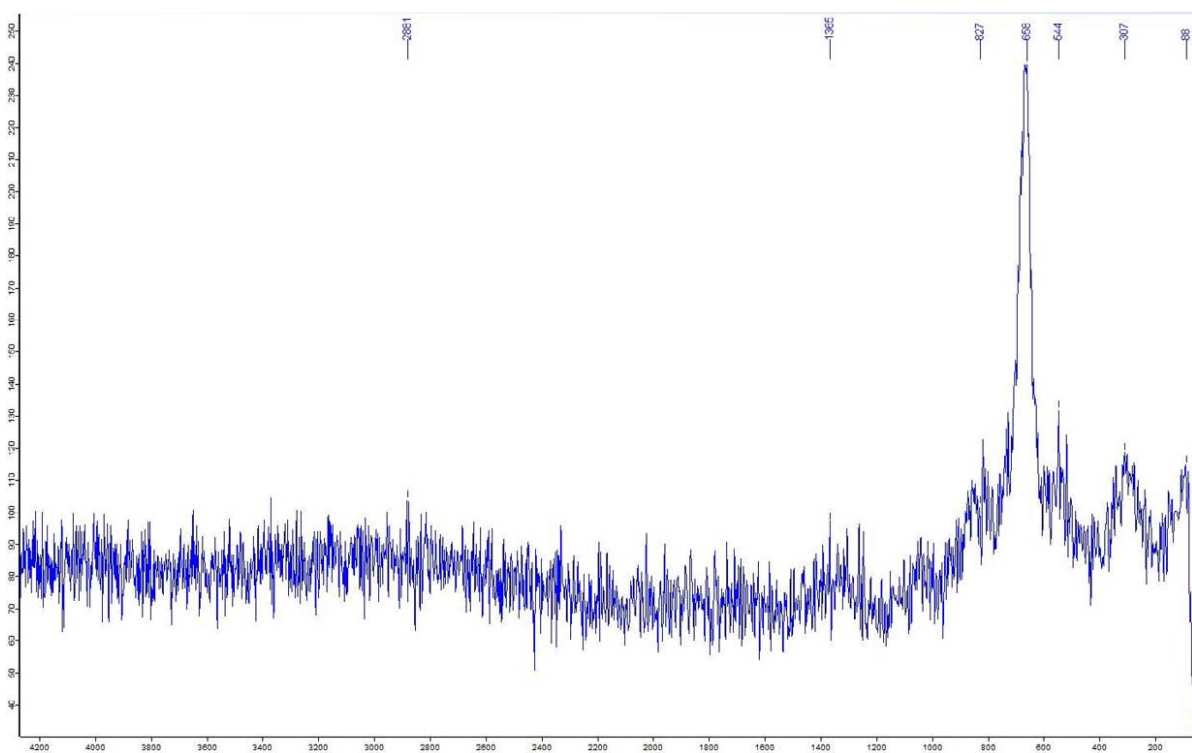
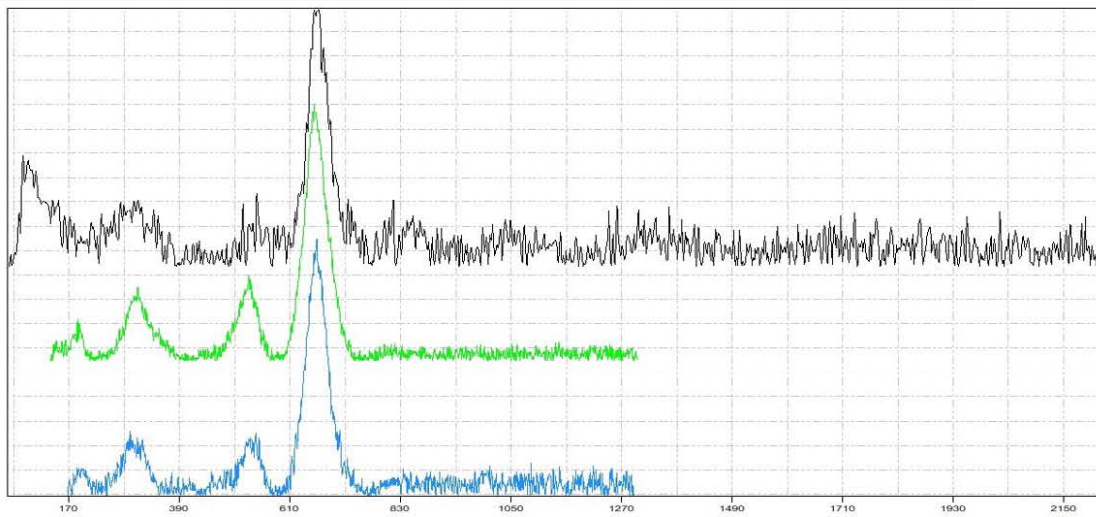
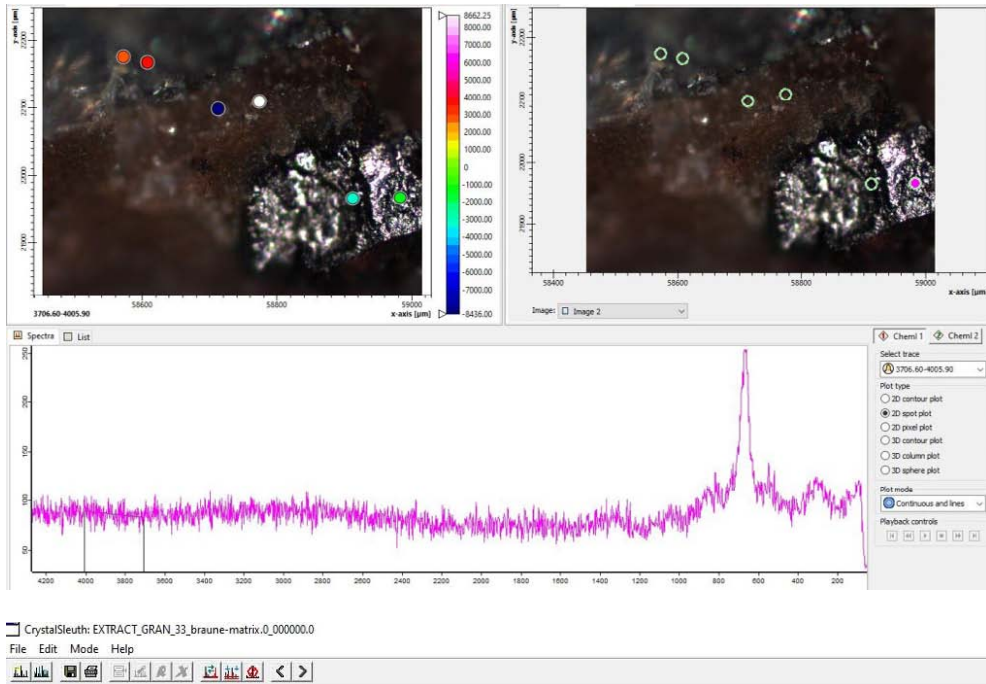


This spectrum may indicate weakly shocked feldspar
This would indicate a shock pressure
between 5 and 14 GPa

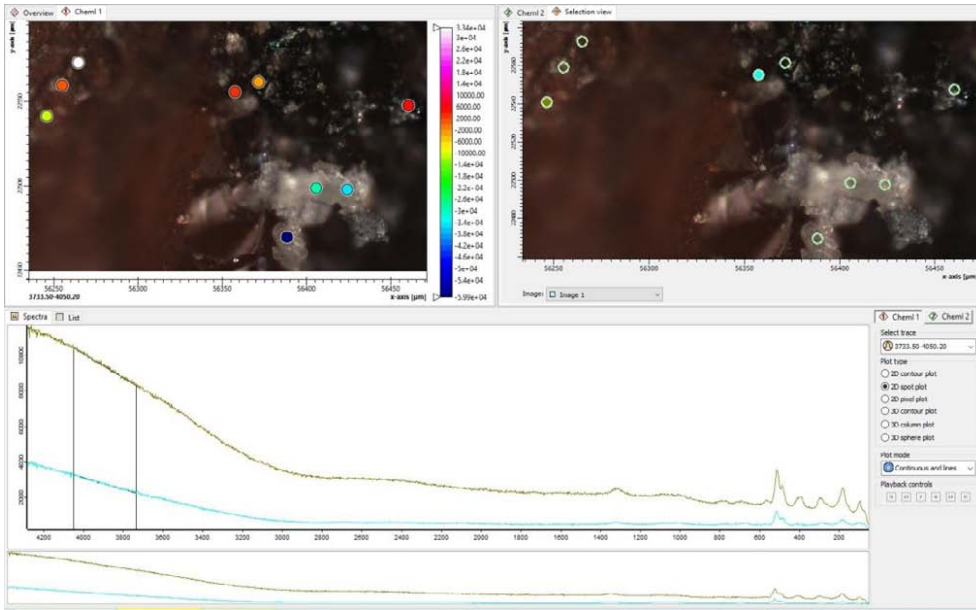
Sample Site **33** : Stone 1 (brown matrix material)_spectra 1 indicates: **Magnetite, Coyoteite** (RRUFF_CS)

Note : The rock mainly consists of Magnetite ! (or Coyoteite)
 → **iron-bearer minerals**

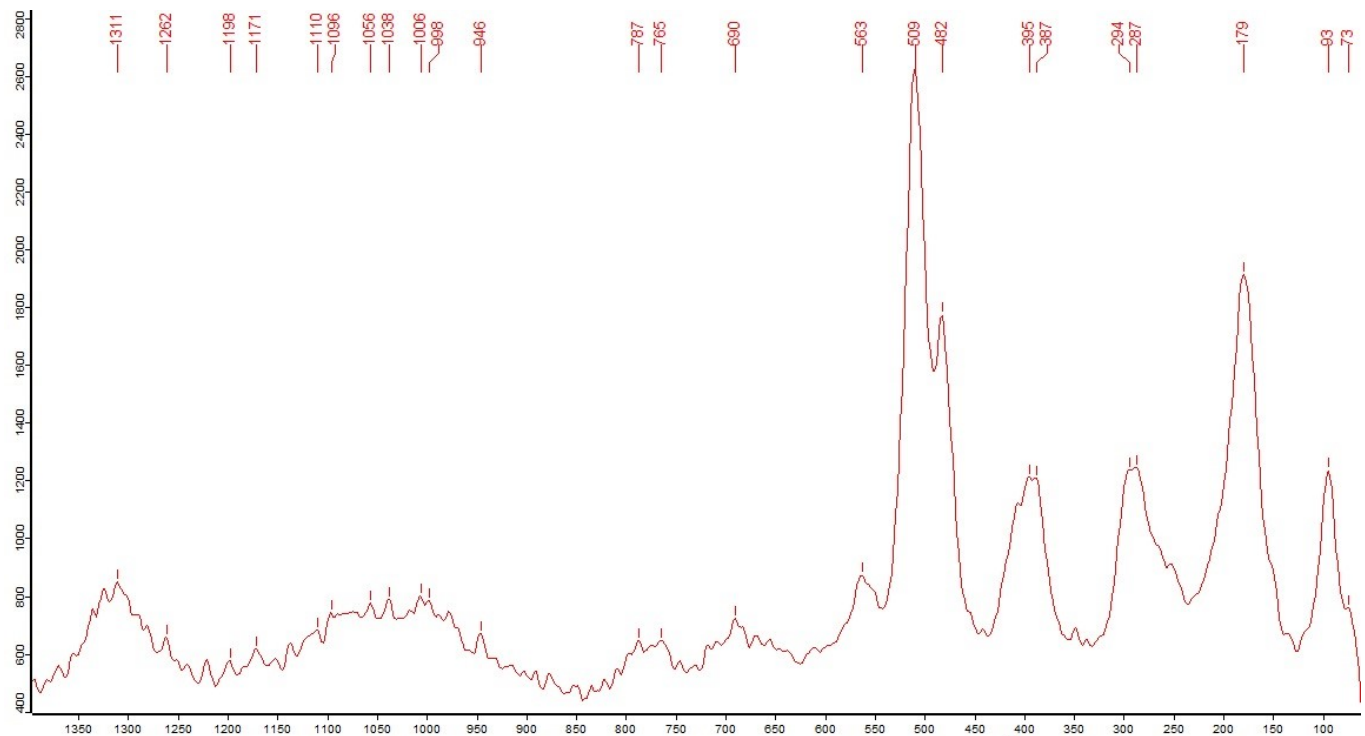
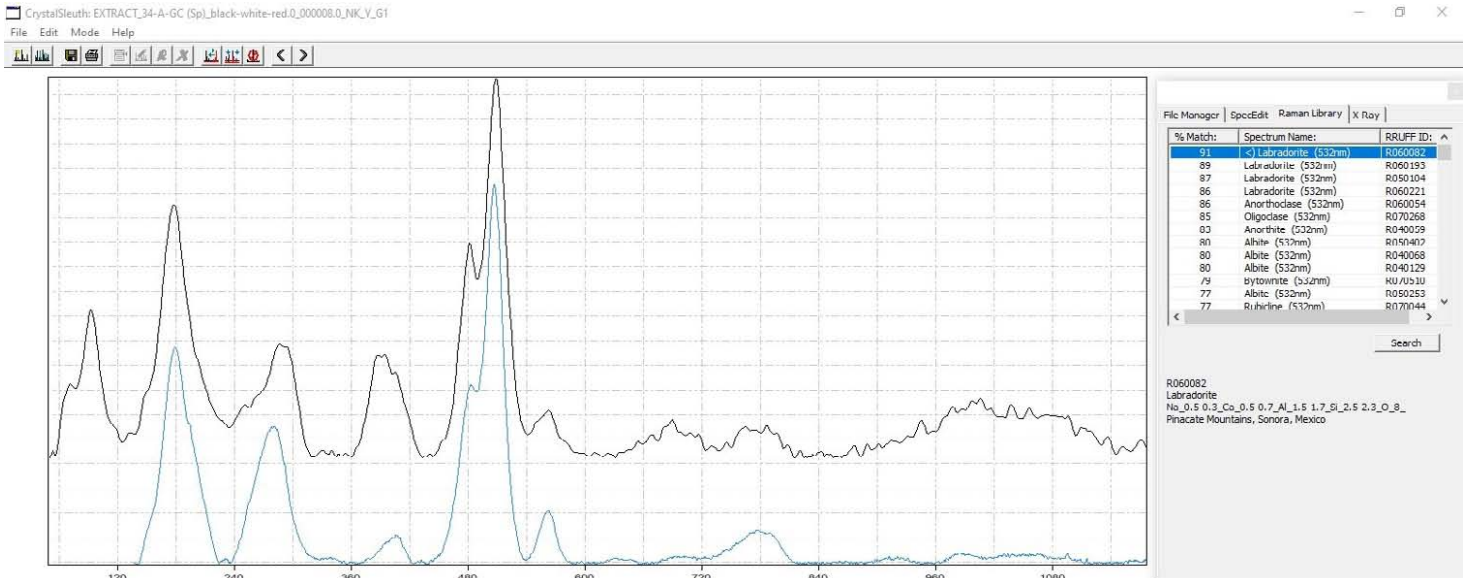
Sample :



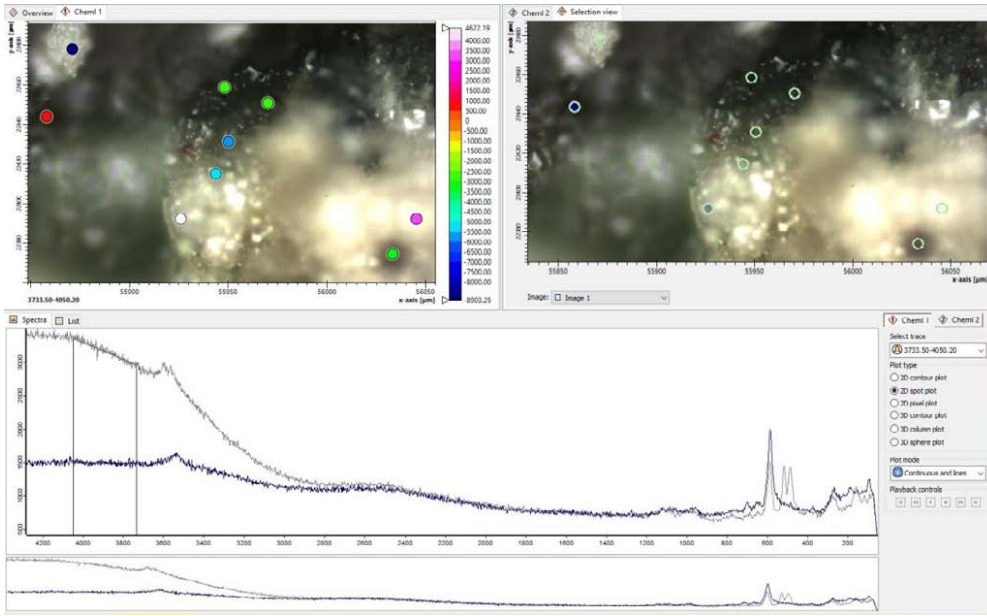
Sample Site **34-A** : Stone 1_spectra 1 indicates : **Labradorite** (→ see RRUFF_CS)



Sample :



Sample Site **34-B** : Stone 1_spectra 1 indicates : **Hollandite, Labradorite, Tengerite-(Y)** (→ see RRUFF_CS)

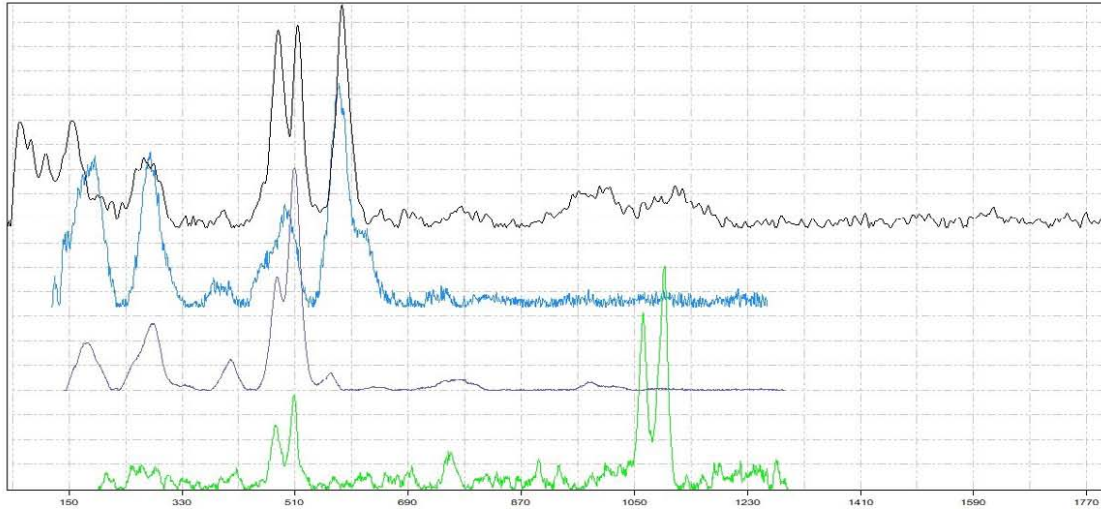


Sample :



CrystalSleuth: EXTRACT_34-B-stein 1-GC (Sp)_grain-black-white_0_000000_0_NK_G1

File Edit Mode Help



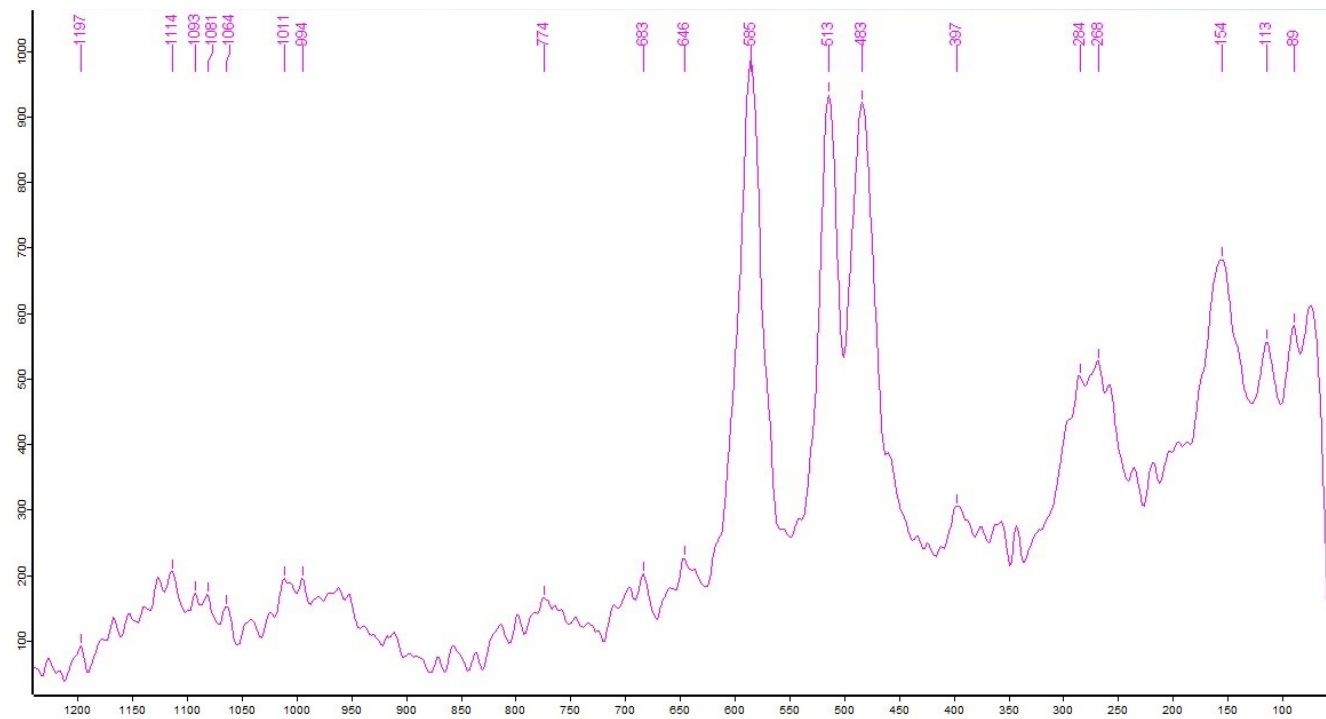
% Match	Spectrum Name	RRUFF ID
80	<-> Hollandite (532nm)	R060852
79	<-> Bilechite (532nm)	R070243
77	<-> Lilekearite (532nm)	R060768
77	<-> Cesstibantite (532nm)	R061058
76	<-> Perite (532nm)	R060766
76	<-> Vernadite (532nm)	R080100
76	Nilschakanite (532nm)	R060573
76	Stronolite (532nm)	R080919
76	Montgomeryite (532nm)	R080094
75	<-> Tengerite-(Y) (532nm)	R060480
75	<-> Labradorite (532nm)	R050104
74	Labradorite (532nm)	R060002
74	Whewellite (532nm)	D050140

Search:

R060852
Hollandite
Beltite, 7_O_16,
Illeus, Suoharav, Sweden

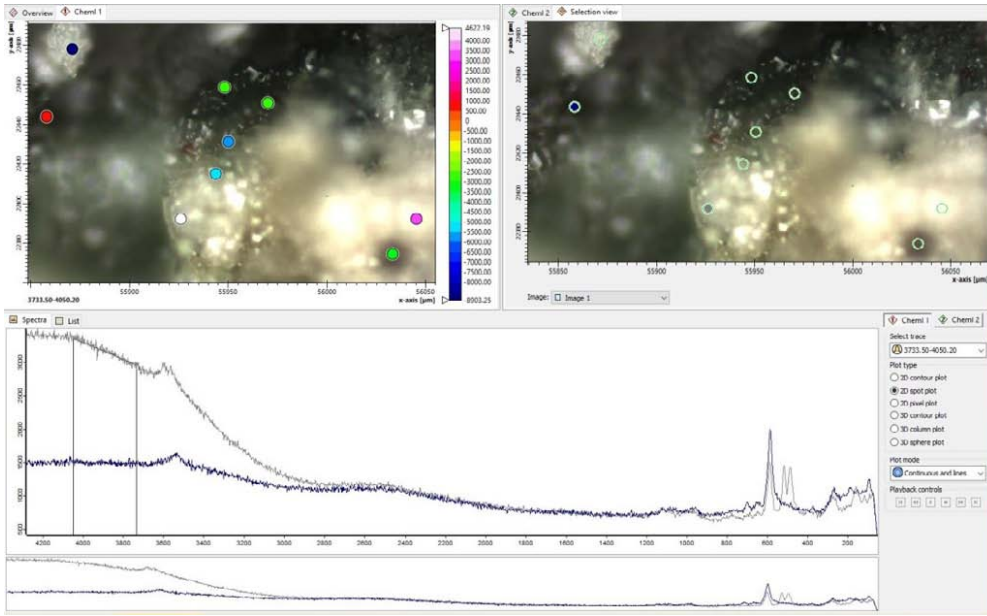
R050104
Labradorite
Na_0.5-0.3_Ca_0.5-0.7_Al_1.5-1.7_Si_2.5-2.3_O_8_unknow

R060480
Tengerite-(Y)
Y_2(CO_3)_3_#183;2-3H_2O
Ytterby, Sweden



Sample Site **34-B** : Stone 1_spectra 2 indicates : **Hollandite, Tuperssuatsiaite** (→ see RRUFF_CS)

Iron- or mangan bearer mineral

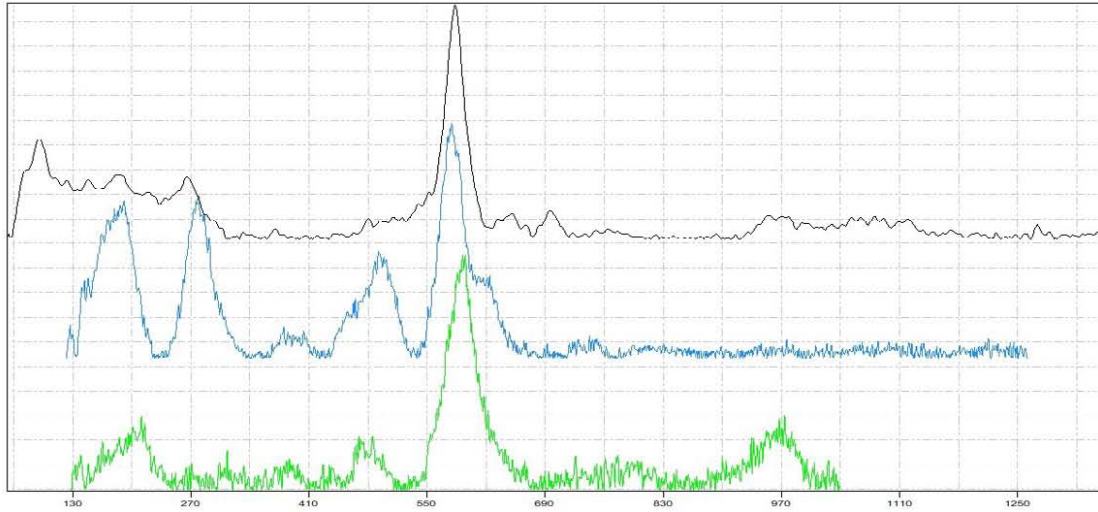


Sample :



CrystalSleuth: EXTRACT 34-B-stein 1-GC (Sp) grün-black-white.0 000008.0 NK G1

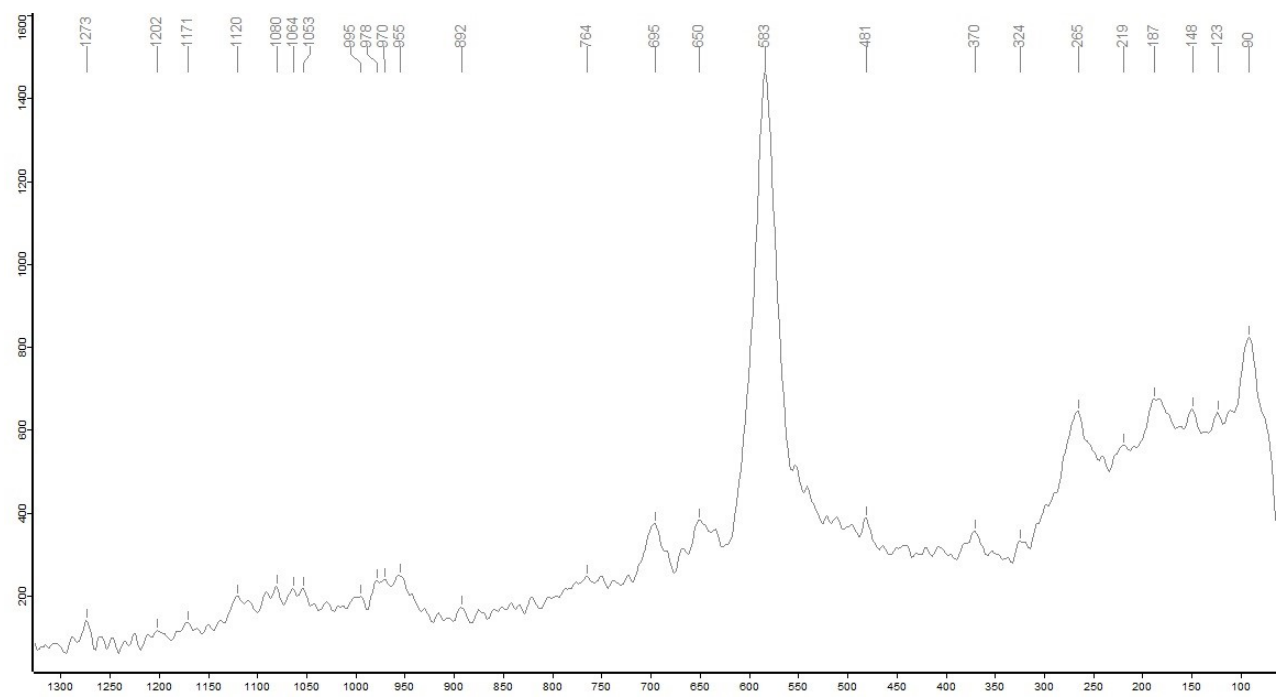
File Edit Mode Help



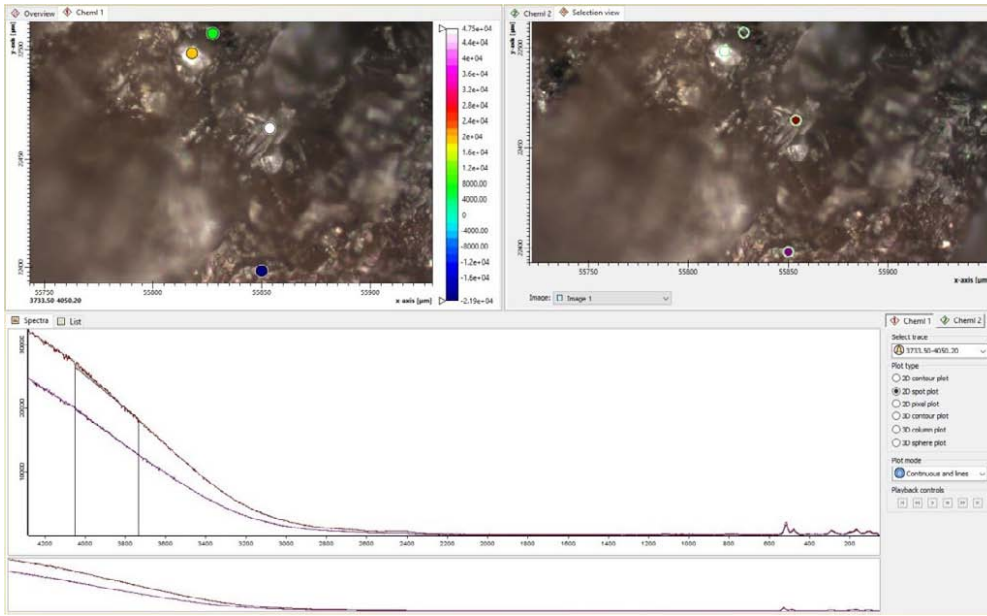
% Match	Spectrum Name	RRUFF ID
78	<> Hollandite (532nm)	R060852
77	<> Tuperssuatsiaite (532nm)	R050223
75	Hisingerite (532nm)	R070696
74	Coronadite (532nm)	R060258
73	Aurorite (532nm)	R061037
73	Macfarlaneite (532nm)	KU00104
72	Lucifite (532nm)	R000025
72	Dawsonite (532nm)	R070193
71	Keibelsbergite (532nm)	R060157
69	Gearskuteite (532nm)	R050657
68	Kozulite (532nm)	R070122
68	Melauranocite (532nm)	R050575
68	Comaruvite (532nm)	R060734

R060852
 Hollandite
 BakkeMin_7_0_16
 Ultevis, Sorfåras, Sweden

R050223
 Tuperssuatsiaite
 Name_3_3_0_0_(UH)_2_#183PH_2_U
 Aris phonolite, Windhoek, Namibia



Sample Site **34-B** : Stone 2_spectra 1 indicates: **Orthoclase** (→ see RRUFF_CS)

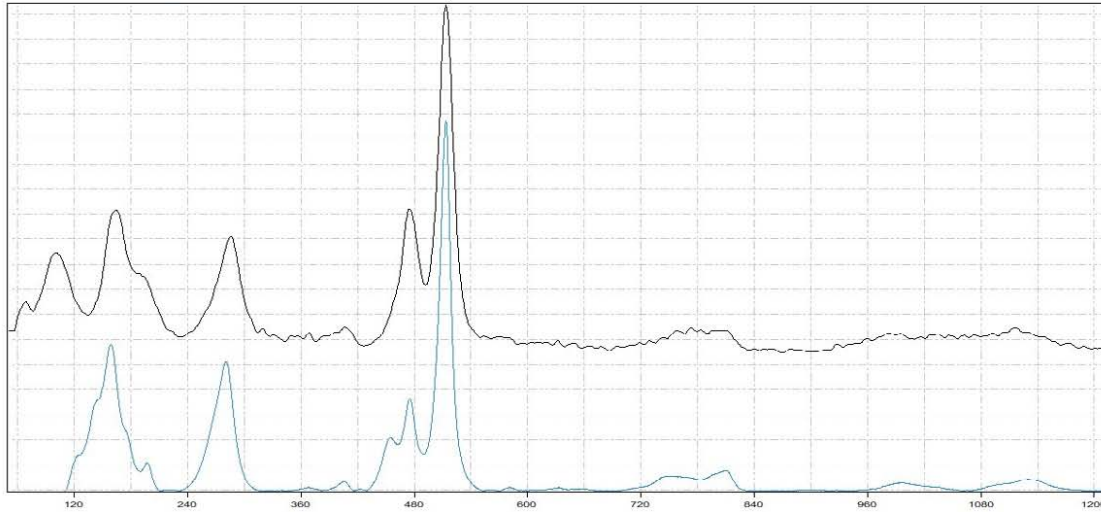


Sample :



CrystalSleuth: EXTRACT_34-B-stein 2-GC (Sp)_pink-grau.0.00000.0_NK_G1

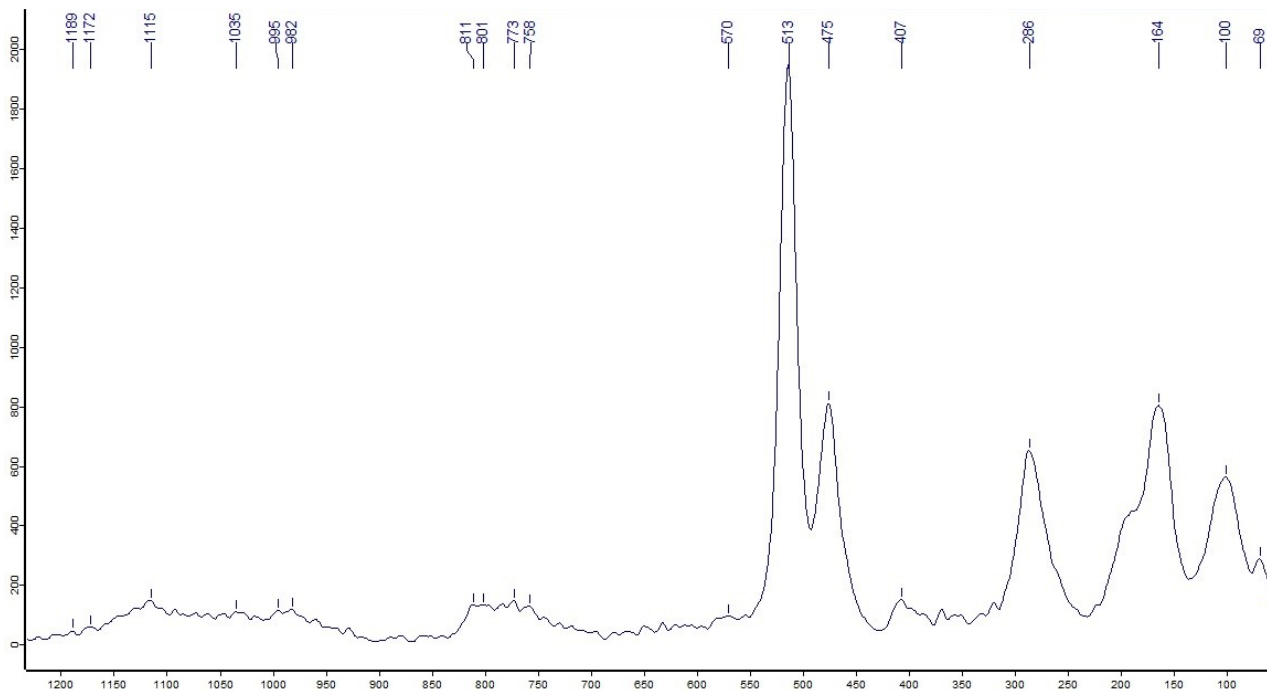
File Edit Mode Help



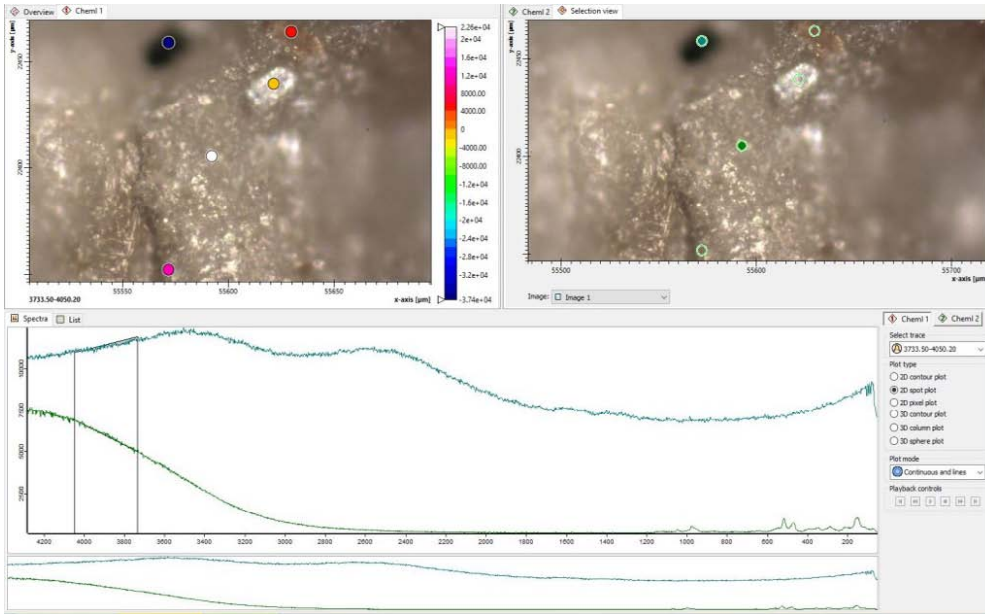
File Manager | SpecEdit | Raman Library | X Ray

% Match	Spectrum Name	RRUFF ID
90	<J> Orthoclase (532nm)	R060077
89	Amix Iliteclase (532nm)	R060054
87	Orthoclase (532nm)	R040055
87	Orthoclase (532nm)	R050367
87	Orthoclase (532nm)	R050185
85	Orthoclase (532nm)	R070001
85	Labradorite (532nm)	R050104
84	Microcline (532nm)	R050193
84	Microcline (532nm)	R050054
84	Labradorite (532nm)	R060082
83	Microcline (532nm)	KU40154
81	Oligoclase (532nm)	T070268
80	Microcline (532nm)	R050150

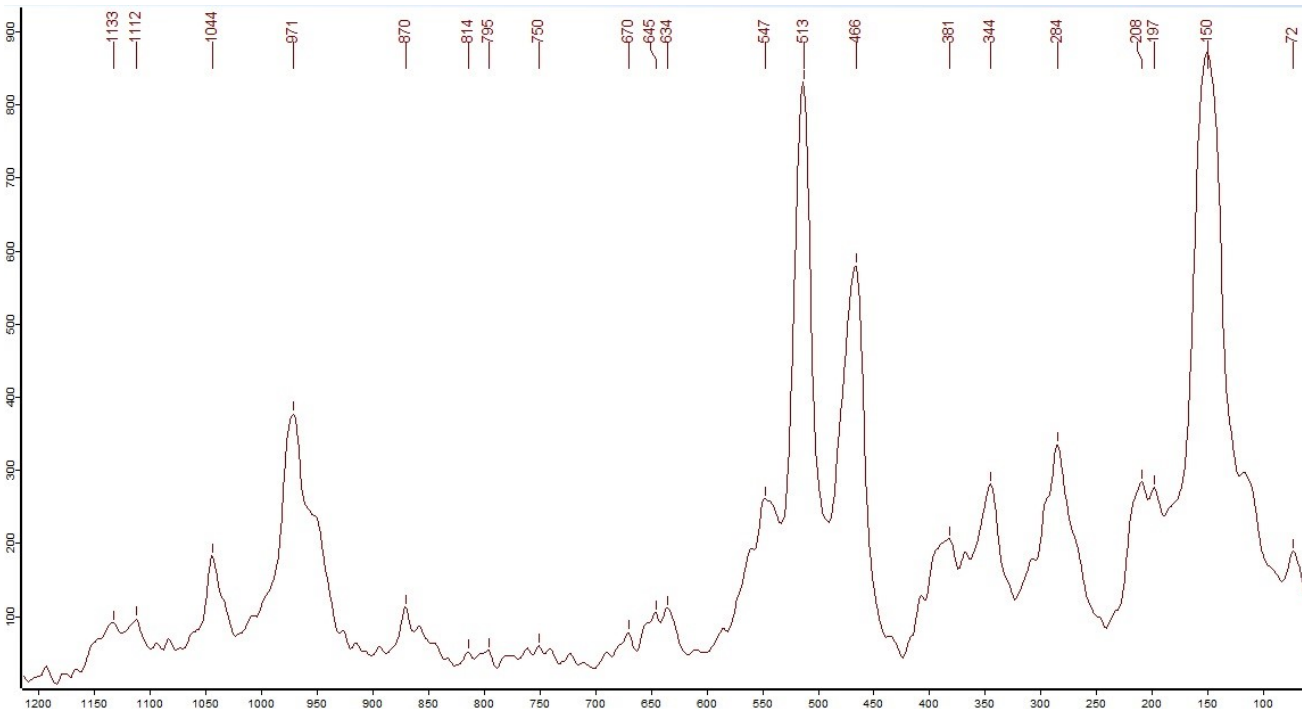
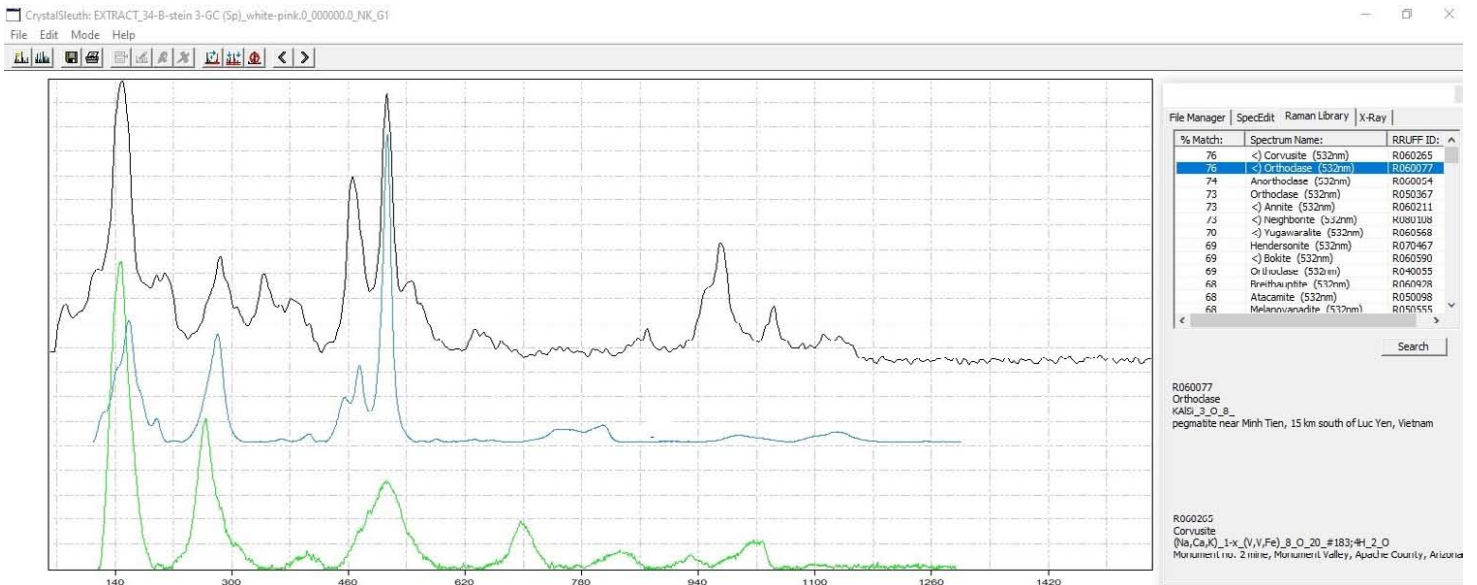
R060077
Orthoclase
KAlSi₃O₈
pegmatite near Minh Tien, 15 km south of Luc Yen, Vietnam



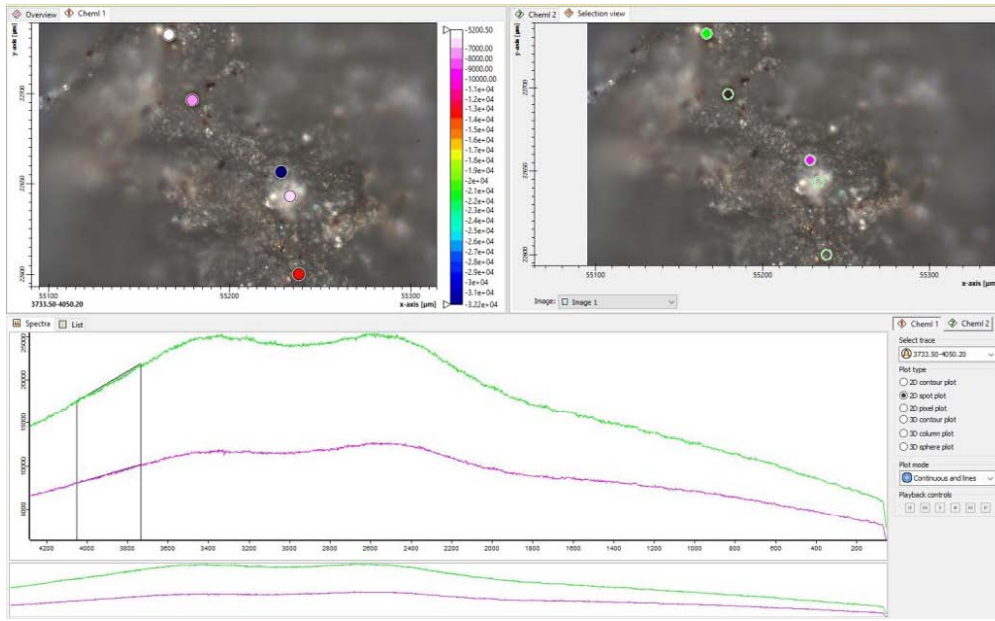
Sample Site **34-B** : Stone 3_spectra 1 indicates: **Orthoclase, Corvusite** (→ see RRUFF_CS)



Sample:



Sample Site 36 : Stone 1_spectra 1 indicates : no usable result from this spectra



Sample :



Appendix 1: Photos of the rock samples from the sites : 14, 20 & 25, 28, 29, 32, 33 & 34-B

→ See next page

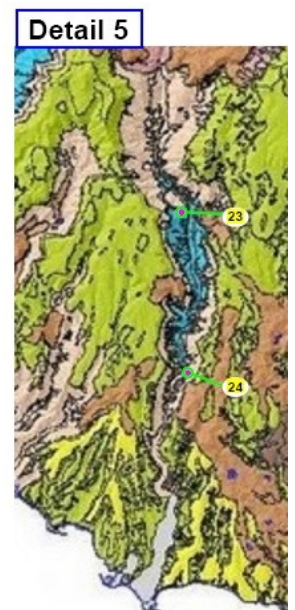
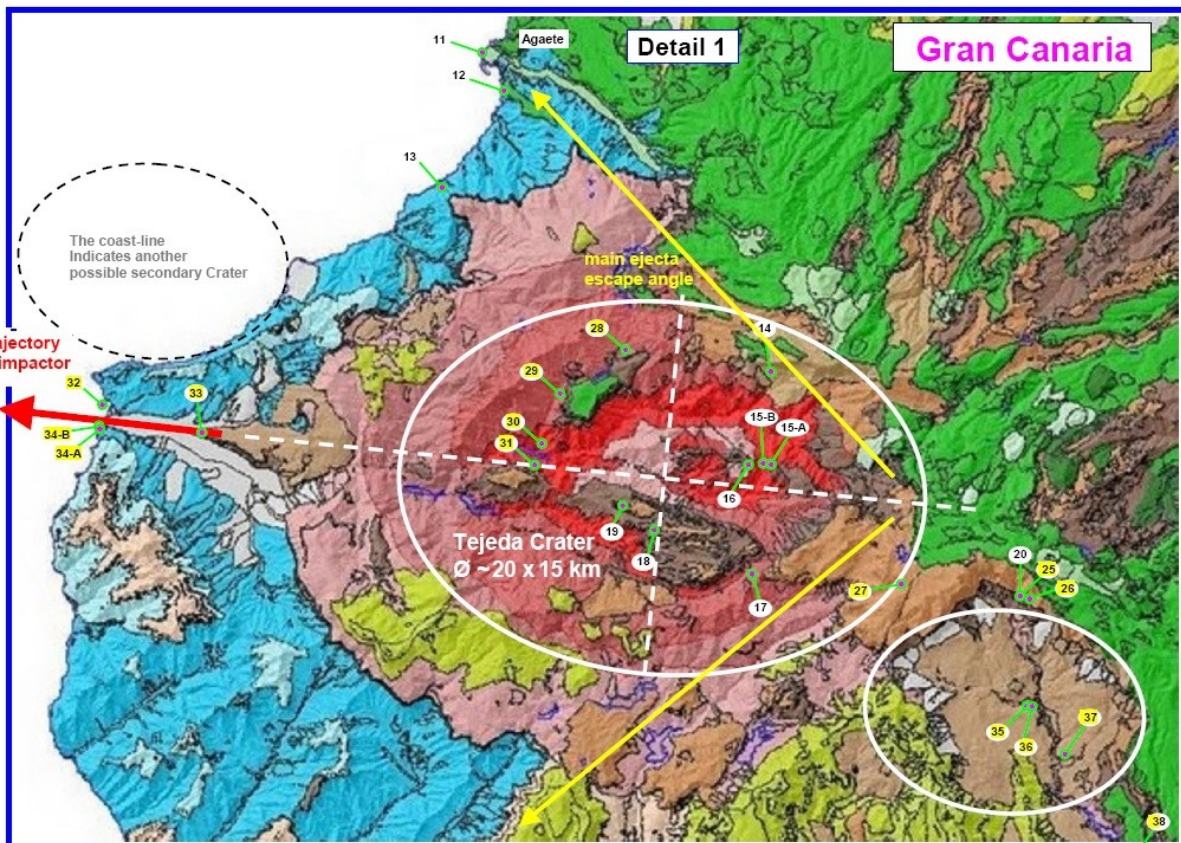
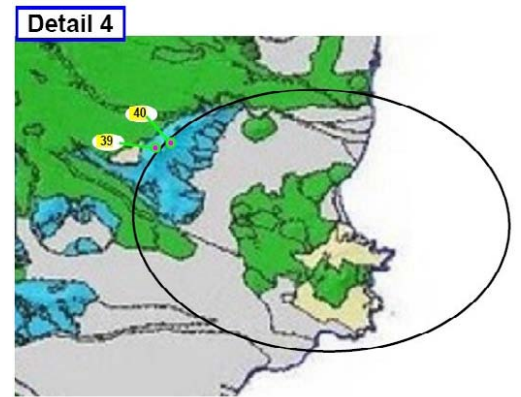
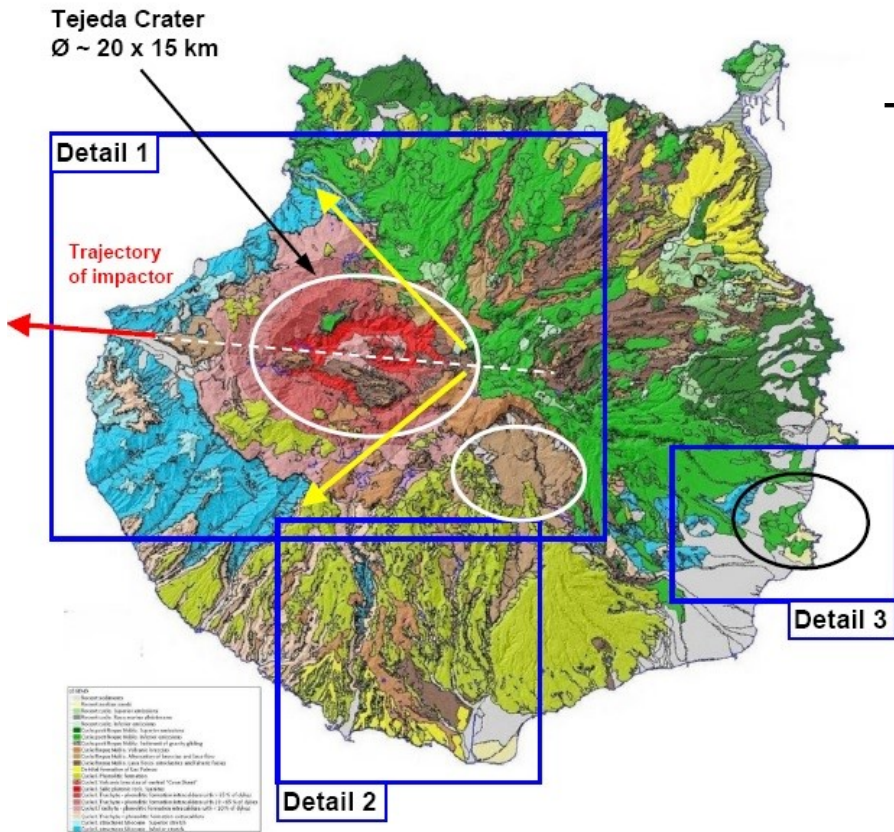
Note : Photos of the Sites 14, 20 & 25, 28, 29, 32, 33 & 34-B and other sample sites are available on my website. → : **Sample Sites "Tejeda Crater"** (or here) together with geological maps and a GPS-Data List of the sample sites.

Geological maps of selected sample areas :

→ Weblink to the Digital Geological-Map (IGME) :

→ <http://info.igme.es/visorweb/>

→ zoom-in to Gran Canaria





Sample Site 15-A



15-A

15-A 27° 59,450 N 15° 37,901 W 10 m Spain - Canary Islands

Sample Site 23



23



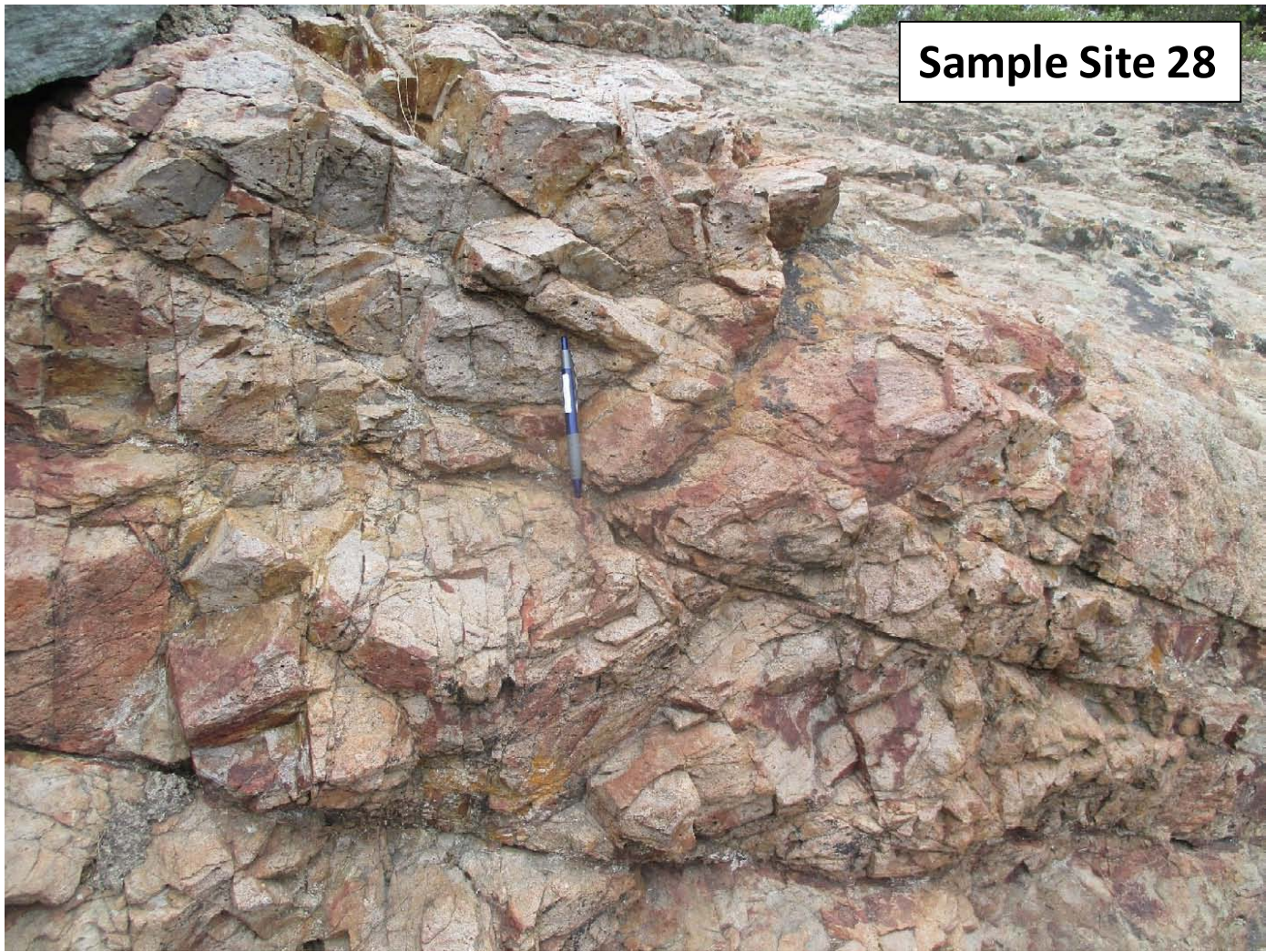
Sample Site 25



25



Sample Site 28



28



Sample Site 29



29



29 | 28° 0,577 N | 15° 41,325 W | 16 m | Canary Islands-3 (Gran Canaria-2)

Sample Site 32



32



32 | 28° 0,344 N | 15° 48,974 W | 12 m | Canary Islands-3 (Gran Canaria-2)

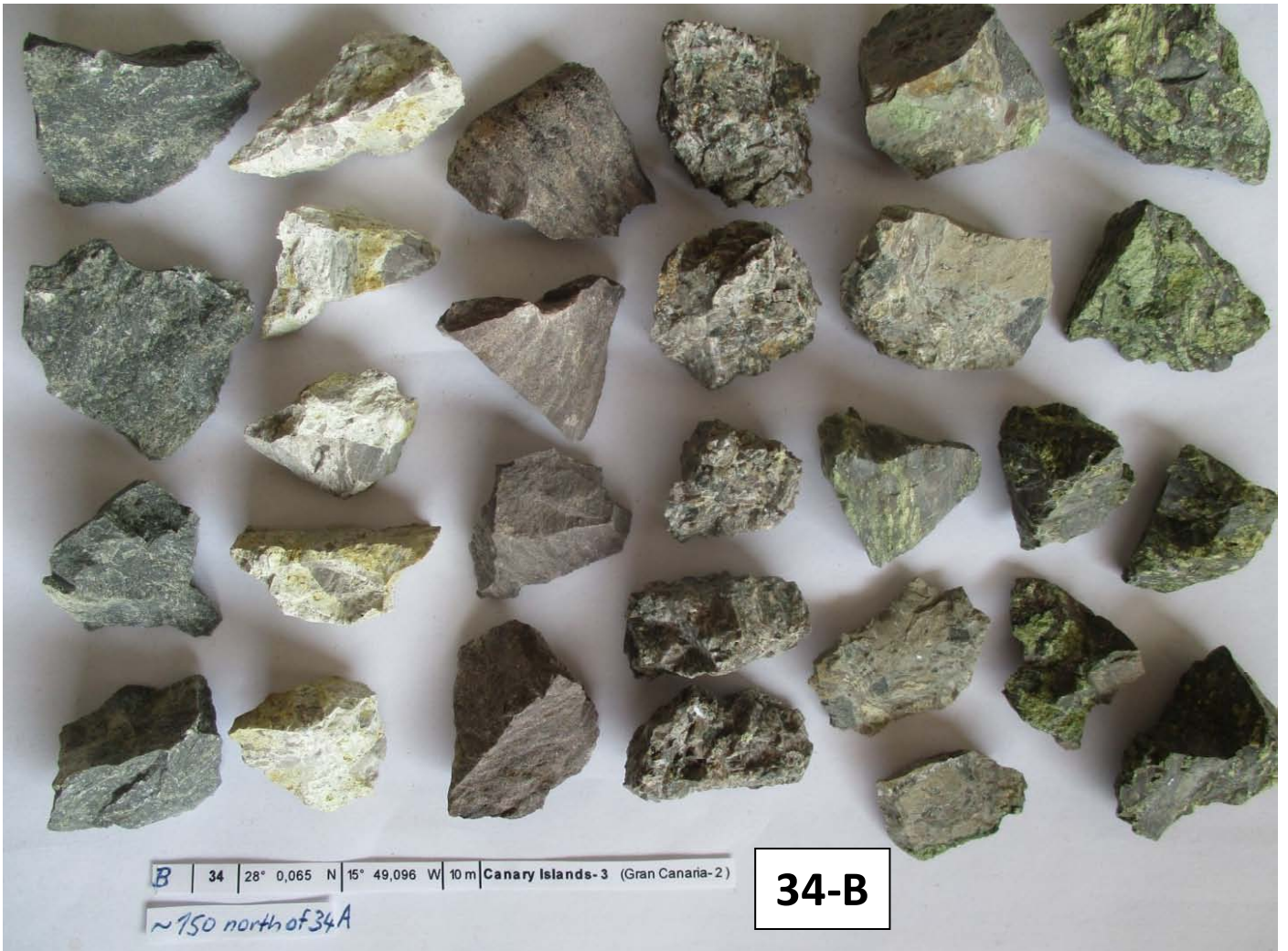
Sample Site 33



33



Sample Site 34-B



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

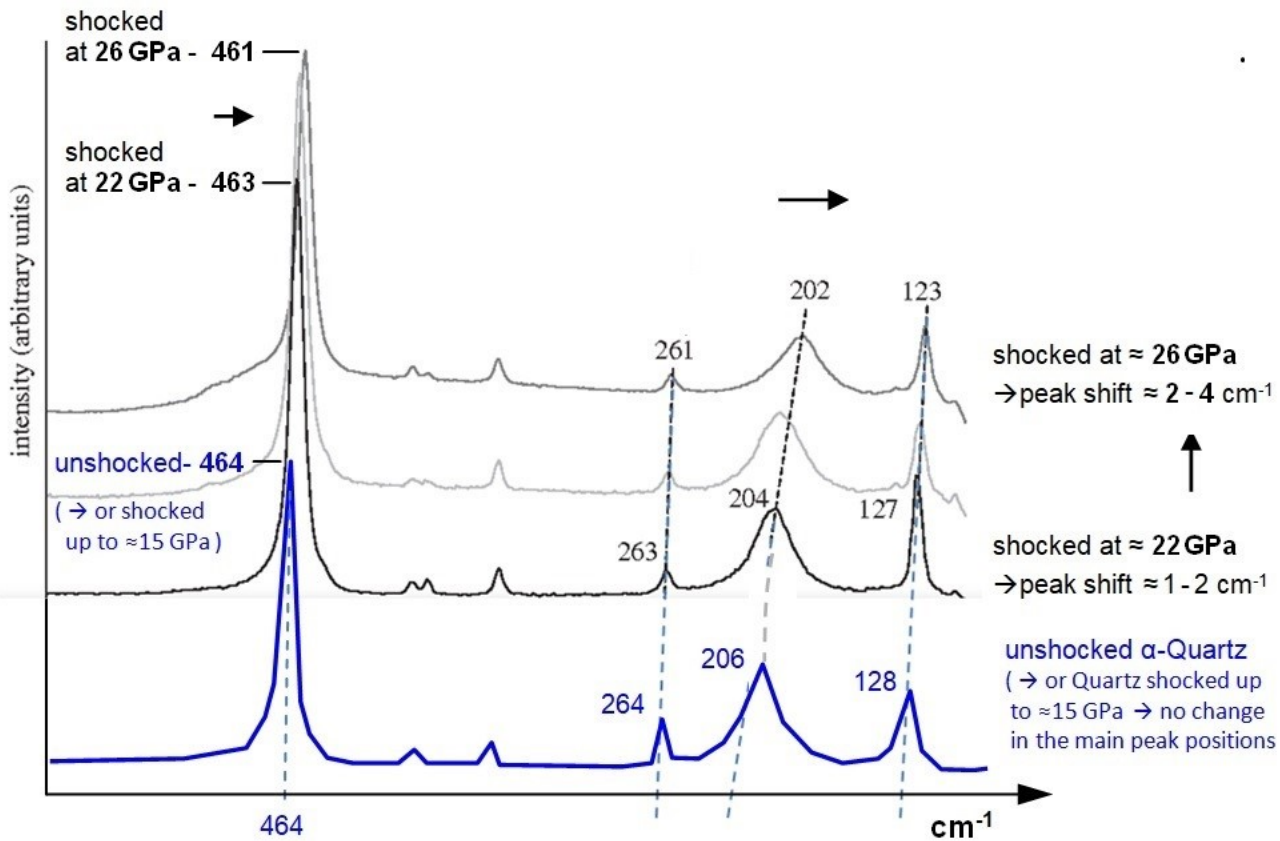
In order to verify a sample site as an impact site or impact structure, [shock-metamorphic effects](#) must be discovered in the rocks of the sample site. This can be done by different methods.

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.

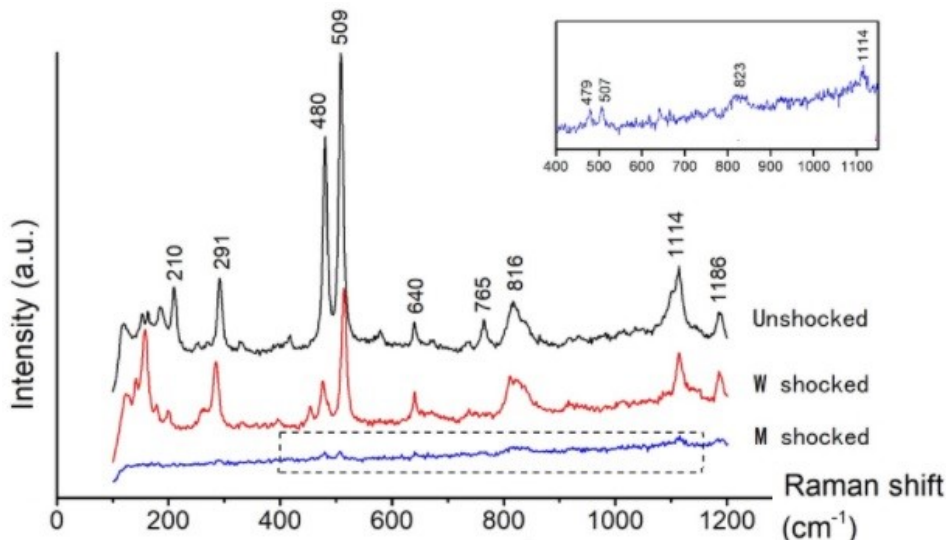
Mc Millan et al. (1992) and others have shown that the main RAMAN-peaks of Quartz shift towards lower frequencies if the Quartz was exposed the a shock-pressure > 15 GPa. → see diagram below

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 are available on : [Sample Sites "Tejeda Crater"](#) (or alternatively [here](#))

The following Impact-Craters & -structures belong to the same large-scale secondary impact event caused by the PTI :

[The 130 x 110 km Bay-of-Lyon Impact Crater \(France\)_Raman spectra of selected Rock Samples](#) (or [here](#))

[A 30 km Impact Structure and a 1.6 x 1.2 km Elliptical Crater in Southern Spain_Raman Spectra of Rock Samples](#) (or [here](#))

[Impact Craters on Fuerteventura & Tenerife](#): Raman-anlysis of rock-samples published soon on [vixra.org](#) & [archive.org](#)

Please also read : 1.) ScientificStudies to [Fuerteventura & Canarian Island's Geology](#) (→ links on page 2 !) - (→ or [here](#))

2.) ScientificStudies to [Tenerife & the Canarian Island's Geology](#) (→ links on page 2 !) - (→ 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](#)

[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, Phillipe 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

alternative : <https://www.sciencedirect.com/science/article/pii/S1631071302017005>

[Shock-induced irreversible transition from \$\alpha\$ -quartz to CaCl₂-like silica](#) - Journal of Applied Physics: Vol 96, No 8

<https://aip.scitation.org/doi/10.1063/1.1783609>

[Shock experiments on quartz targets pre-cooled to 77 K](#) - J. Fritz, K. Wünnemann, W. U. Reimold, C. Meyer

https://www.researchgate.net/publication/234026075_Shock_experiments_on_quartz_targets_pre-cooled_to_77_K

[A Raman spectroscopic study of a fulgurite](#) – by E. A. Carter, M.D. Hargreaves, ...

https://www.researchgate.net/publication/44655699_Raman_Spectroscopic_Study_of_a_Fulgurite

alternative : <https://royalsocietypublishing.org/doi/abs/10.1098/rsta.2010.0022>

[Shock-Related Deformation of Feldspars from the Tenoumer Impact Crater, Mauritania](#) - by Steven J. Jaret

<https://trace.tennessee.edu/cgi/viewcontent.cgi?article=1002&context=pursuit>

[A Study of Shock-Metamorphic Features of Feldspars from the Xiuyan Impact Crater](#) - by Feng Yin, Dequi Dai

[https://www.researchgate.net/publication/339672303_A_Study_of_Shock-](https://www.researchgate.net/publication/339672303_A_Study_of_Shock-Metamorphic_Features_of_Feldspars_from_the_Xiuyan_Impact_Crater)

[Metamorphic_Features_of_Feldspars_from_the_Xiuyan_Impact_Crater](#)

[Shock effects in plagioclase feldspar from the Mistastin Lake impact structure, Canada](#) – A. E. Pickersgill – 2015

<https://onlinelibrary.wiley.com/doi/pdf/10.1111/maps.12495>

[Shock Effects in feldspar: an overview](#) - by A. E. Pickersgill

<https://www.hou.usra.edu/meetings/lmi2019/pdf/5086.pdf>

[ExoMars Raman Laser Spectrometer RLS, a tool for the potential recognition of wet target craters on Mars](#)

https://www.researchgate.net/publication/348675414_ExoMars_Raman_Laser_Spectrometer_RLS_a_tool_for_the_potential_recognition_of_wet_target_craters_on_Mars