

An Impact Structure Ø 30 km and Impact Crater Ø 1,6 x 1,2 km in Southern Spain

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

Summary :

Raman spectra of samples taken from the sample sites **50**, **30** and **19** provide evidence that the large bow-shaped structure visible on the satellite image (see image below) was caused by an impact event. This bow-shaped structure $\approx \text{Ø } 30 \text{ km}$ belongs to a large-scale impact event which according to my hypothesis was caused by (impacting) ejecta material from the Permian Triassic Crater in the Arctic Sea (\rightarrow weblink to my Permian Triassic Impact Hypothesis : see **Part 1 (P1)** and **Part 2 (P2)** of my study).

The bow-shaped impact structure is located near Puerto de Mazarron in the state of Murcia in Andalusia. This impact structure belongs to large Secondary Crater Chain of the PT-Impact Event.

Further evidence for the large-scale impact event in Southern Spain (Andalusia & Murcia) comes from rock-samples collected in a small elliptical Crater with $\text{Ø } 1,6 \times 1,2 \text{ km}$ near the town of Rodalquilar. This elliptical crater in the remote East of Andalusia, which belongs to the assumed large-scale impact event in Southern Spain, has the potential to provide precise evidence for my hypothesis, because it provides the precise trajectory and impact angle of the impactor (\rightarrow ejecta from the P/T-Crater) !

The Raman spectra of quartz from sample site **50** on the outside of the crater-wall of the bow-shaped impact structure (near the tunnel exit of the AP7) provides clear evidence for an impact event !

The shift of the main Raman bands (peaks) to the lower frequencies **463, 261, 205** and **127 cm^{-1}** which is visible in the Raman Spectra of the quartz-sample, clearly indicates that the quartz was exposed to a **shock pressure of around 22 GPa**. (see explanation in the Appendix at page **24**). Similar shifts of the Raman bands are visible in the spectra of samples **19** & **30** from the center of the structure

The spectra of the quartz sample **40-B** from the center of the $\text{Ø } 1,6 \times 1,2 \text{ km}$ elliptical Crater shows similar shifts of the Raman bands, e.g. the measured bands at **463, 261/263, 203** and **127 cm^{-1}** , which also indicate a shock pressure of $\approx 22 \text{ GPa}$ that can only be the result of an impact event !

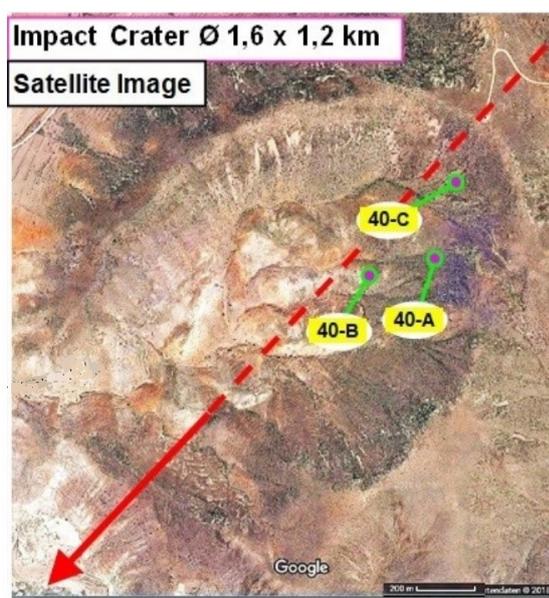
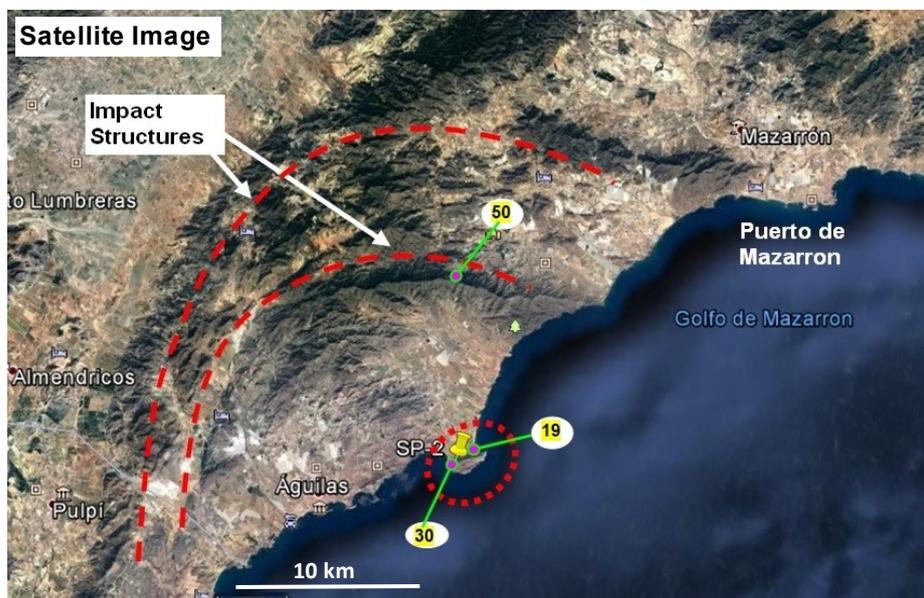
All spectra were made with a **BRUKER Senterra-II Raman Microscope** (wavenumber precision $<0.1 \text{cm}^{-1}$)

A shock pressure of 22 GPa far exceeds every pressure caused by normal terrestrial metamorphism. Therefore the quartz was clearly shocked by an impact event. The indicated shock pressure of 22 GPa is lower than the shock pressure that occurred in other large impact craters on Earth, which can reach 100 GPa. This indicates that the bow-shaped structure was caused by an oblique impact That means the impactor which formed the structure (\rightarrow ejecta of the PT-Crater) impacted in a very shallow angle. The same is true for the yet unknown $\text{Ø } 1,6 \times 1,2 \text{ km}$ elliptical Impact Crater near Rodalquilar.

\rightarrow Images of the analysed rock samples and photos of the sample sites are in the Appendix at **page 19**.

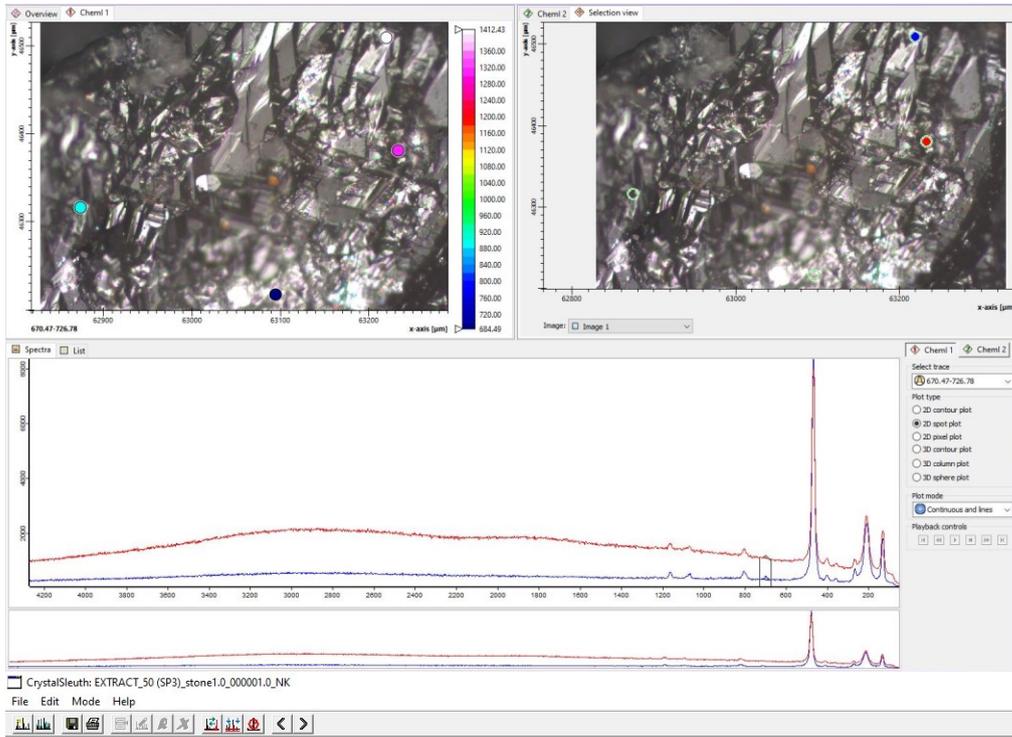
\rightarrow A general summary to all analysed sample sites is provided by **Part 6 (P6)** of my **PTI-hypothesis (P1)**

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

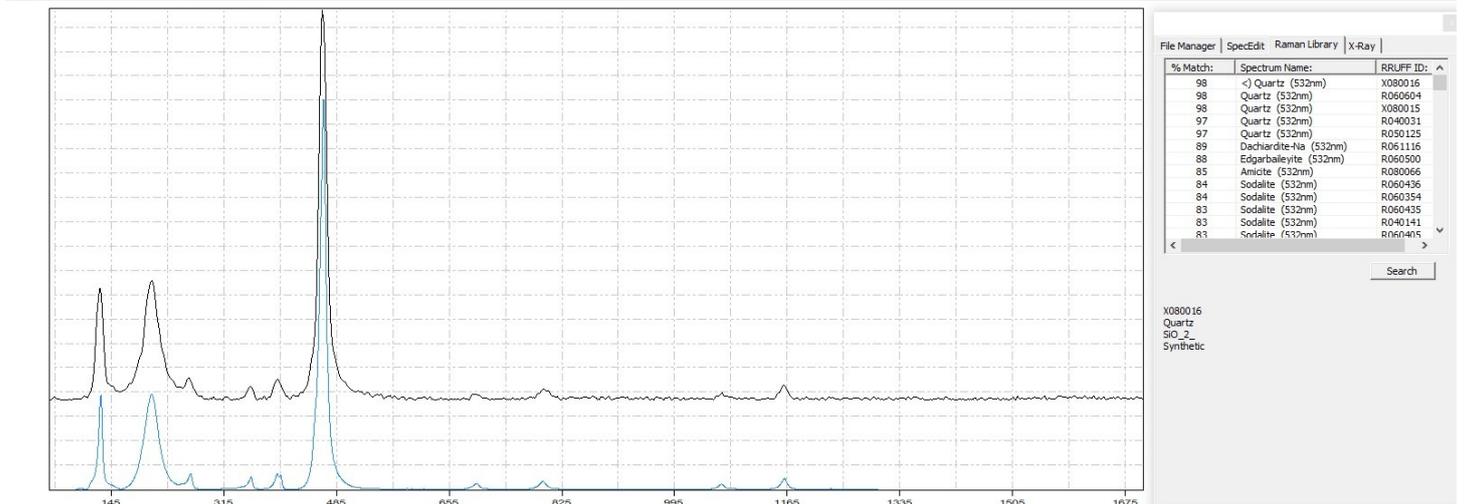


Sample Site 50: Stone 1_spectra 1 indicates: **Quartz**

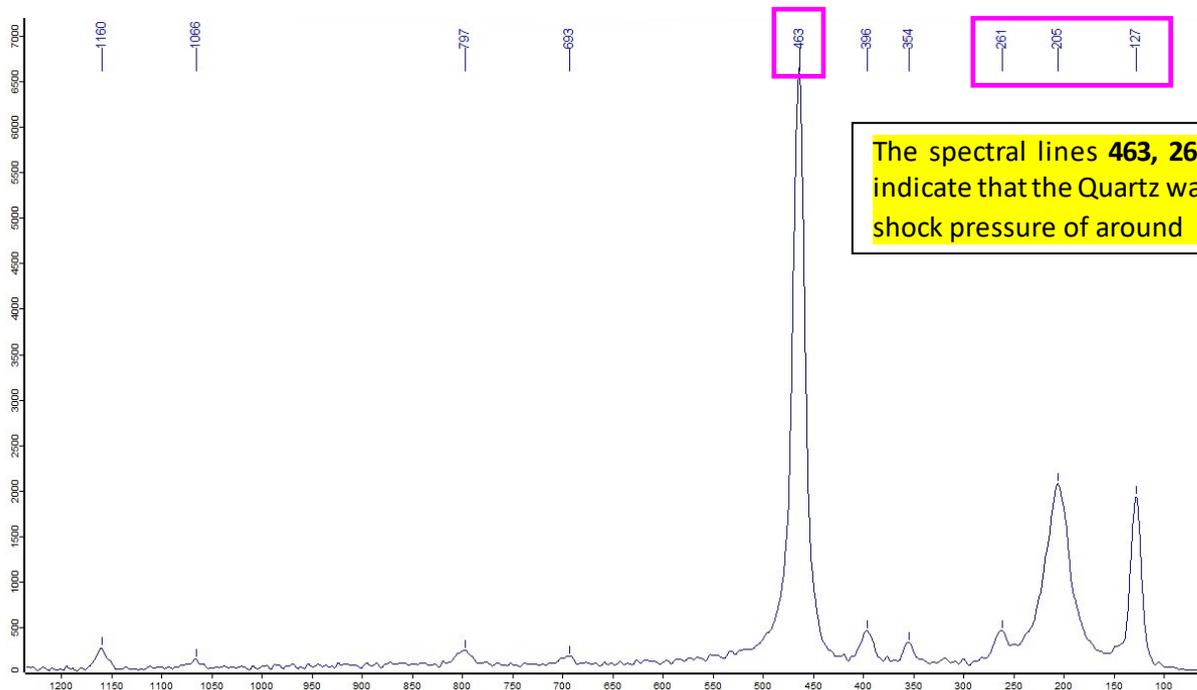
(→ see RRUFF_search results)



Sample :



Indication for a shock event are the shifts of the marked Quartz spectral lines towards 463, 261, 205 and 127

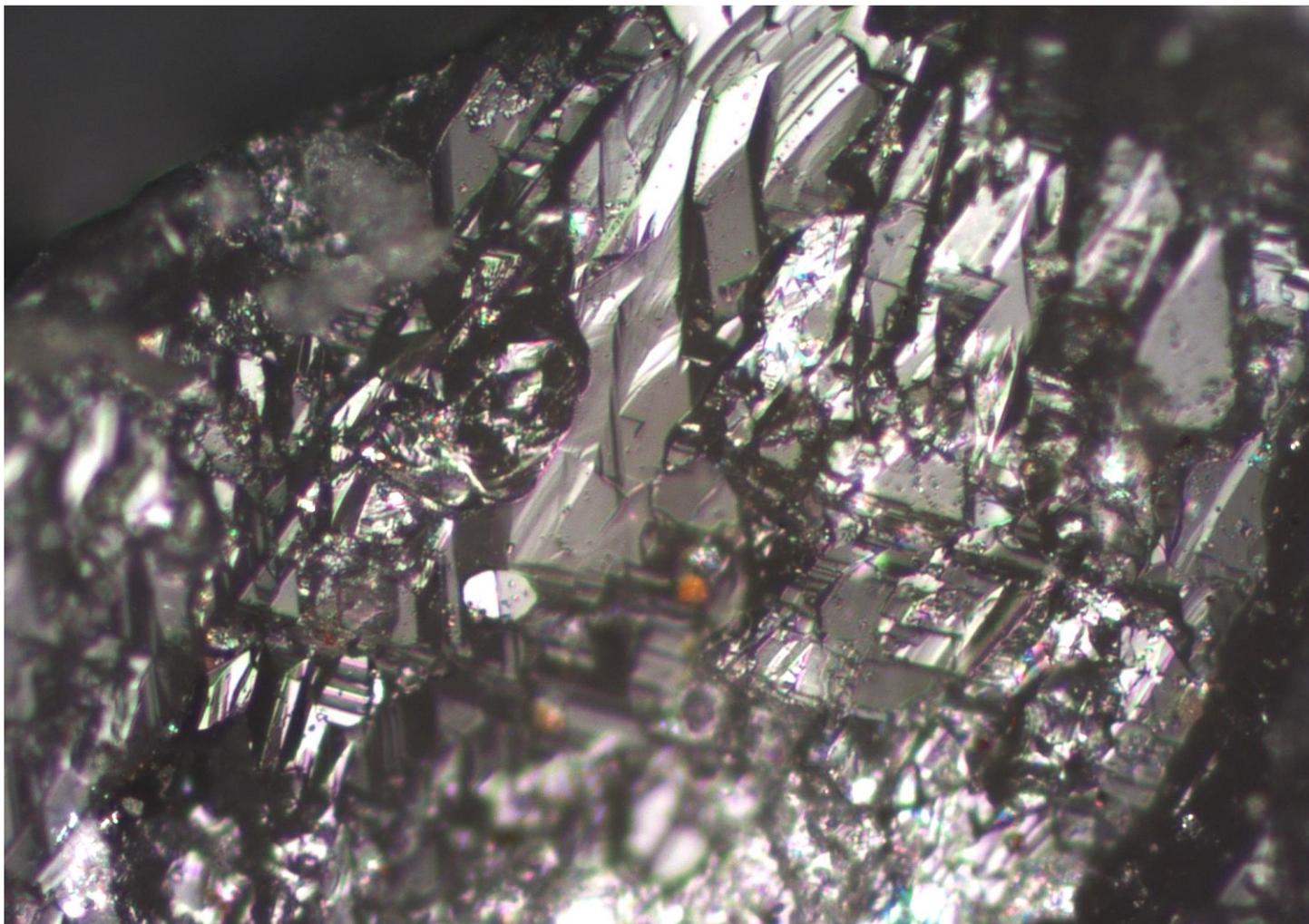


The spectral lines 463, 261, 205 and 127 indicate that the Quartz was exposed to a shock pressure of around 22 GPa

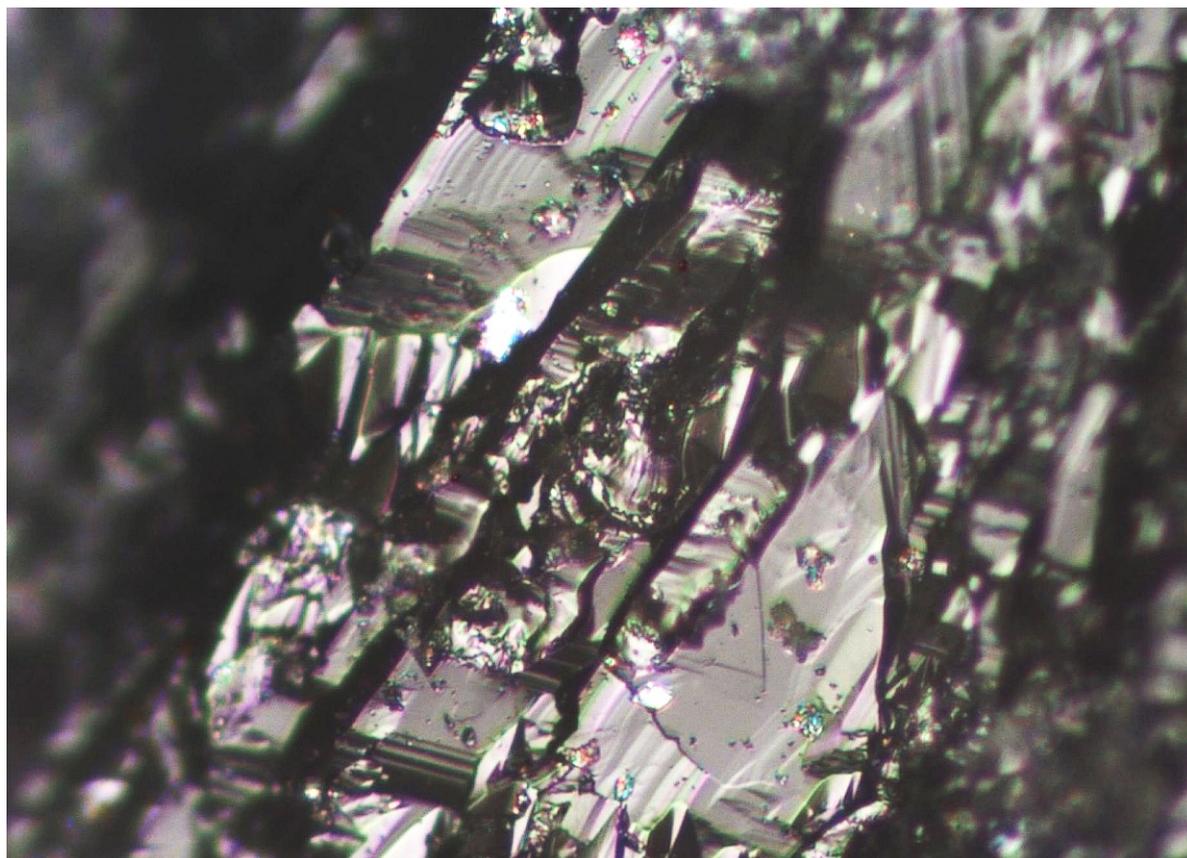
Microscopic Images : Sample from Site 50 → original state (no preparation for analysis)

Sample Site 50 : Stone 1_spectra 1 indicates : Quartz - Image size : ~ 400 x 300 μm

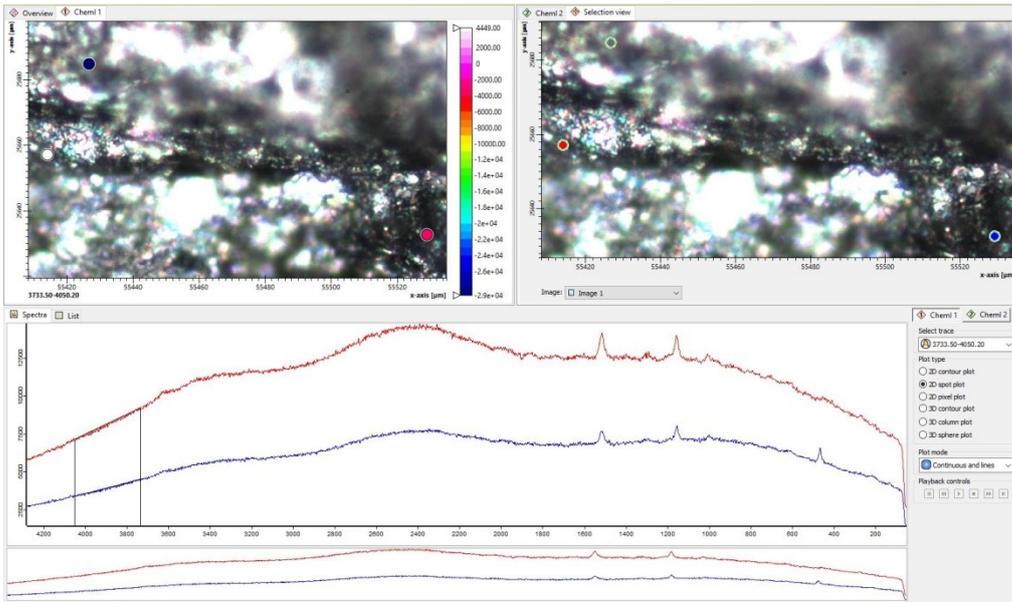
Note the exceptional fracture pattern visible in the quartz sample !



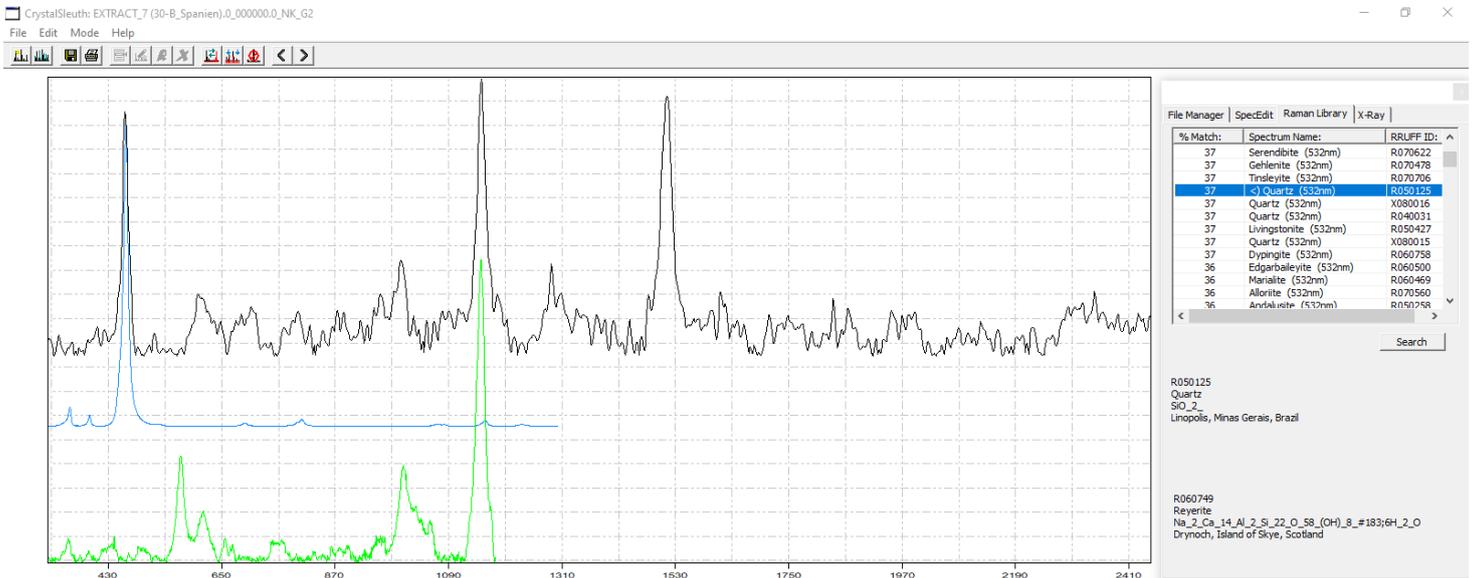
Sample Site 50 : Stone 1_spectra 1 indicates : Quartz - Image size : ~ 300 x 200 μm



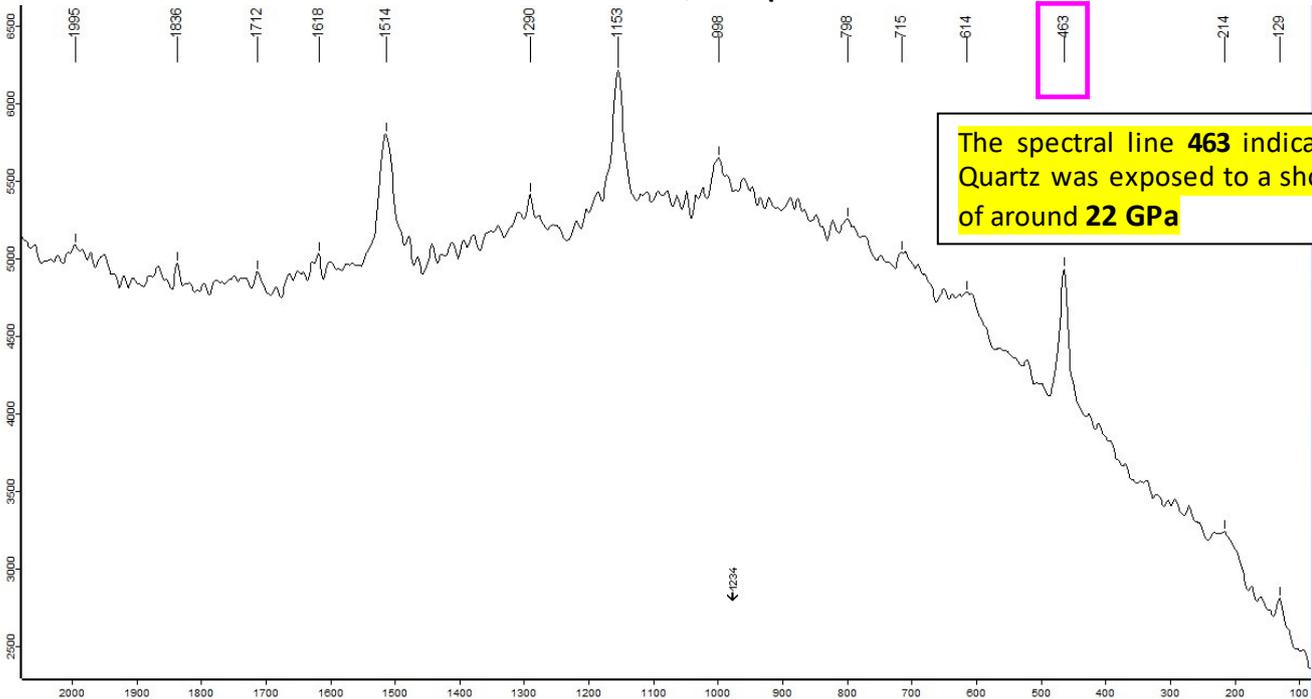
Sample Site **30-B** : Stone 1_spectra 1 indicates : **Quarz, Reyerite** (→ see RRUFF_search results)



Sample :

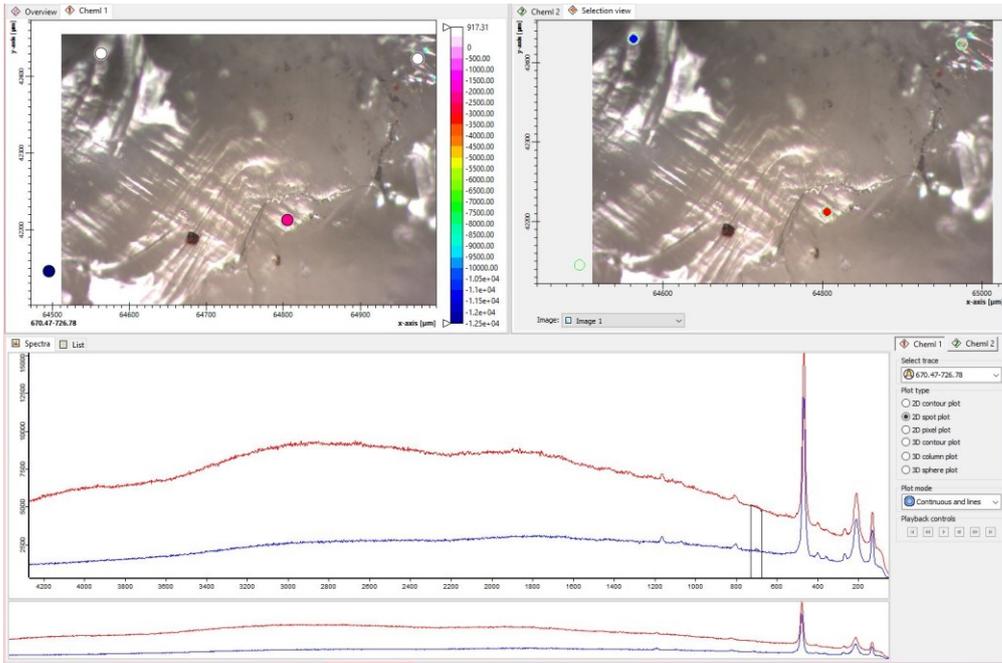


Indication for a shock event is the shift of the marked Quartz spectral line towards 463

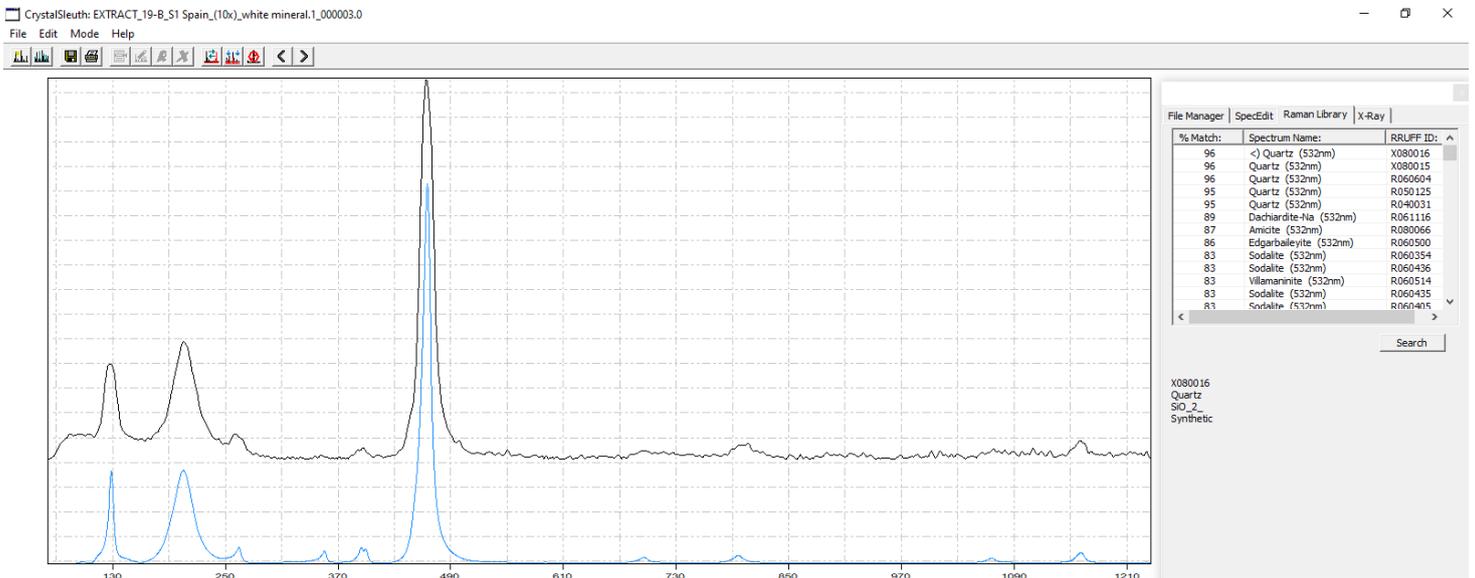


Sample Site **19-B** : Stone 3_spectra 1 indicates : **Quartz**

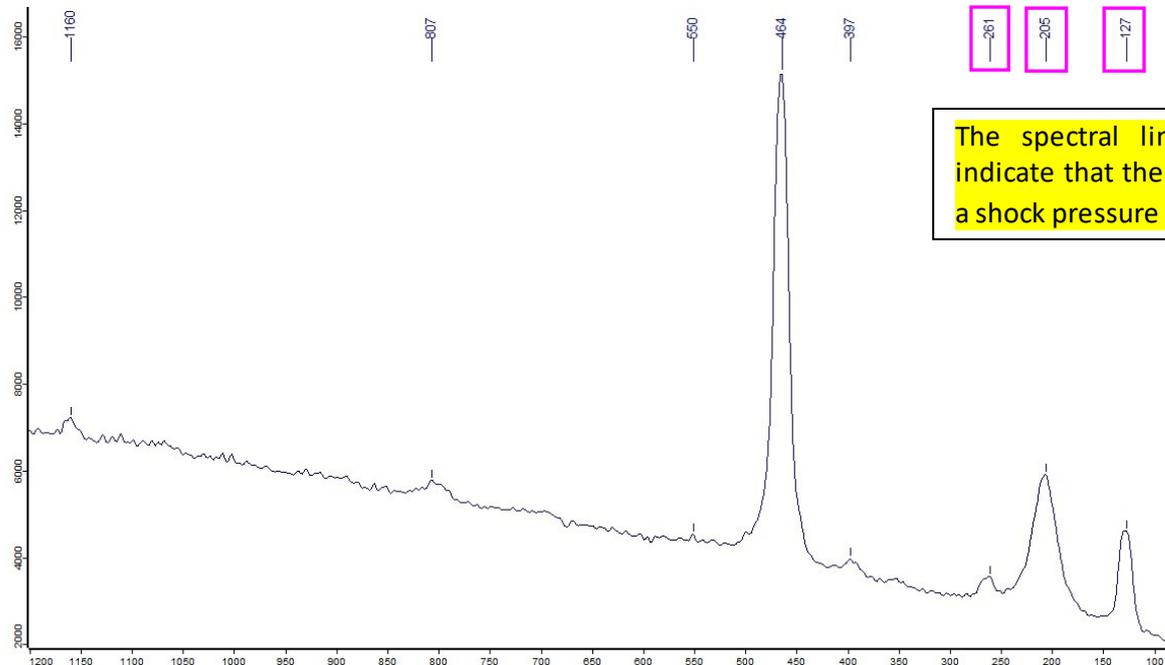
(→ see RRUFF_search results)



Sample :



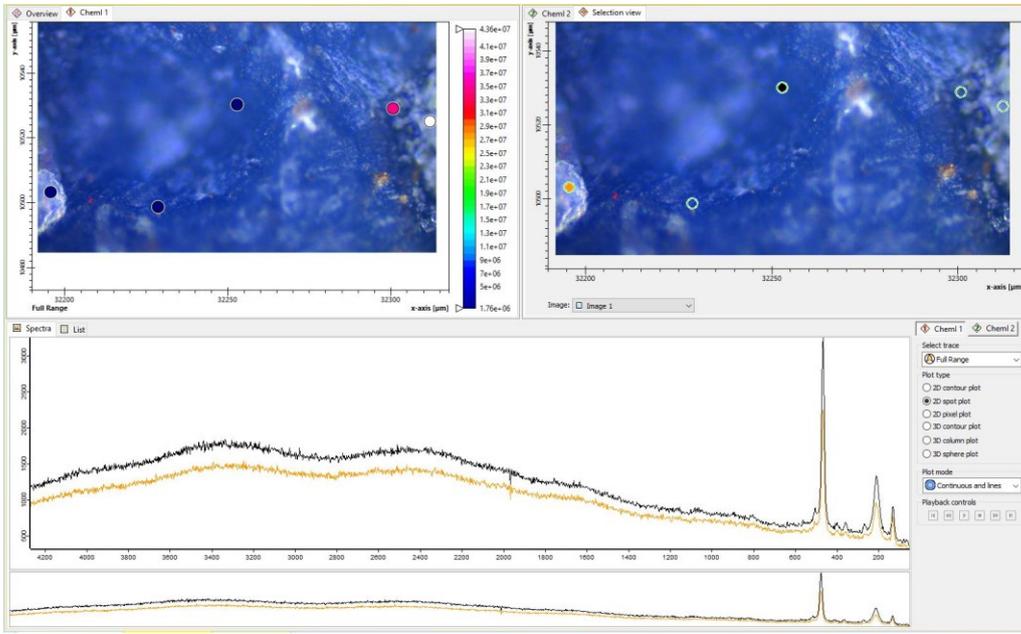
Indication for a shock event are the shifts of the marked Quartz spectral lines towards 261, 205 and 127



The spectral lines 261, 205 and 127 indicate that the Quartz was exposed to a shock pressure of around 20 – 22 GPa

Sample Site **40-B** : Stone 1_spectra 1 indicates : **Quartz**

(→ see RRUFF_search results)

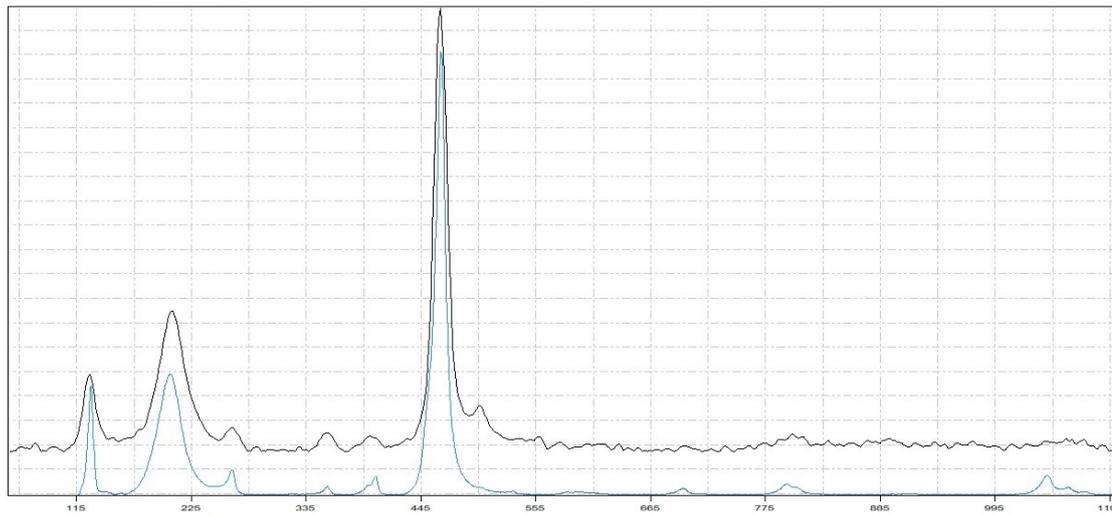


Sample :



CrystalSleuth: EXTRACT_40-B (SP3)_messung1.0_000000.0_G1_NK

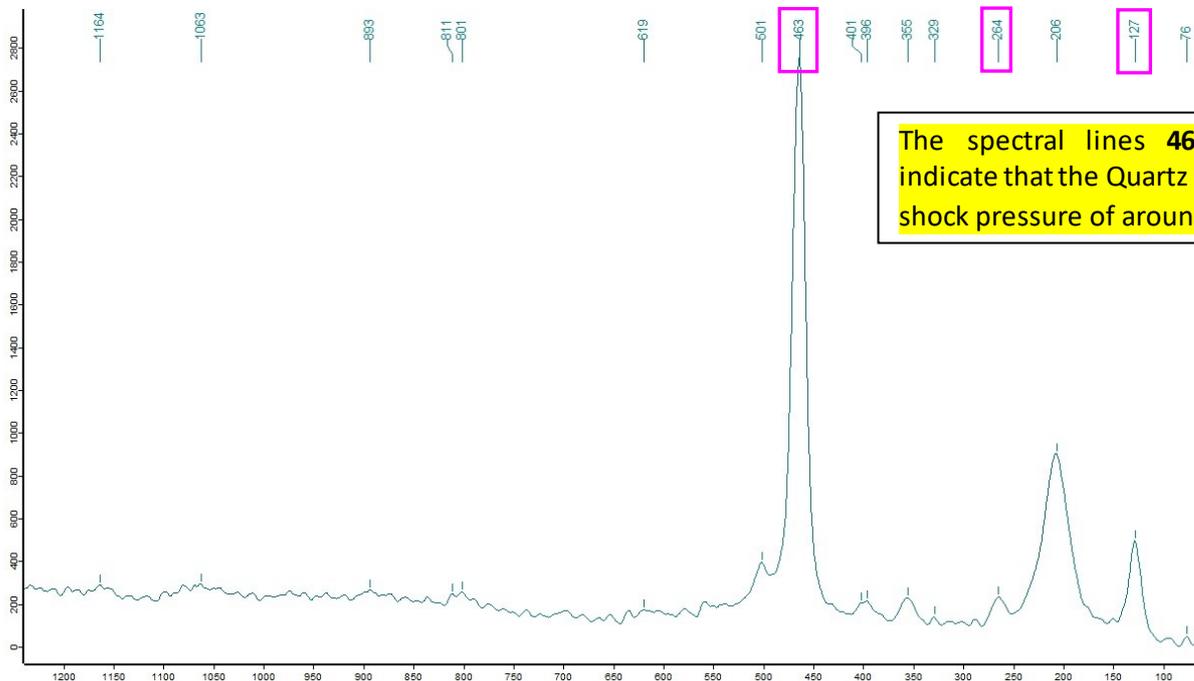
File Edit Mode Help



% Match:	Spectrum Name:	RRUFF ID:
97	<-) Quartz (532nm)	R060604
97	<-) Quartz (532nm)	X080015
97	Quartz (532nm)	R040031
97	<-) Quartz (532nm)	X080016
97	Quartz (532nm)	R050125
92	Dachiardite-Na (532nm)	R061116
88	Edgarbaeyleite (532nm)	R060500
87	Amicite (532nm)	R080056
85	Sodalite (532nm)	R060435
85	Sodalite (532nm)	R060354
85	Sodalite (532nm)	R060436
85	Sugilite (532nm)	R070684
85	Sodalite (532nm)	R040141

X080015
Quartz
SiO₂
Synthetic

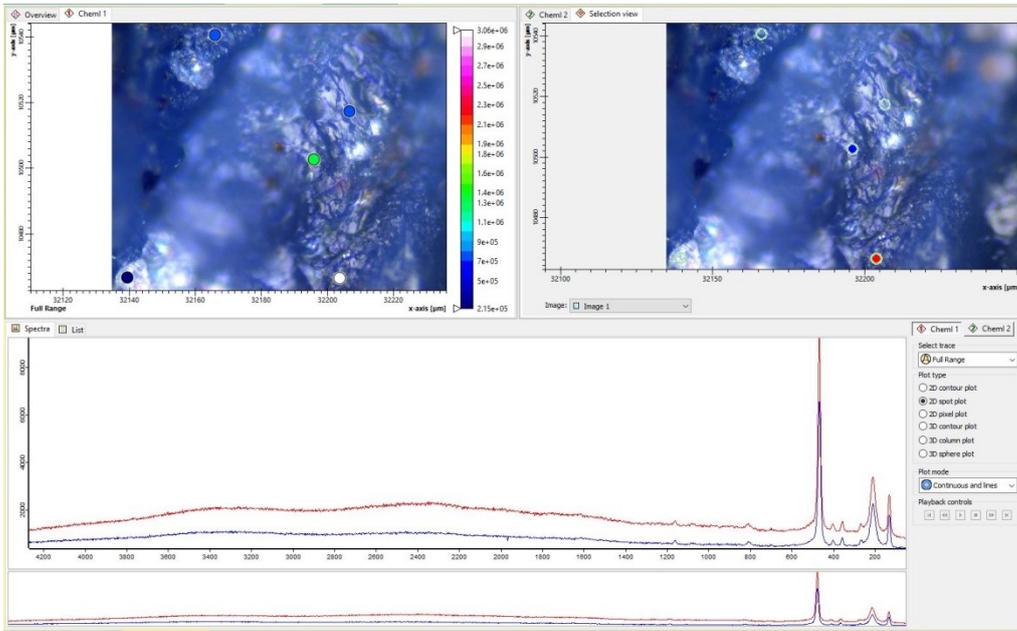
Indication for a shock event are the shifts of the marked Quartz spectral lines towards 463, 264 and 127



The spectral lines **463, 264 and 127** indicate that the Quartz was exposed to a shock pressure of around **22 GPa**

Sample Site **40-B** : Stone 1_spectra 2 indicates : **Quartz**

(→ see RRUFF_search results)

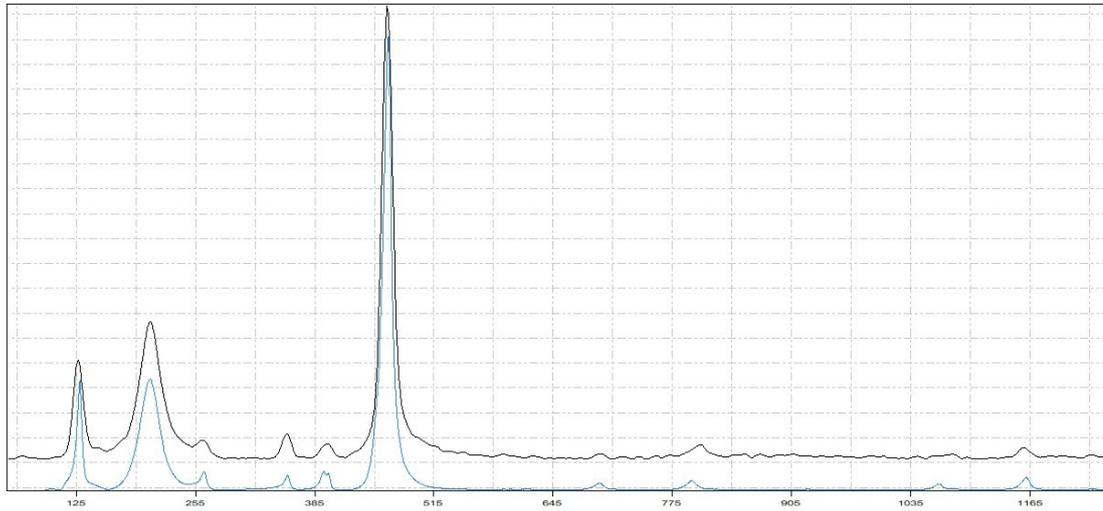


Sample :



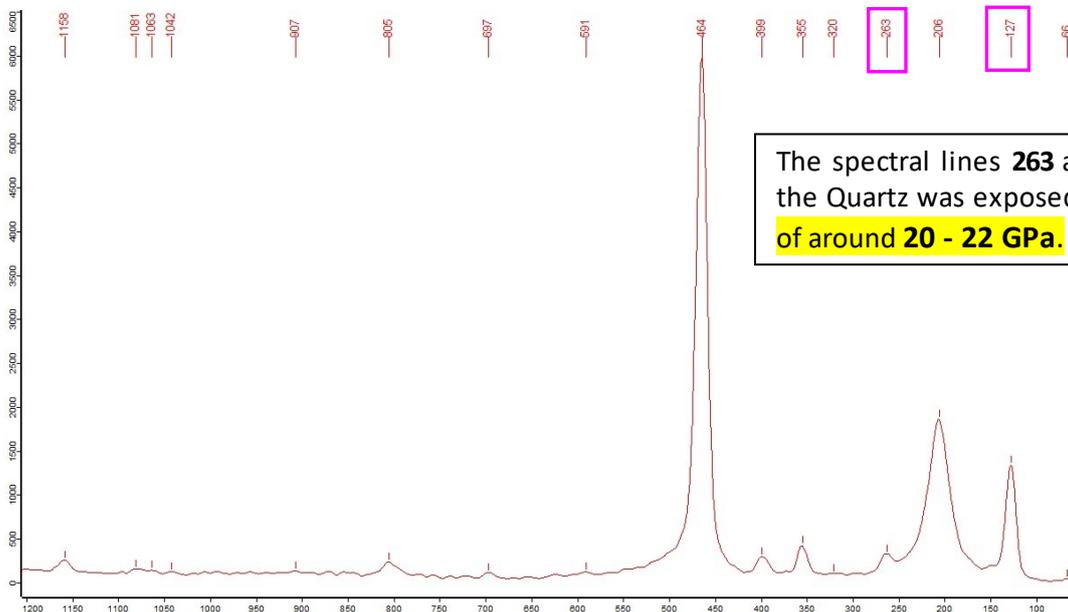
CrystalSleuth: EXTRACT_40-B (SP3)_messung2.0_000000.0_NK_G2

File Edit Mode Help



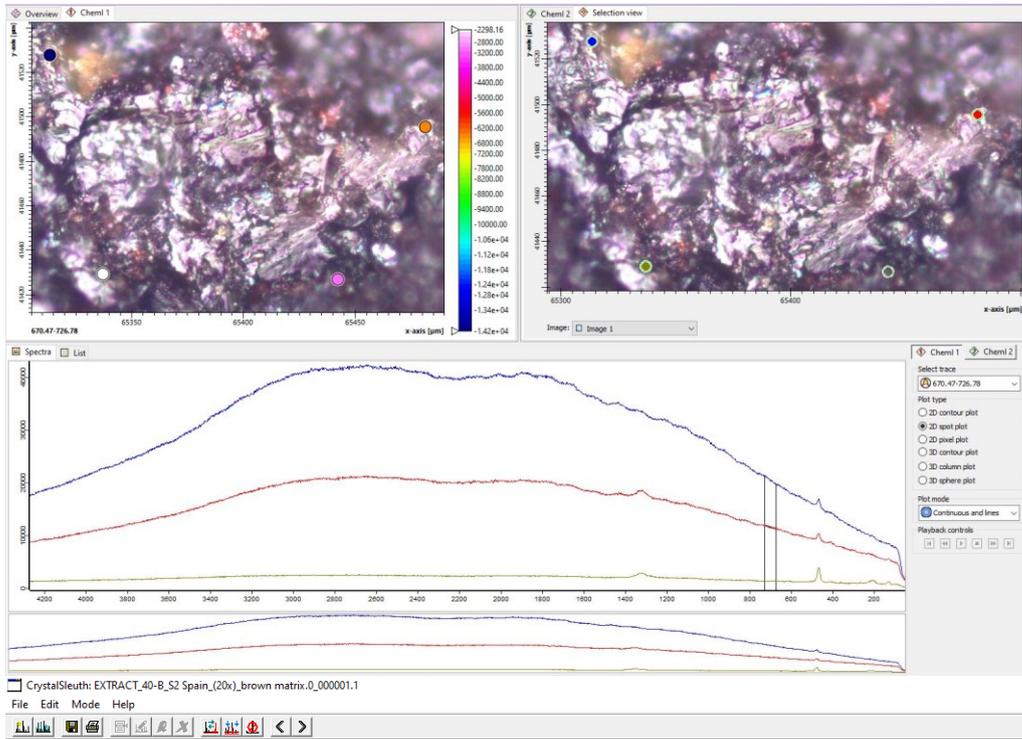
% Match:	Spectrum Name:	RRUFF ID:
99	-) Quartz (532nm)	X080016
99	Quartz (532nm)	X080015
98	Quartz (532nm)	R060604
98	Quartz (532nm)	R050125
98	Quartz (532nm)	R040031
90	Dachshardite-Ha (532nm)	R061116
88	Edgarbaleyite (532nm)	R060500
86	Amicite (532nm)	R080066
85	Sodalite (532nm)	R060436
84	Sodalite (532nm)	R060354
84	Sodalite (532nm)	R040141
84	Sodalite (532nm)	R060435
84	Sodalite (532nm)	R060405

Indication for a shock event are the shifts of the marked Quartz spectral lines towards 263 and 127

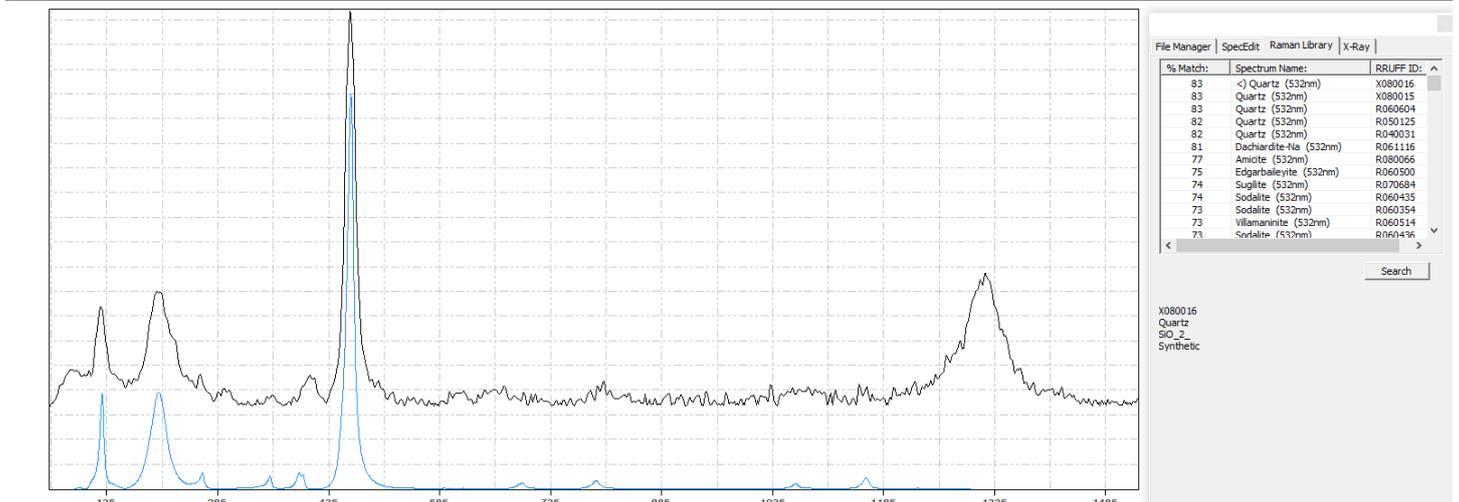


The spectral lines **263** and **127** indicate that the Quartz was exposed to a **shock pressure of around 20 - 22 GPa.**

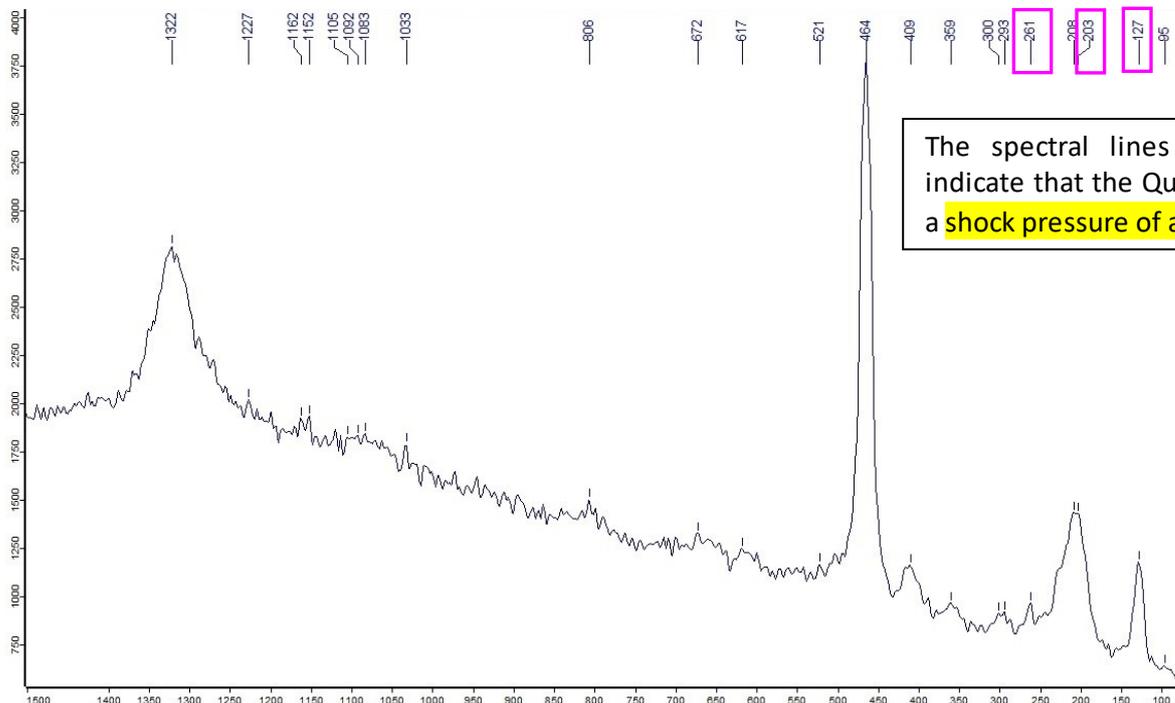
Sample Site **40-B** : Stone 2_spectra 1 (brown mineral) indicates : **Quartz** (→ see RRUFF_search results)



Sample :

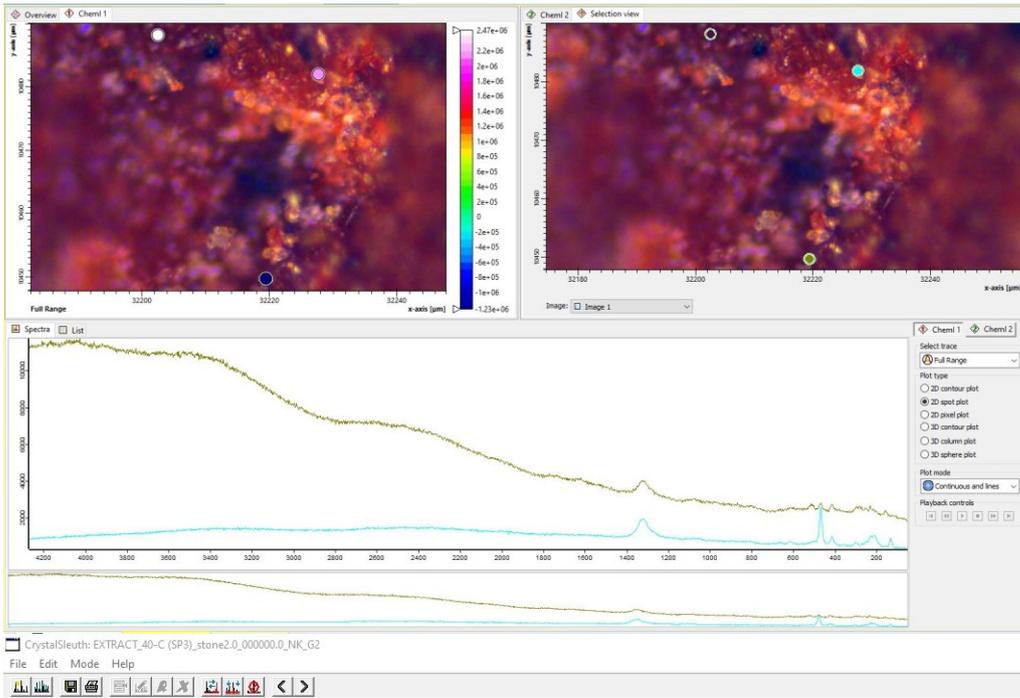


Indication for a shock event are the shifts of the marked Quartz spectral lines towards 261, 203 and 127

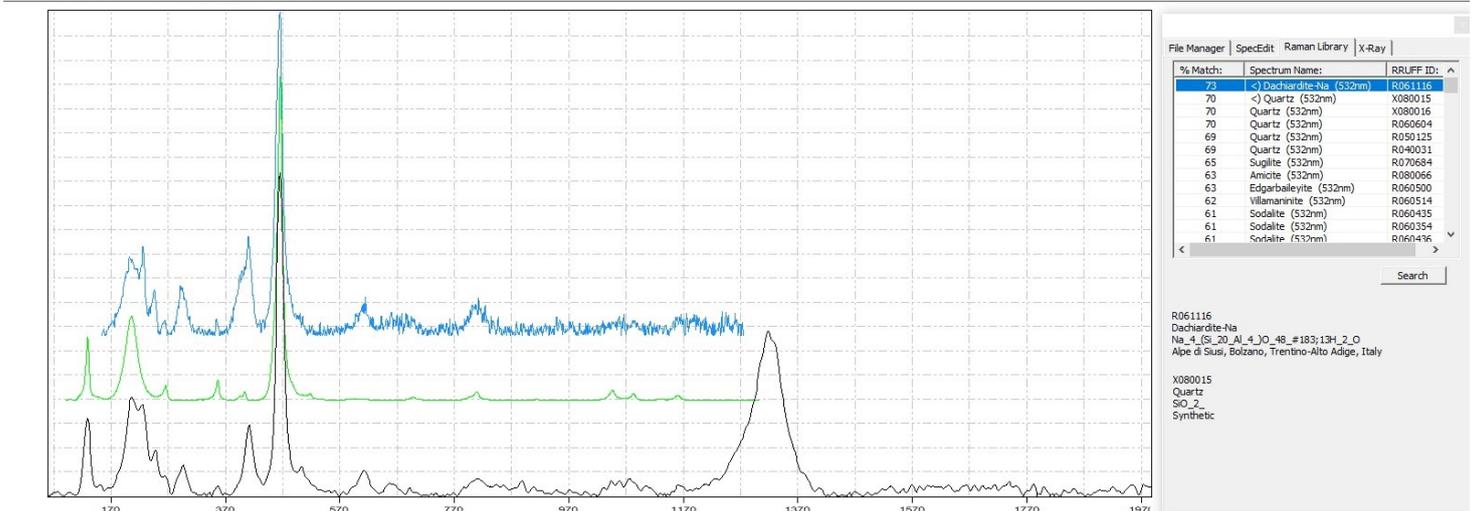


The spectral lines 261, 203 and 127 indicate that the Quartz was exposed to a shock pressure of around 20 – 22 GPa

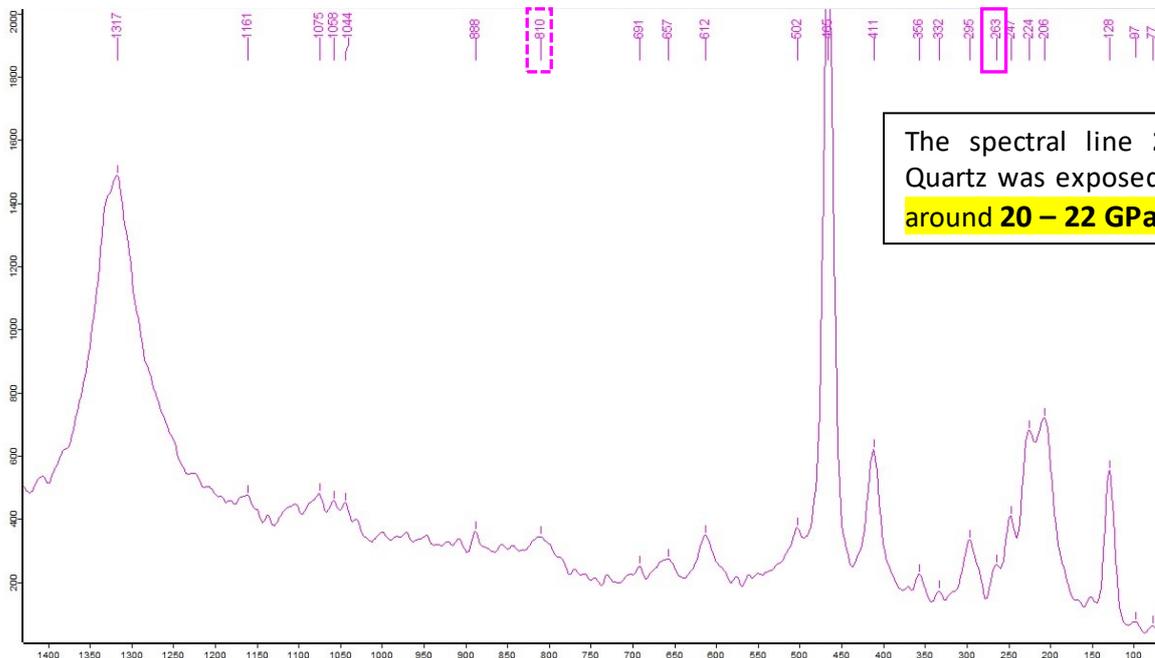
Sample Site **40-C** : Stone 2_spectra 1(brown mineral) indicates : **Quartz, Dachiardite-Na** (→RRUFF)



Sample :

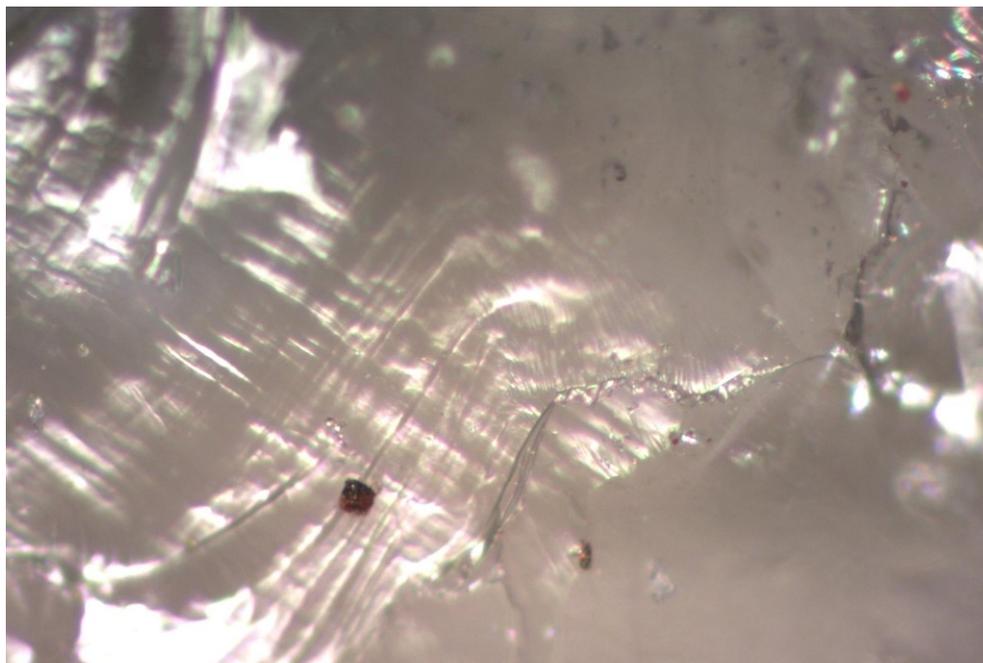


Indication for a shock event are the shifts of the marked Quartz spectral line towards 263

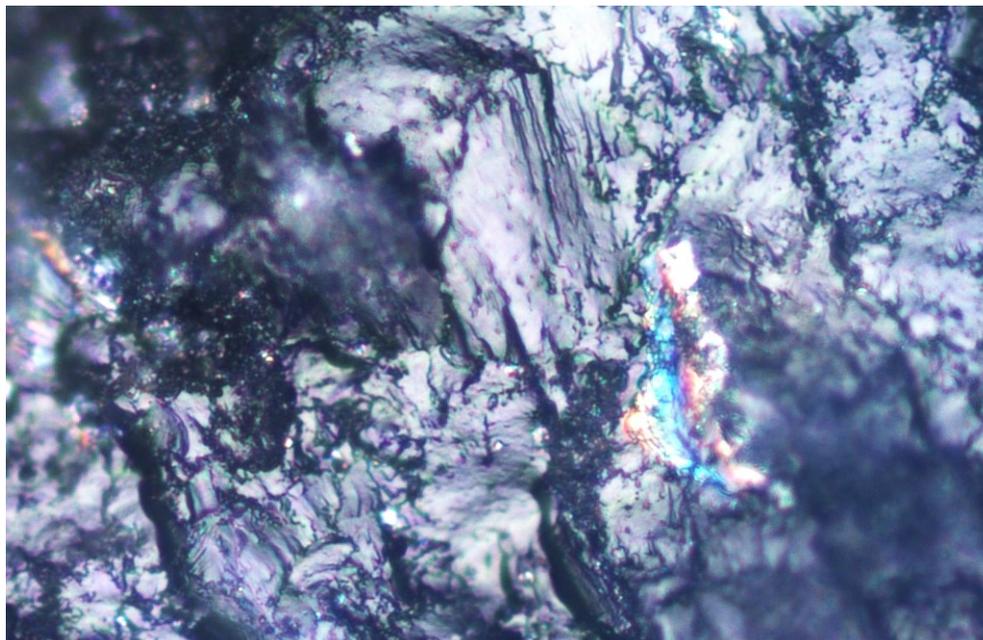


Microscopic Images : Sample from Sites 19-B, 40-B and 40-C → original state (no preparation)

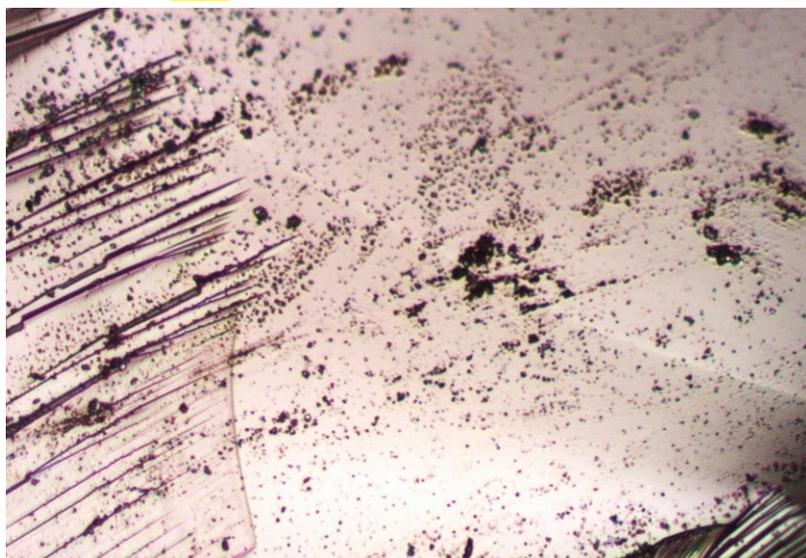
Sample Site 19-B : Stone 3_spectra 1 : Quartz - Image size : ~ 400 x 300 μm



Sample Site 40-B : Stone 1_spectra 2 : Quartz - Image size : ~ 400 x 300 μm

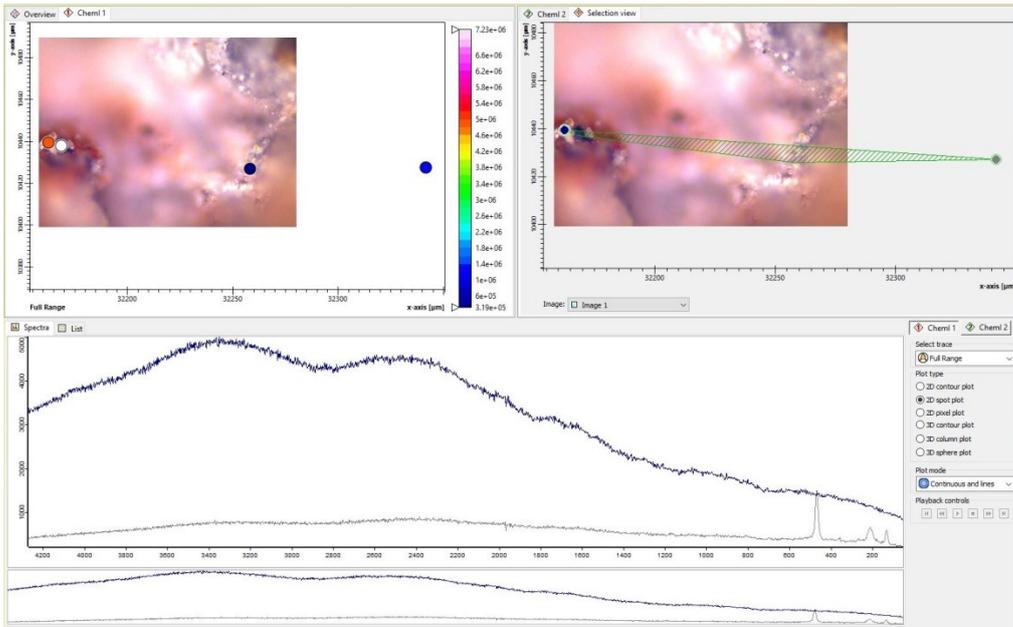


Sample Site 40-C : Stone 2 : Quartz, : ~ 300 x 200 μm

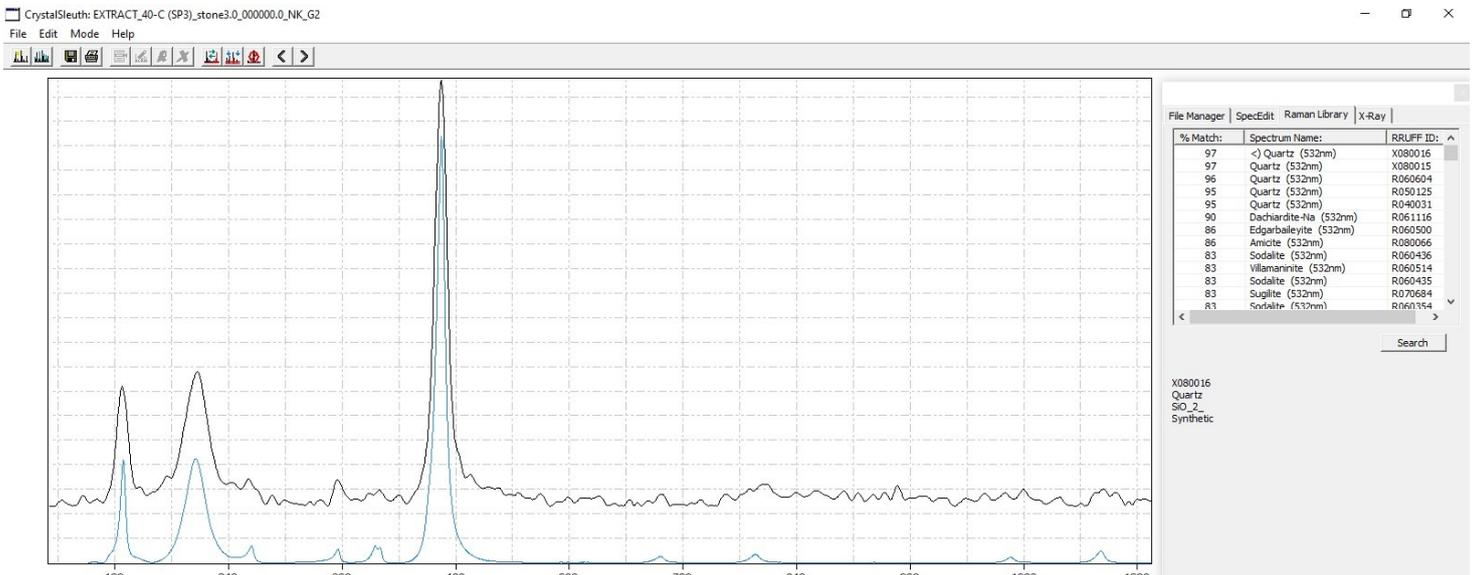


Sample Site **40-C** : Stone 3_spectra 1 indicates : **Quartz**

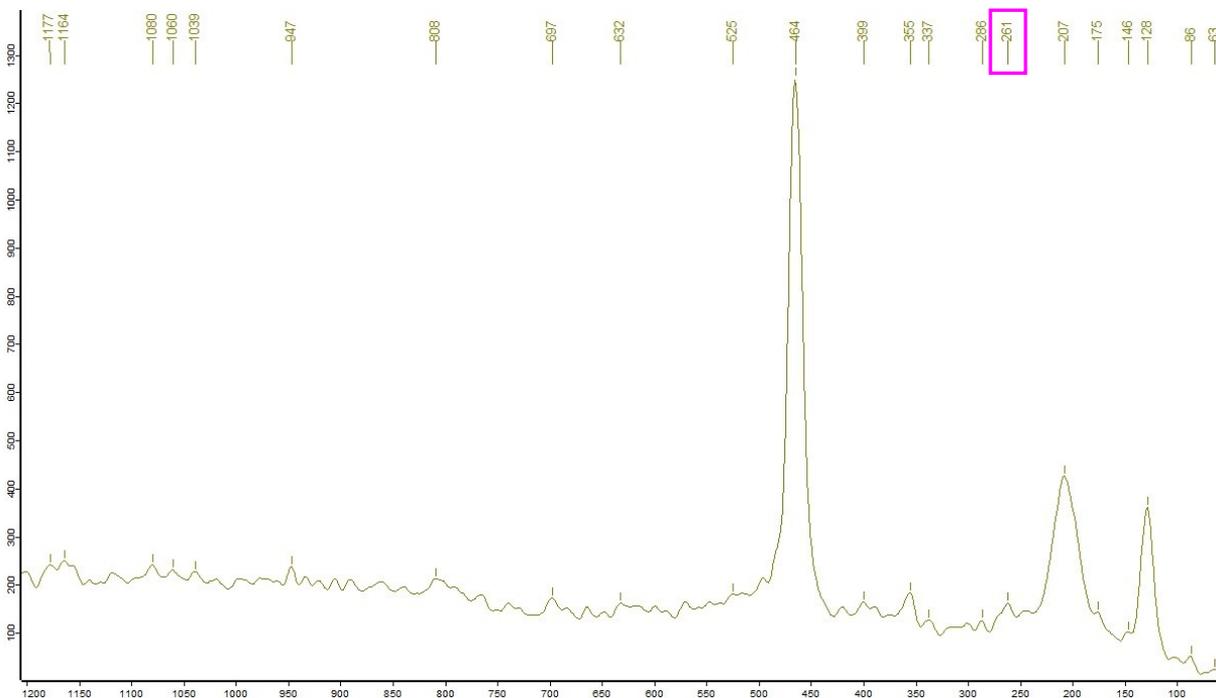
(→ see RRUFF_search results)



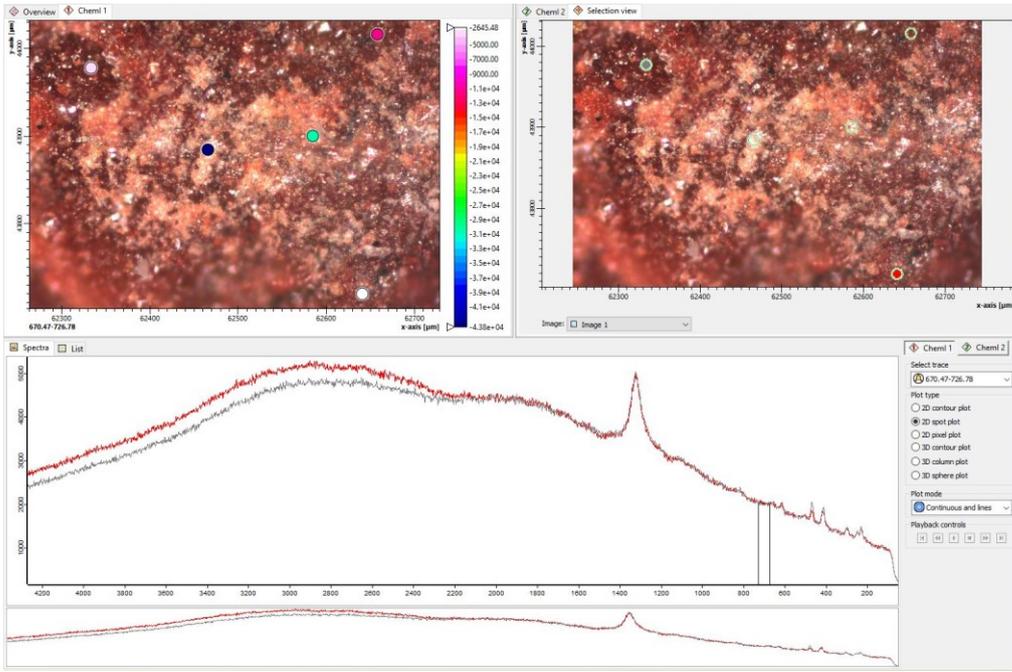
Sample :



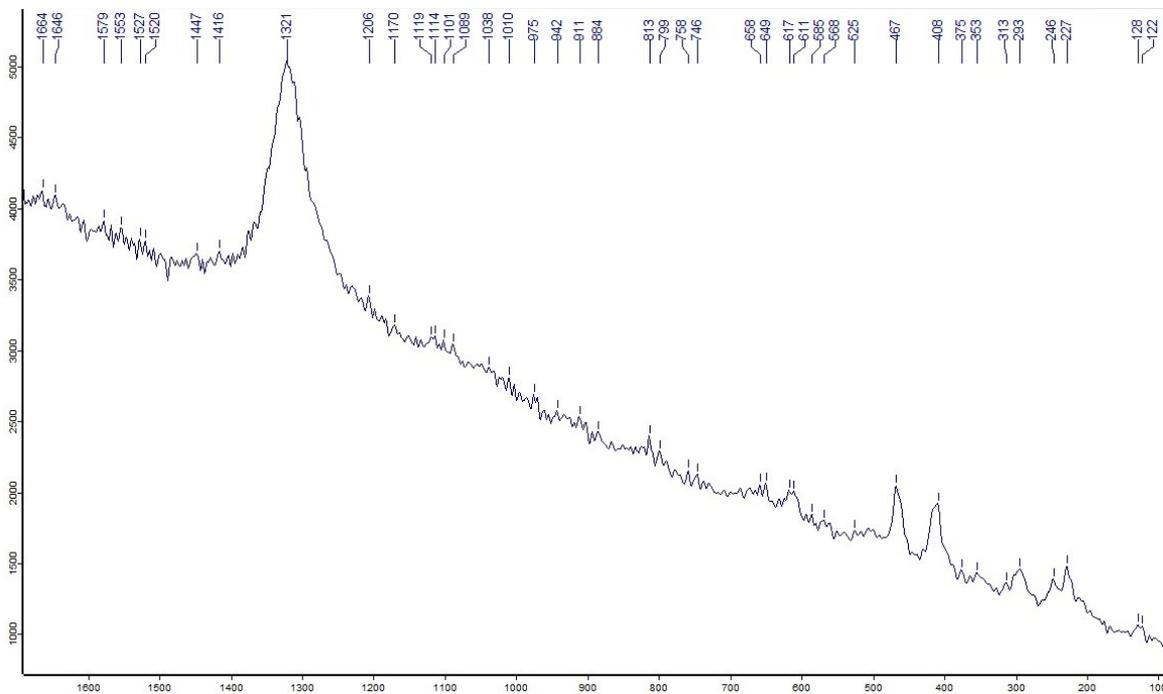
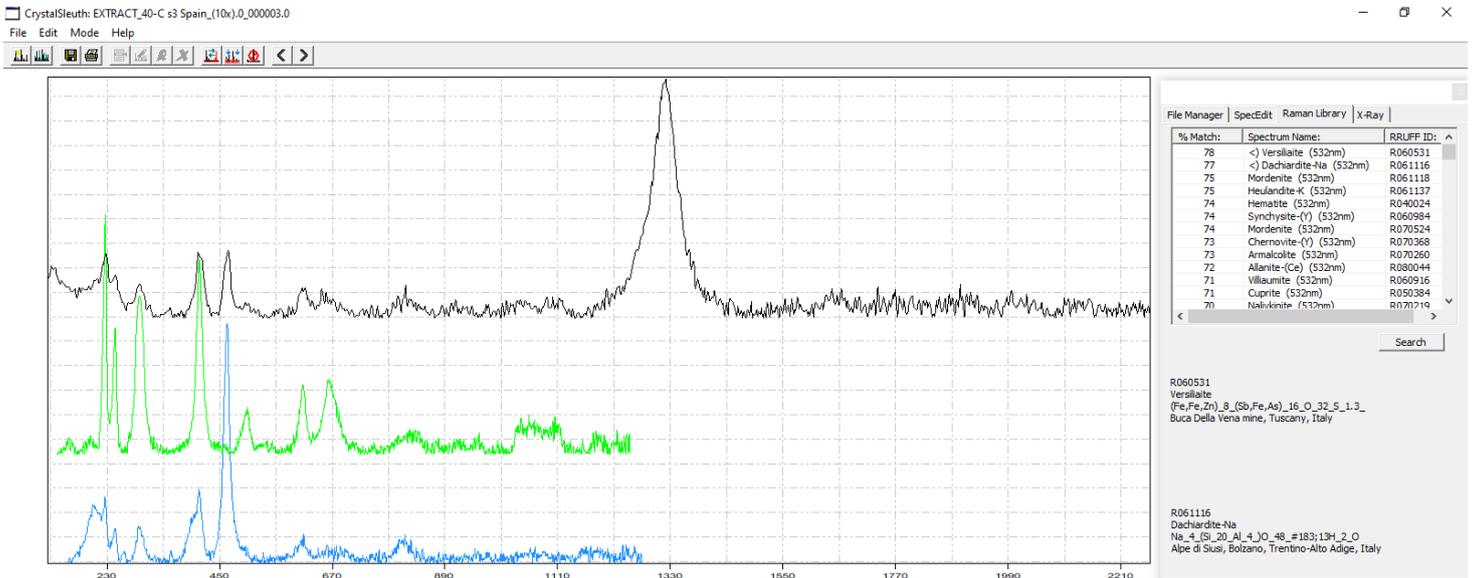
Indication for a shock event are the shifts of the marked Quartz spectral lines towards 261



Sample Site **40-C** : Stone 3_spectra 2 indicates : **Dachiardite-Na, Versiliaite** (→ see RRUFF_search results)

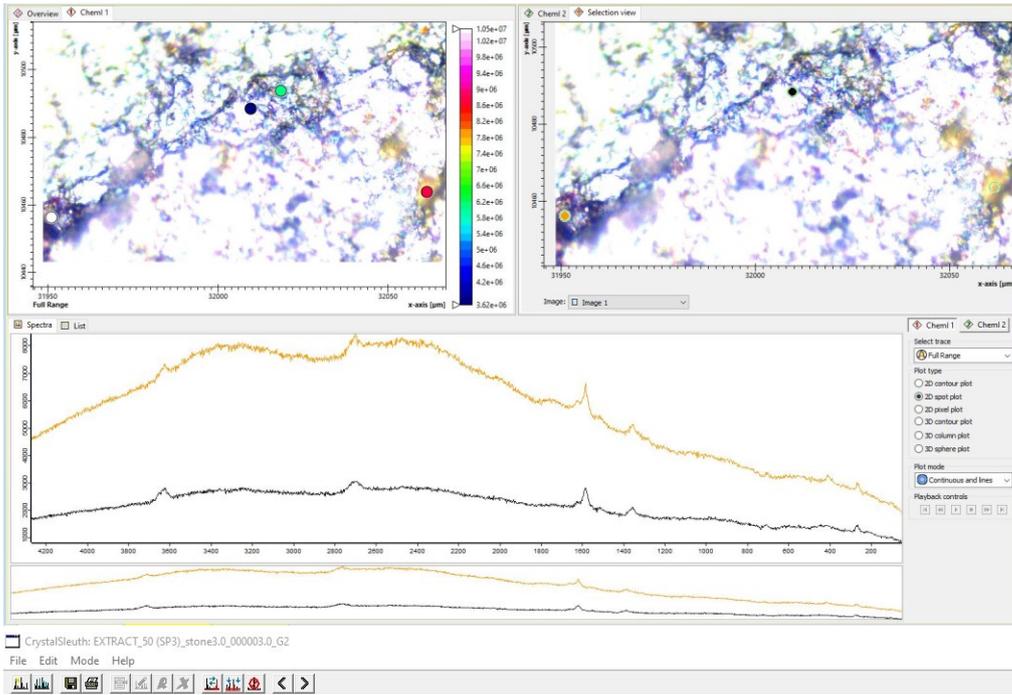


Sample :

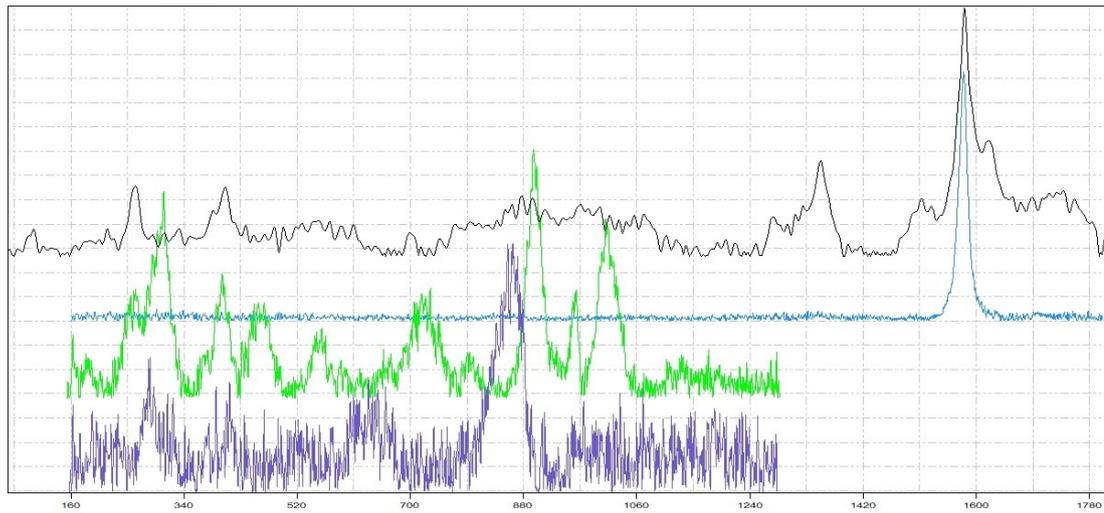


Sample Site 50: Stone 3_spectra 1 indicates : **Graphite** (less probable : Stillwellite , Ixiolite) (→RRUFF)

The Spectral Lines 264 and 129 indicate that also Quartz is present in the sample



Sample :

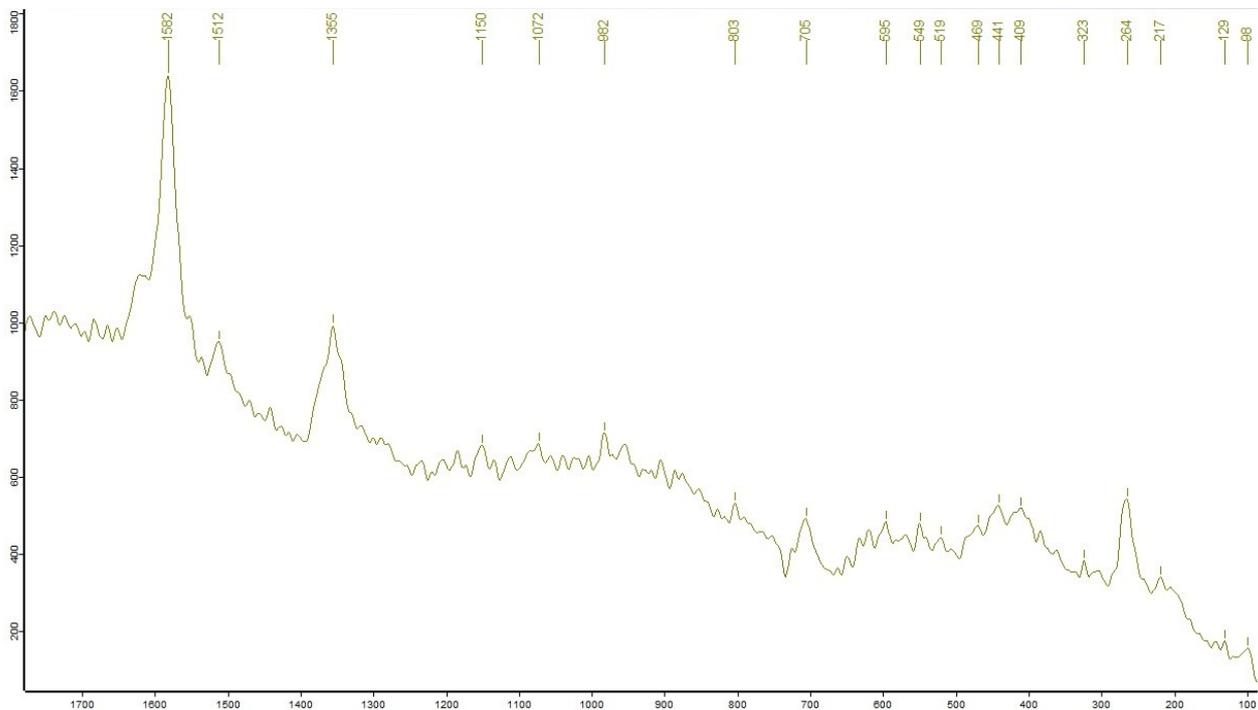


% Match:	Spectrum Name:	RRUFF ID:
63	K-G Graphite (532nm)	R050503
63	Graphite (532nm)	R090047
42	<-) Clinohedrite (532nm)	R050416
39	<-) Mordenite (532nm)	R070524
38	<-) Digenite (532nm)	R060840
38	<-) Issemannite (532nm)	R070513
38	<-) Stillwellite-(Ce) (532nm)	R060911
38	<-) Wickenburgite (532nm)	R060048
38	<-) Ishikawite (532nm)	R070496
38	<-) Ixiolite (532nm)	R070495
38	Trotterite (532nm)	R060623
38	Radhakrishnaite (532nm)	R070711
37	Znuzelite (532nm)	R070483

R050503
Graphite
C
Sterling mine, Ogdensburg, New Jersey, USA

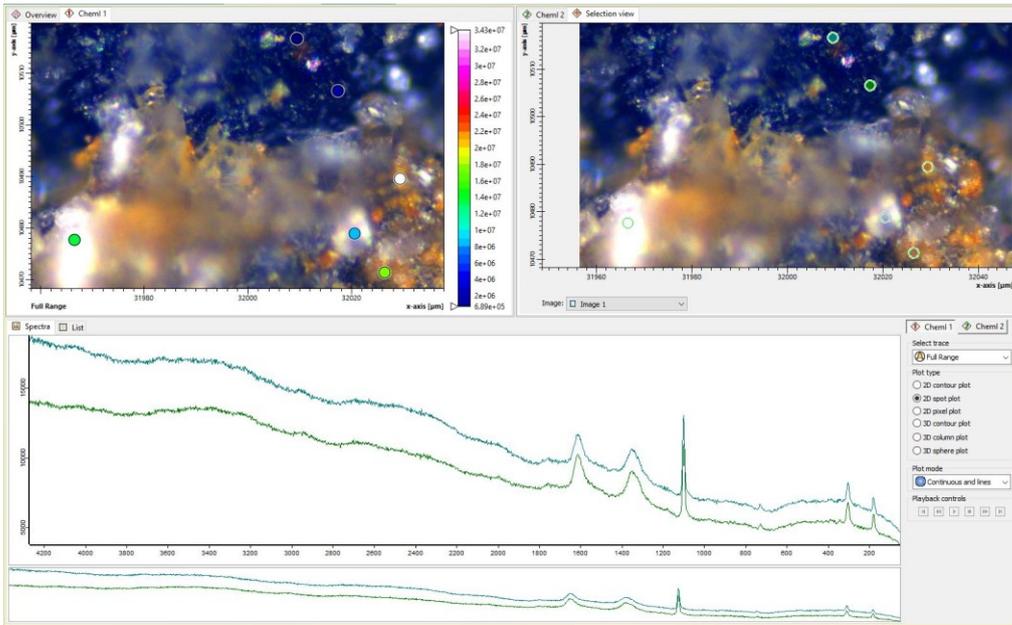
R060911
Stillwellite-(Ce)
CeSiO₅
Dimbulah, Queensland, Australia

R070495
Ixiolite
(Ta,Mn,Nb)O₂
Alto Ligonha pegmatite, Alto Ligonha District, Zambezia Province,



Sample Site 50 : Stone 2_spectra 1 indicates : **Dolomite**

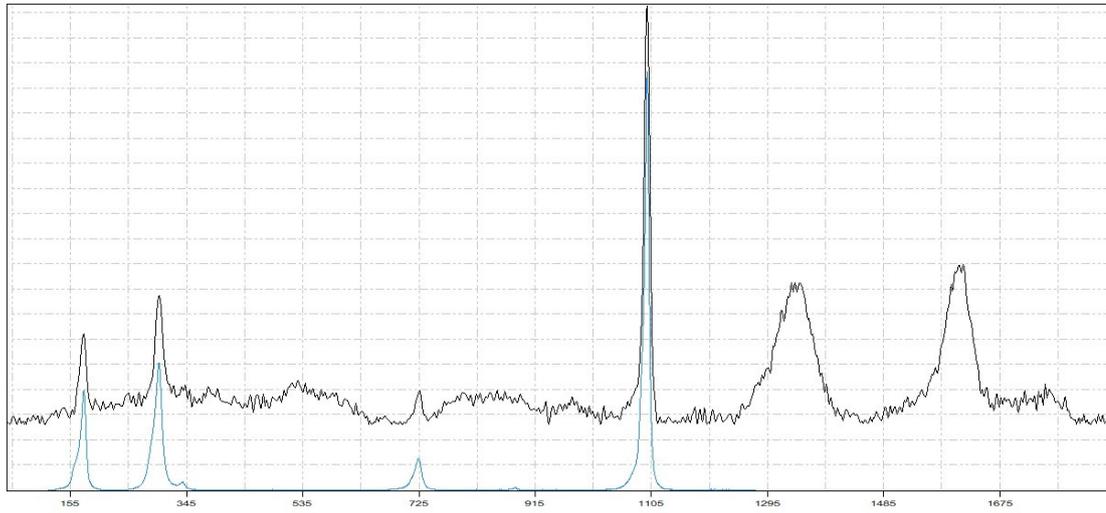
(→ see RRUFF_search results)



Sample :

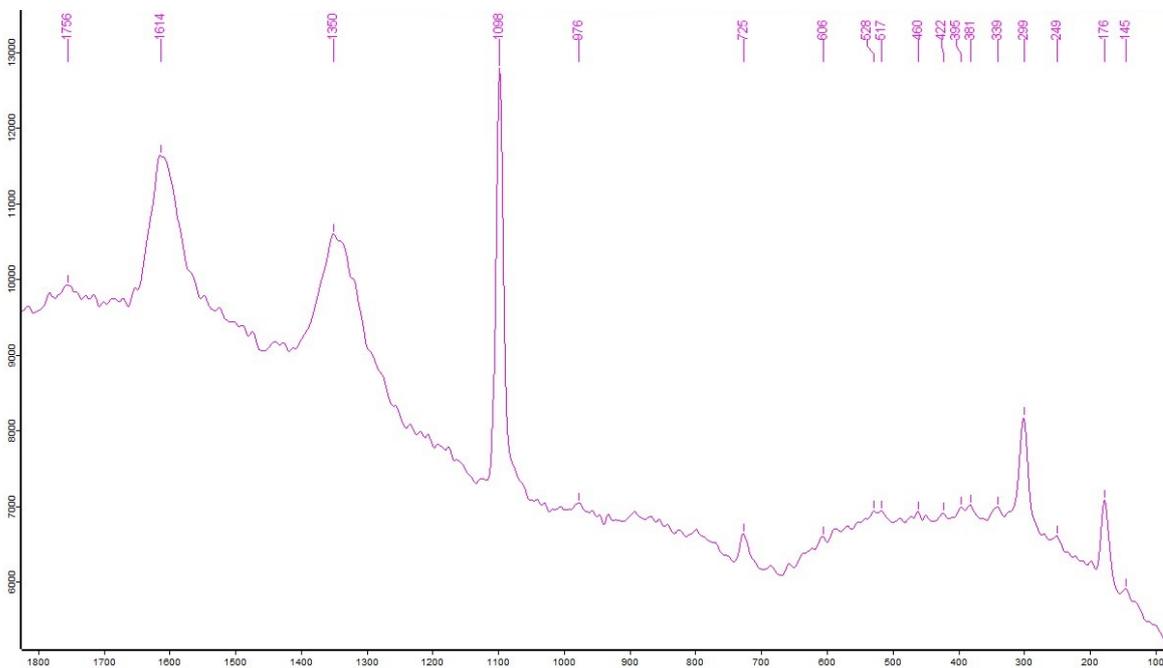


CrystalSleuth: EXTRACT_50 (SP3)_stone2_0_000005_0_NK



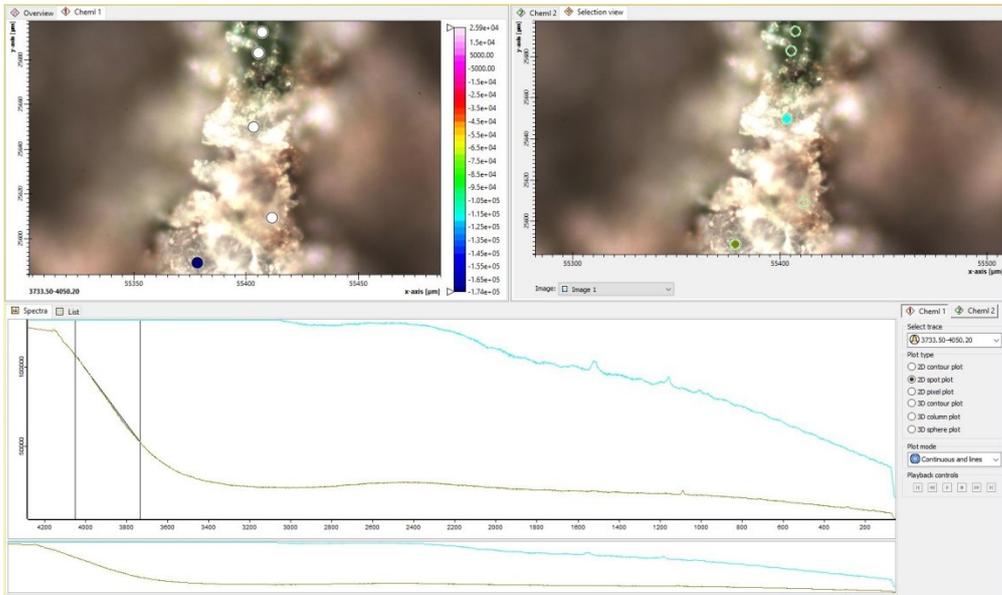
% Match	Spectrum Name	RRUFF ID
64	< Dolomite (532nm)	R050357
64	Sahamalite-(Ce) (532nm)	R080043
63	Dolomite (532nm)	R050241
62	Dolomite (532nm)	R040030
61	Dolomite (532nm)	R050370
59	Nesquehonite (532nm)	R050639
56	Dolomite (532nm)	R050272
55	Kimurate-(Y) (736nm)	R050586
54	Lokkaiite-(Y) (532nm)	R061092
54	Alumohydrocalcite (532nm)	R070516
52	Tengerite-(Y) (532nm)	R060480
52	Dolomite (532nm)	R050129
52	Bastnaesite-(Ce) (532nm)	R060737

R050357
 Dolomite
 CaMg(CO₃)₂
 Black Rock, Lawrence County, Arkansas, USA



Sample Site **19-B** : Stone 1_spectra 1 indicates : **Reyerite**

(→ see RRUFF_search results)

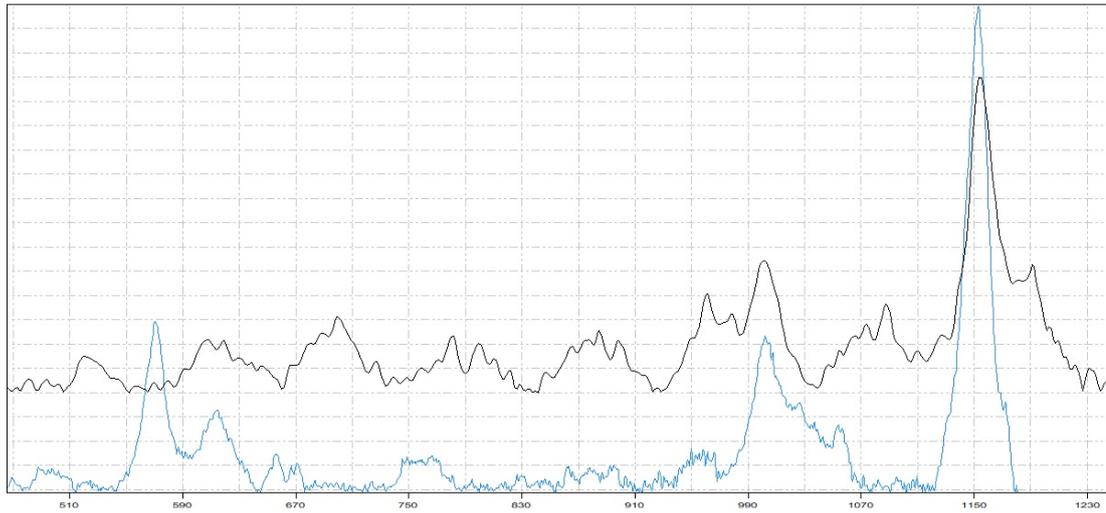


Sample :



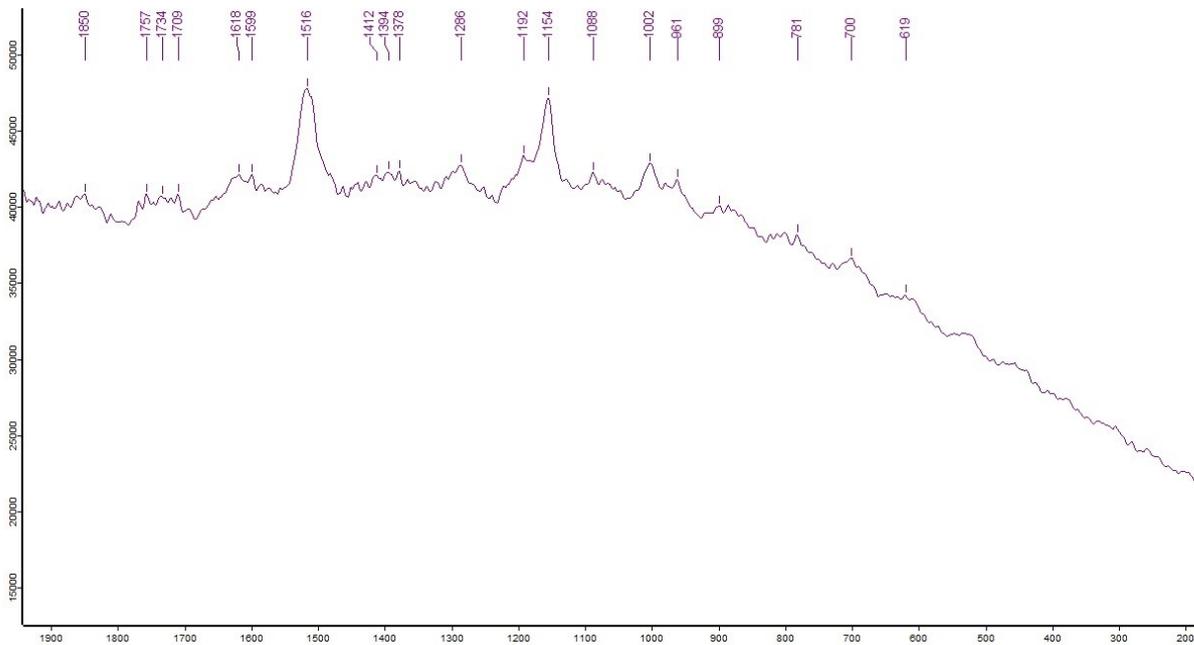
CrystalSleuth: EXTRACT_6-A (19-B_Spanien)_0_000000_0_NK_G1

File Edit Mode Help



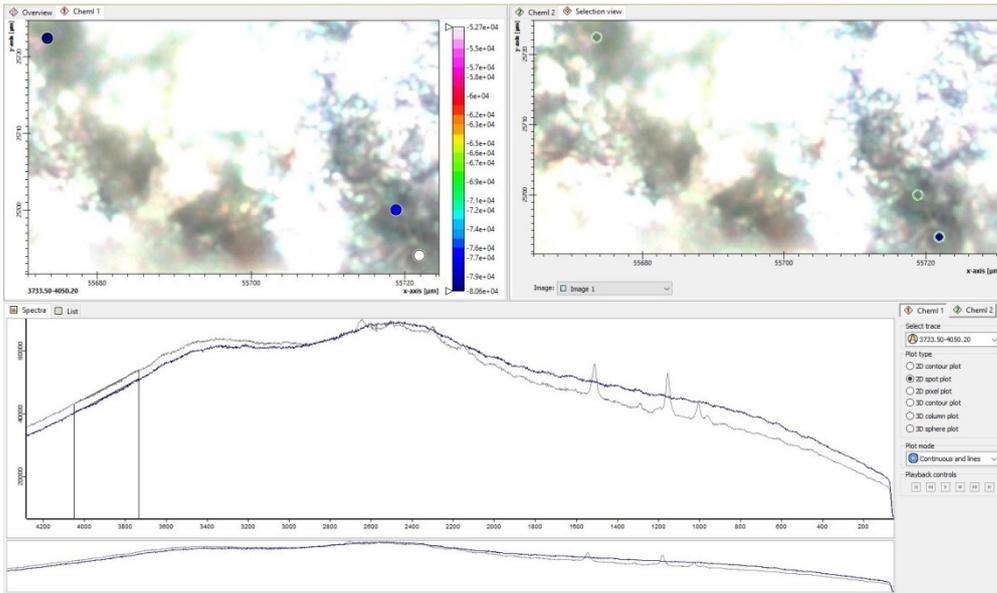
% Match:	Spectrum Name:	RRUFF ID:
57	<-> Reyerte (532nm)	R060749
57	<-> Dachardite-Ca (532nm)	R061125
57	<-> Reedmergerite (532nm)	R060096
56	<-> Inderite (532nm)	R050195
56	<-> Congolite (532nm)	R070149
56	<-> Thonrite (532nm)	R060849
55	Roselite (532nm)	R070384
55	Heulandite-Na (532nm)	R070281
55	Paulingite-K (532nm)	R070604
55	Heulandite-Sr (532nm)	R070272
55	Ferrierite-Mg (532nm)	R070091
54	Clinoptilolite-Ca (532nm)	R061098
54	Clinoptilolite-Na (532nm)	R061099

R060749
Reyerite
Na₂Ca₁₄Al₂Si₂₂O₅₈(OH)₈#183;6H₂O
Drynoch, Island of Skye, Scotland



Sample Site **19-B** : Stone 2_spectra 1 indicates : **Reyerite**

(→ see RRUFF_search results)

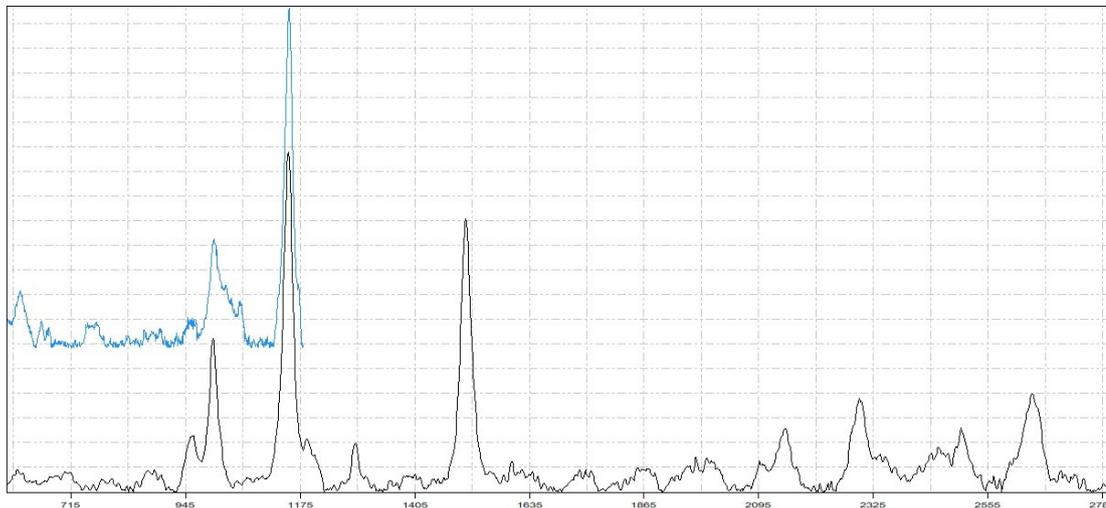


Sample :



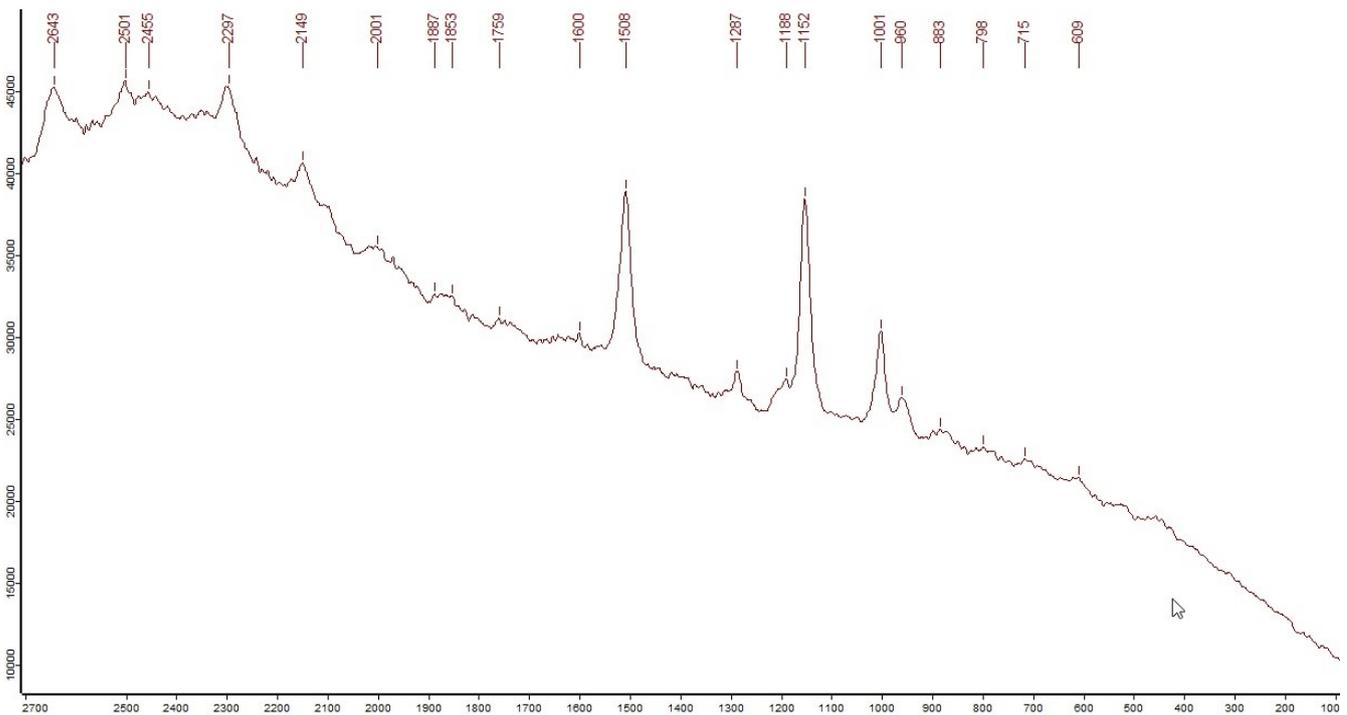
CrystalSleuth: EXTRACT_6-C (19-B_Spanien)_0_000000_0_NK_G1

File Edit Mode Help



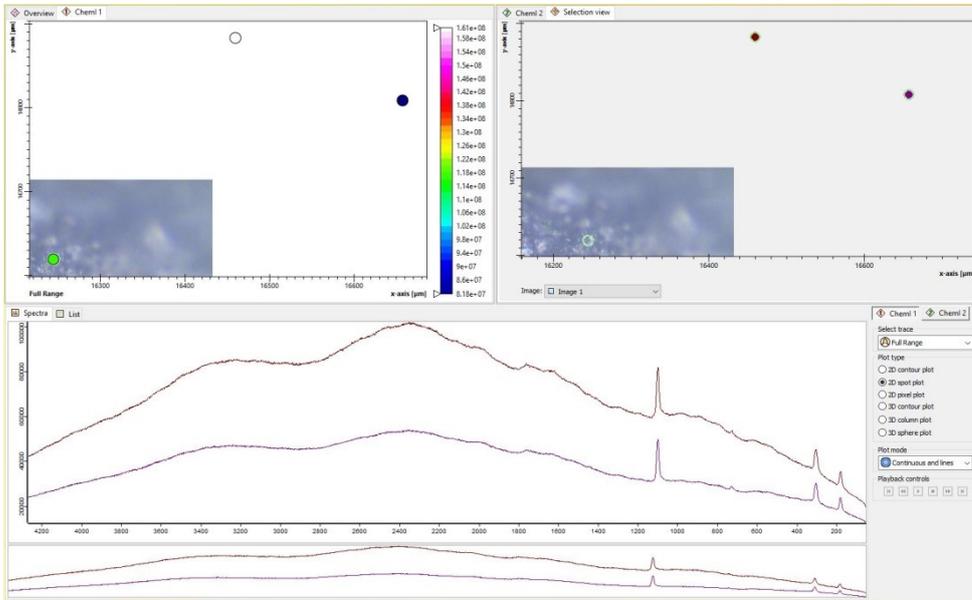
% Match	Spectrum Name	RRUFF ID
68	c1)Reyerite (532nm)	R060749
63	Namibite (532nm)	R060782
58	Reedmergerite (532nm)	R060096
56	Jacobsite (532nm)	R070719
56	Polyolithionite (532nm)	R060225
56	Thorianite (532nm)	R060848
55	Heulandite-Sr (532nm)	R070272
54	Abelsonite (532nm)	R070007
54	Znchite (532nm)	R060027
54	Clinopillolite-Na (532nm)	R061099
54	Polyolithionite (532nm)	R060215
54	Stellerite (532nm)	R070535
54	Clinonhilitite-Ca (532nm)	R061098

R060749
Reyerite
Na₂Ca₁₄Al₂Si₂₂O₅₈(OH)₈#183;6H₂O
Drynoch, Island of Skye, Scotland



Sample Site **19-B** : Stone 3_spectra 2 indicates : **Sahamalite, Dolomite**

(→ see RRUFF_search results)

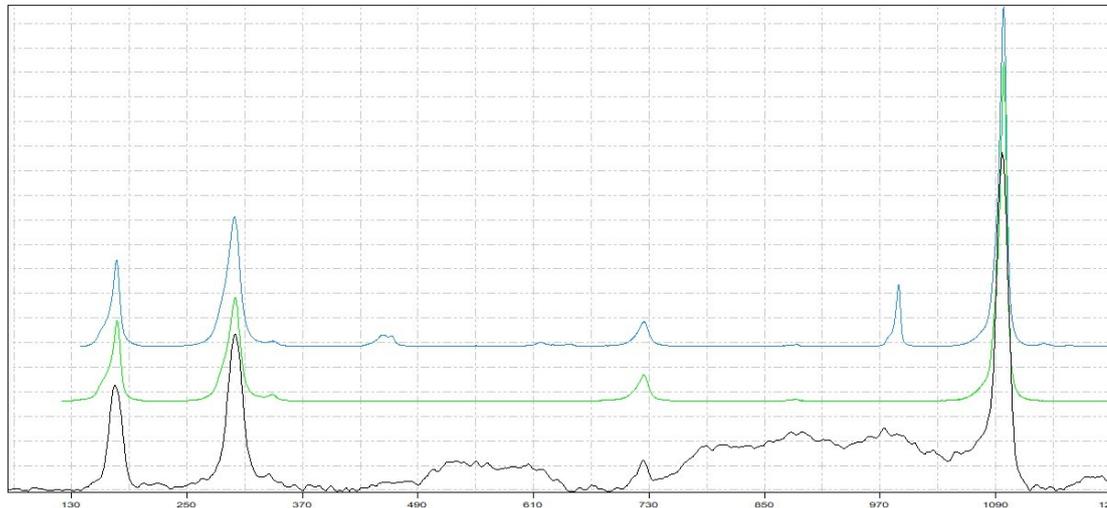


Sample :



CrystalSleuth: EXTRACT_19-B(SP1)_1.0_000000.0_NK_G1

File Edit Mode Help

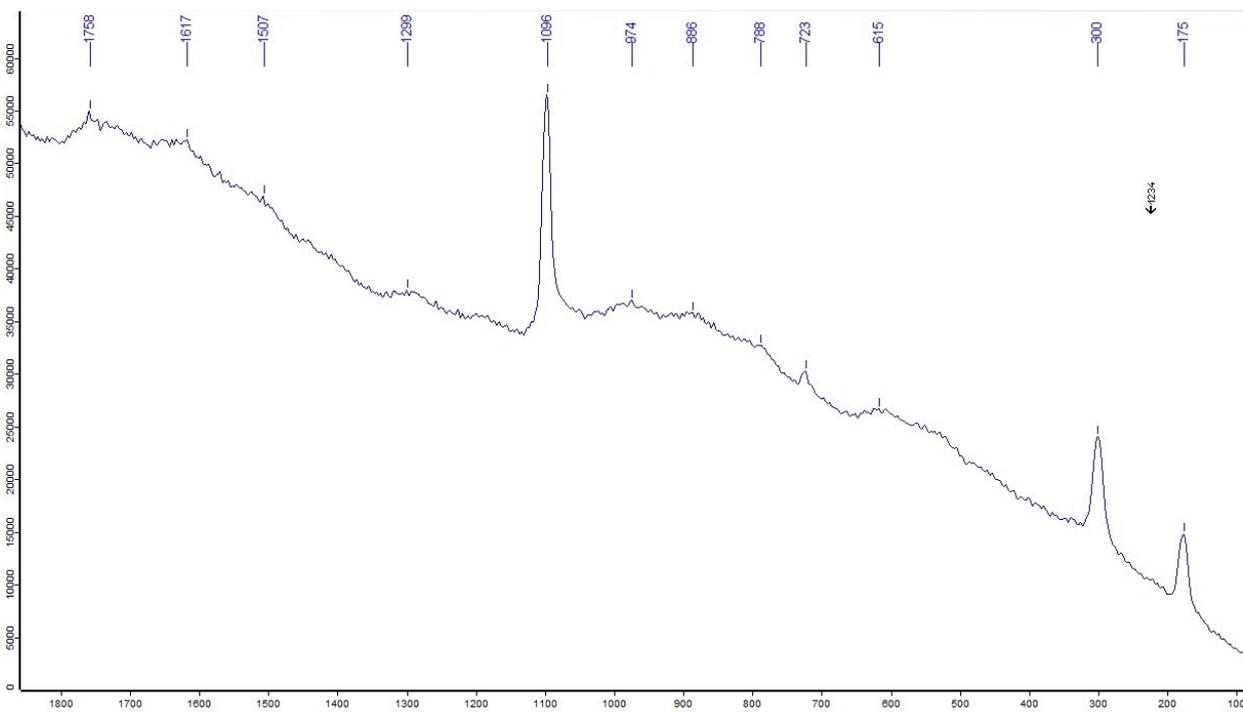


File Manager SpecEdit Raman Library X-Ray

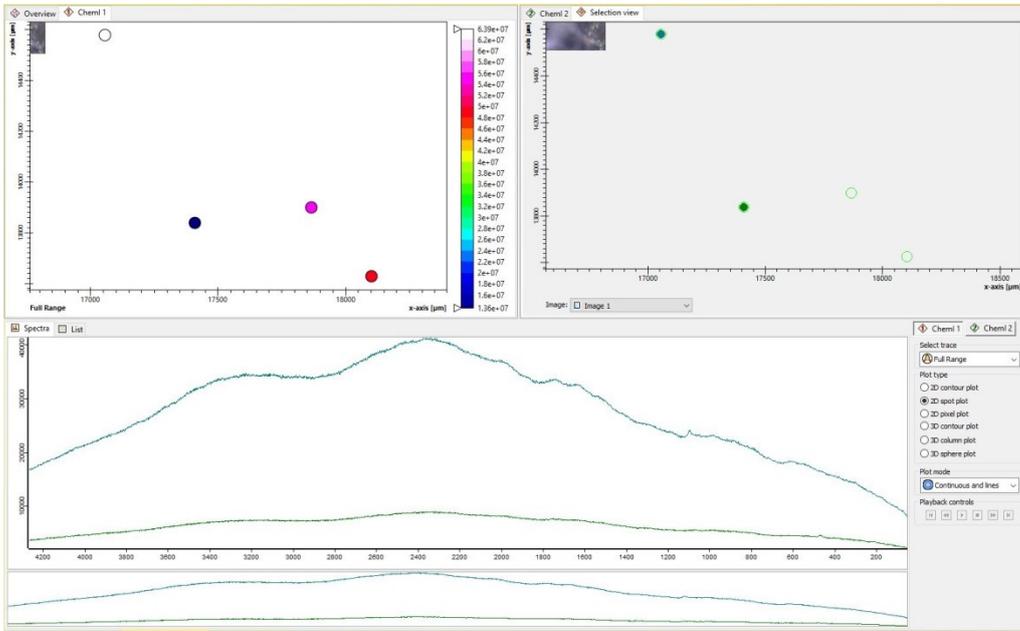
% Match	Spectrum Name	RRUFF ID
82	<J> Sahamalite-(Ce) (532nm)	R080043
81	<J> Dolomite (532nm)	R050357
80	Dolomite (532nm)	R040330
79	Dolomite (532nm)	R050370
77	Dolomite (532nm)	R050241
75	Dolomite (532nm)	R050272
72	Kimuraitite-(Y) (736nm)	R050586
72	Dundasite (532nm)	R060760
72	Rosasite (532nm)	R050294
71	Nesquehonite (532nm)	R050639
71	Smithsonite (532nm)	R040035
71	Tengerite-(Y) (532nm)	R060480
71	Smithsonite (532nm)	R040151

R080043
Sahamalite-(Ce)
Ca₂Mg(CO₃)₂
Mountain Pass Mine (Sulfide Queen mine; Bastnaesite deposit; Mo)

R050357
Dolomite
CaMg(CO₃)₂
Black Rock, Lawrence County, Arkansas, USA



Sample Site **19-B** : Stone 4 : no usable search result



Sample :

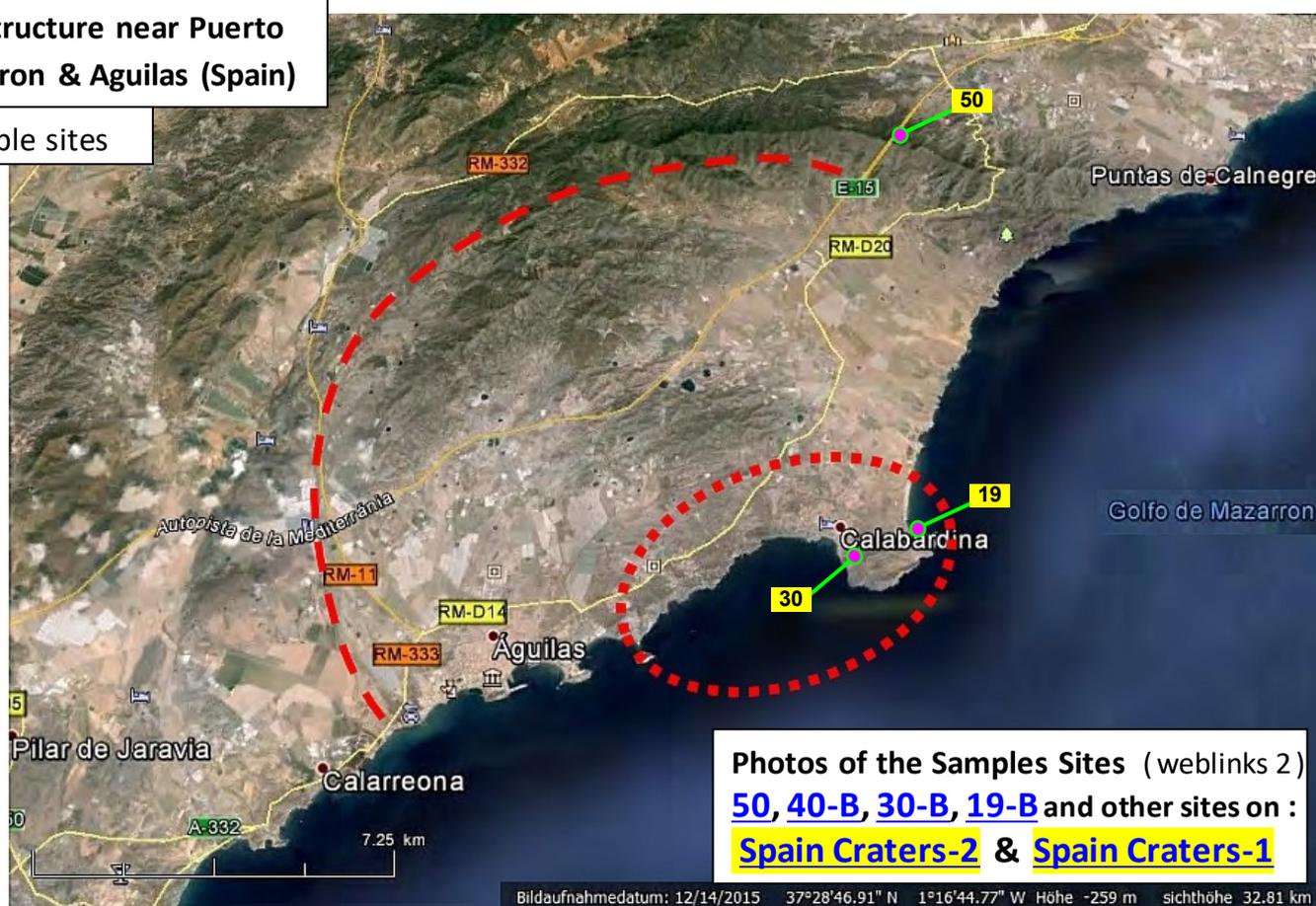


Appendix 1 : Photos of the rock samples from sample sites : 50, 30-B, 19-B, 40-B/C

Please note : Photos of the Sample- Sites [50](#), [30-B](#), [19-B](#), [40-B/C](#) and other sample sites are available here → weblink : Sample Sites : [Spain Craters-2](#) & [Spain Craters-1](#)



Impact Structure near Puerto de Mazarron & Aguilas (Spain)
with sample sites



Photos of the Samples Sites (weblinks 2)
[50](#), [40-B](#), [30-B](#), [19-B](#) and other sites on :
[Spain Craters-2](#) & [Spain Craters-1](#)

30

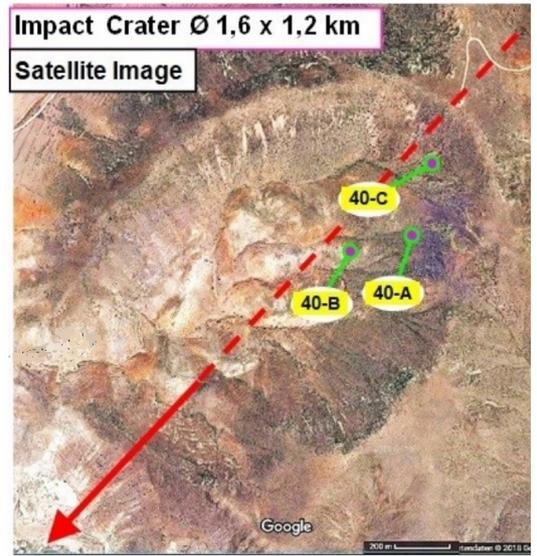


19



Please note : The rock samples **40-B** were collected close to the center of an elliptical Crater \varnothing 1.6 x 1.2 km that is completely unknown to impact research yet !

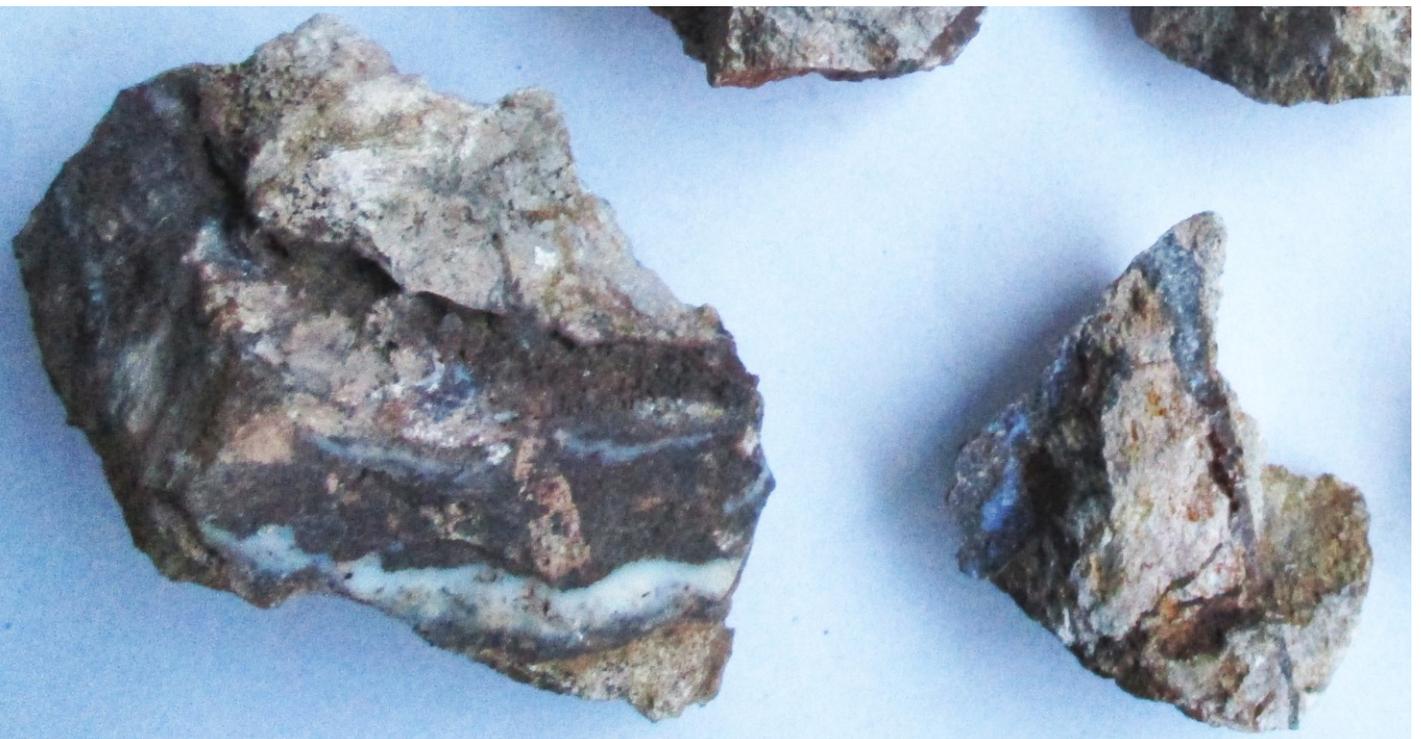
All photos of the samples site here **40-B** (or alternatively available here : **40-B**) (\rightarrow [Spain Craters-2](#) or [Spain Craters-2](#))



40-B



40-B 36° 49,823 N 2° 5,035 W 8 m Spain 3 - (Southern Area)



Site 50 :

(the crater-wall) is accessible over the Highway AP7 (but a long stop on the side-strip of the highway isn't really recommended !)
The site is located near the exit of the highway tunnel just outside of the crater-wall



Site 19-B :

The site is very easy accessible by road.
From a little parking area on the coast it's a 300 m walk to the Impact-affected rocks
The image shows the rocks in the foreground.
Looking towards the parking area, in the background of the image the Crater-wall (the Site 50) of this Secondary Impact-Structure of the Permian Triassic (PT) Impact Event is visible



Site 40-B :

The image shows the center of the small \varnothing 1,6 x 1,2 km elliptical Impact Crater near the village Rodalquilar.
In the background of the image a section of the inner crater-wall is visible. In the foreground an outcrop of impact breccia is visible
The crater is accessible over an unsealed road.
But there is a radar station on the crater rim.
Permission may be required for an expedition

The \varnothing 1,6 x 1,2 km elliptical Impact Crater



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

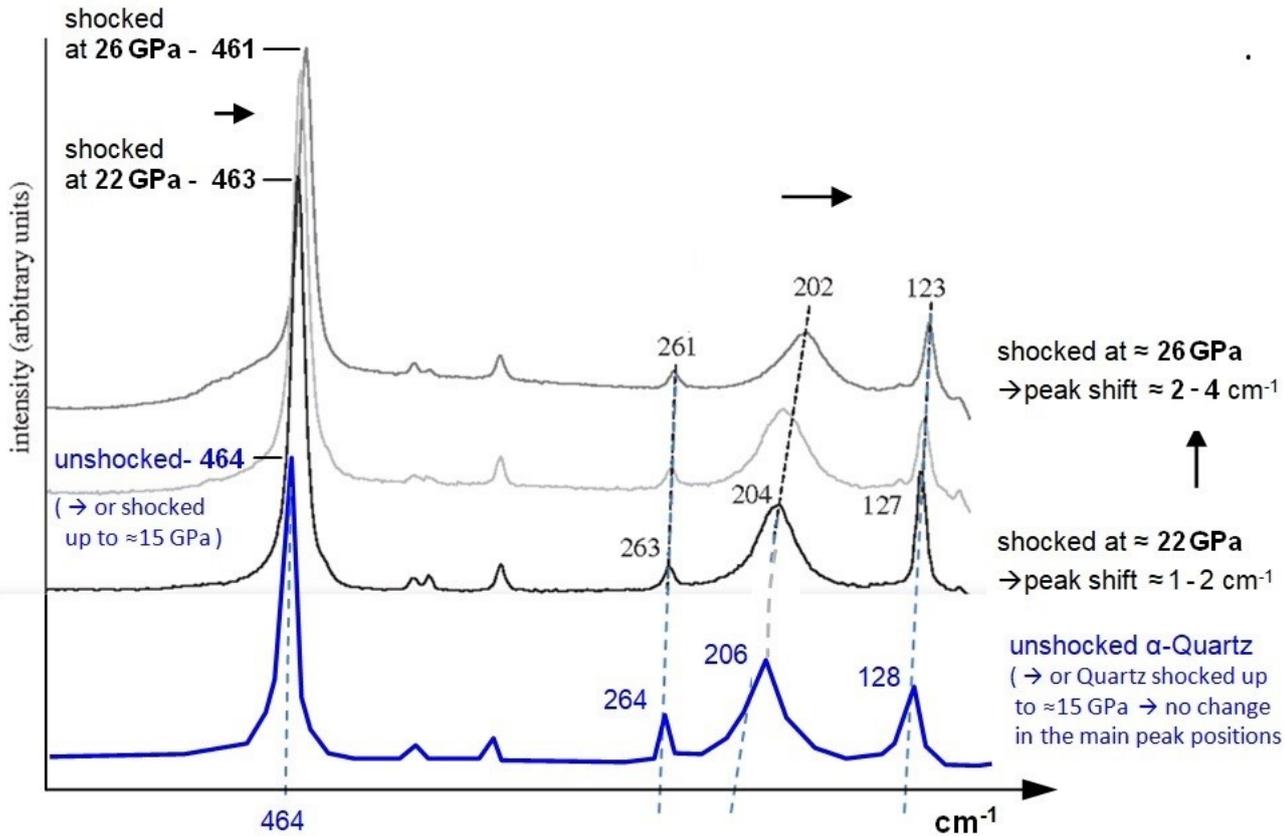
In order to verify a sample site as an impact site or impact structure, [shock-metamorphic effects](#) must be discovered in the rocks of the sample site. This can be done by different methods.

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.

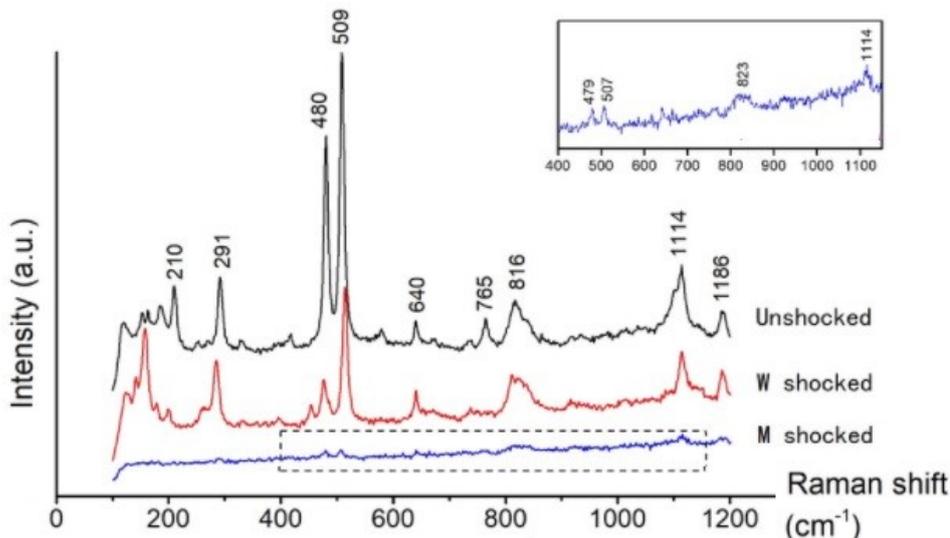
Mc Millan et al. (1992) and others have shown that the main RAMAN-peaks of Quartz shift towards lower frequencies if the Quartz was exposed the a shock-pressure > 15 GPa. → see diagram below

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 : [Spain Craters-2](#) & [Spain Craters-1](#) (or : [Spain-2](#) & [Spain-1](#))

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>

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

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Shock-Related Deformation of Feldspars from the Tenoumer Impact Crater, Mauritania - by Steven J. Jaret

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