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 ≈ **Ø 30 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 (→ 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 Andalucia. 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 (Andalucia & Murcia) comes from rock-samples collected in a small elliptical Crater with Ø 1,6 x 1,2 km near the town of Rodalquilar. This elliptical crater in the remote East of Andalucia, 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 (→ ejecta from the P/T-Crater) !

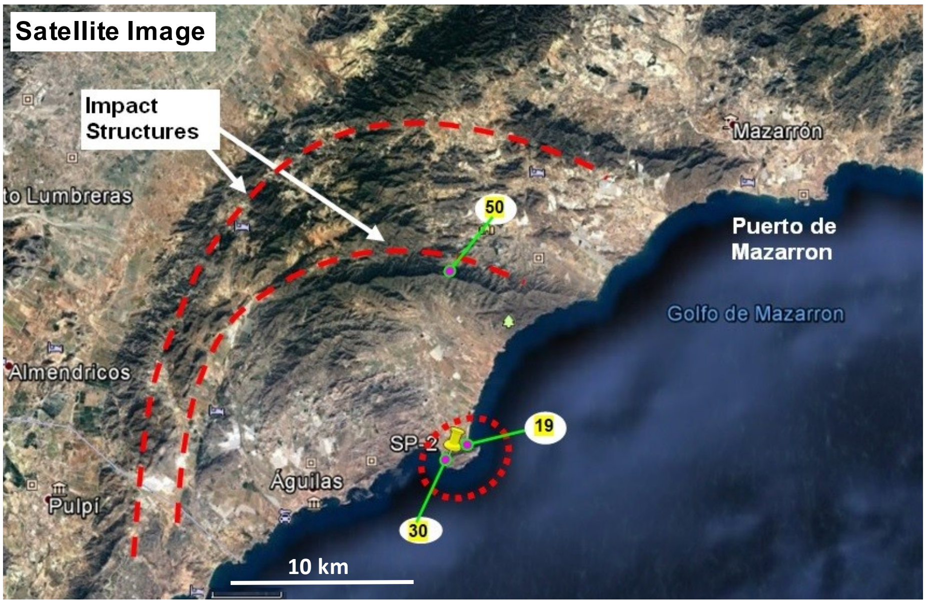
The Raman spectra of quartz from sample site **50** on the outside of the crater-wall of the bow-shaped impact structure (near the tunnel exit of the AP7) provides clear evidence for an impact event !

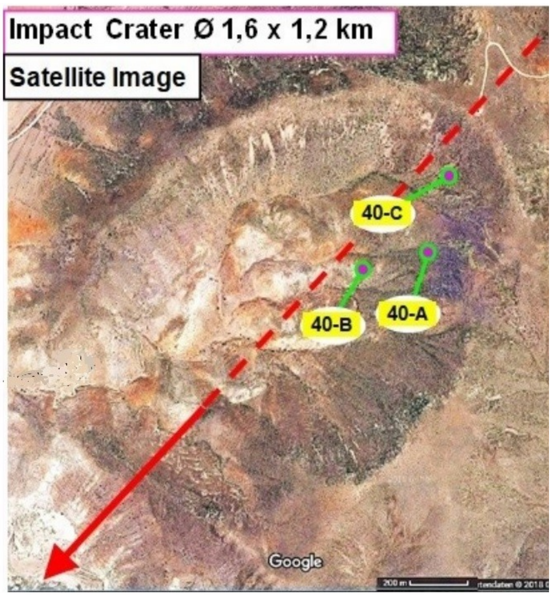
The shift of the main Raman bands (peaks) to the lower frequencies **463, 261, 205** and **127 cm^{-1}** which is visible in the Raman Spectra of the quartz-sample, clearly indicates that the quartz was exposed to a **shock pressure of around 22 GPa**. (see explanation in the Appendix at page **24**). 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 Ø 1,6 x 1,2 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 ≈ **22 GPa** that can only be the result of an impact event !
All spectra were made with a **BRUKER Senterra-II Raman Microscope** (wavenumber precision <0.1cm^{-1})

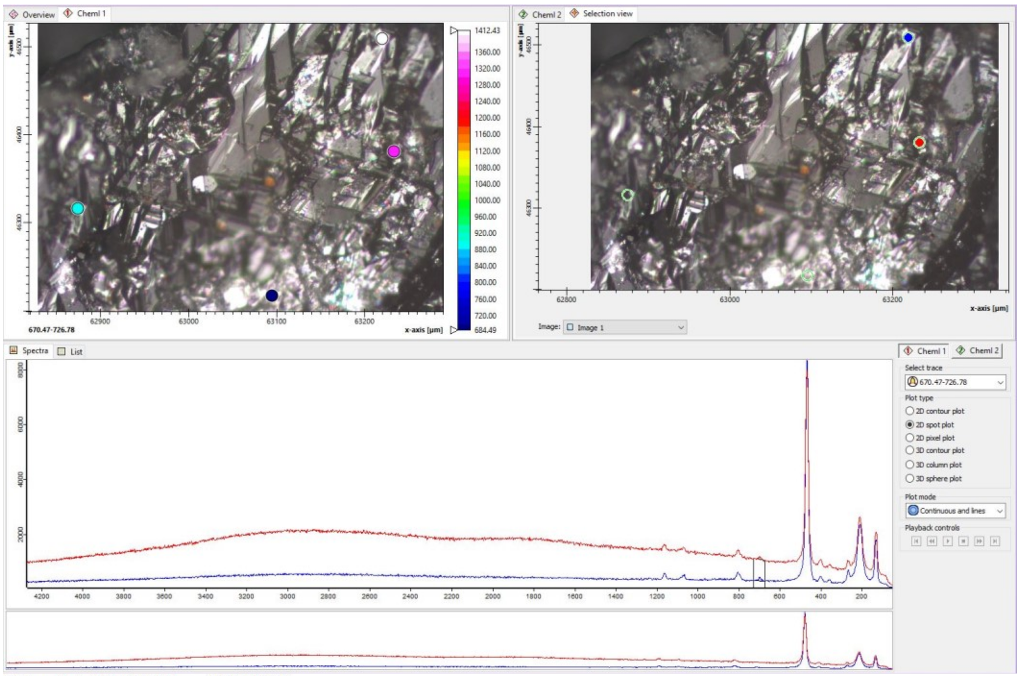
A shock pressure of 22 GPa far exceeds every pressure caused by normal terrestrial metamorphism. Therefore the quartz was clearly shocked by an impact event. The indicated shock pressure of 22 GPa is lower than the shock pressure that occured in other large impact craters on Earth, which can reach 100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

→ Images of the analysed rock samples and photos of the sample sites are in the Appendix at **page 19**.
→ A general summary to all analysed sample sites is provided by **Part 6** (**P6**) of my **PTI-hypothesis** (**P1**)
→ More images of all sample sites are available on www.permiantriassic.de or www.permiantriassic.at

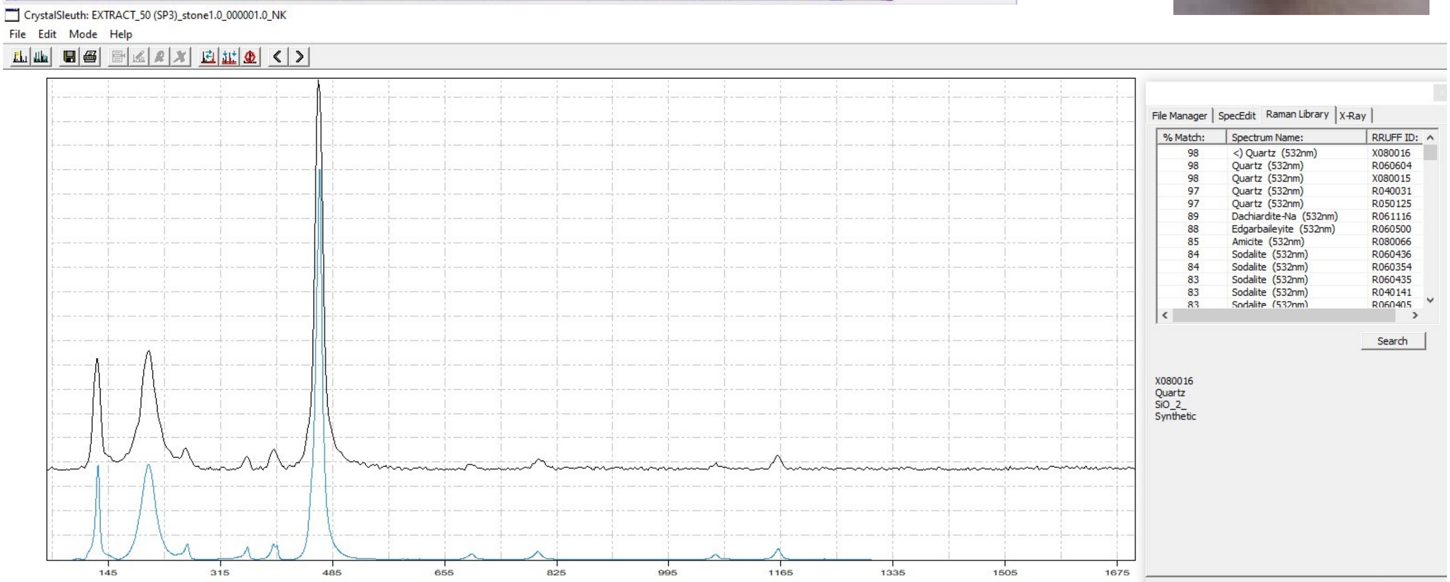




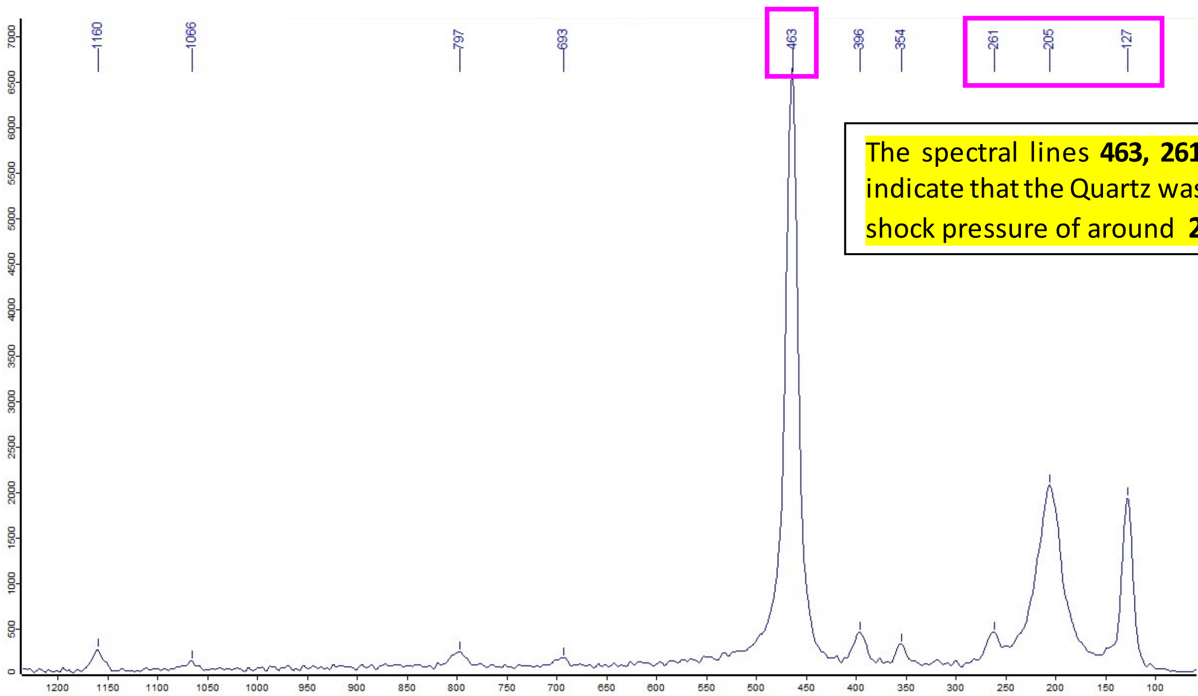
Sample Site 50 : Stone 1_spectra 1 indicates : Quartz (→ see RRUFF_search results)



Sample :



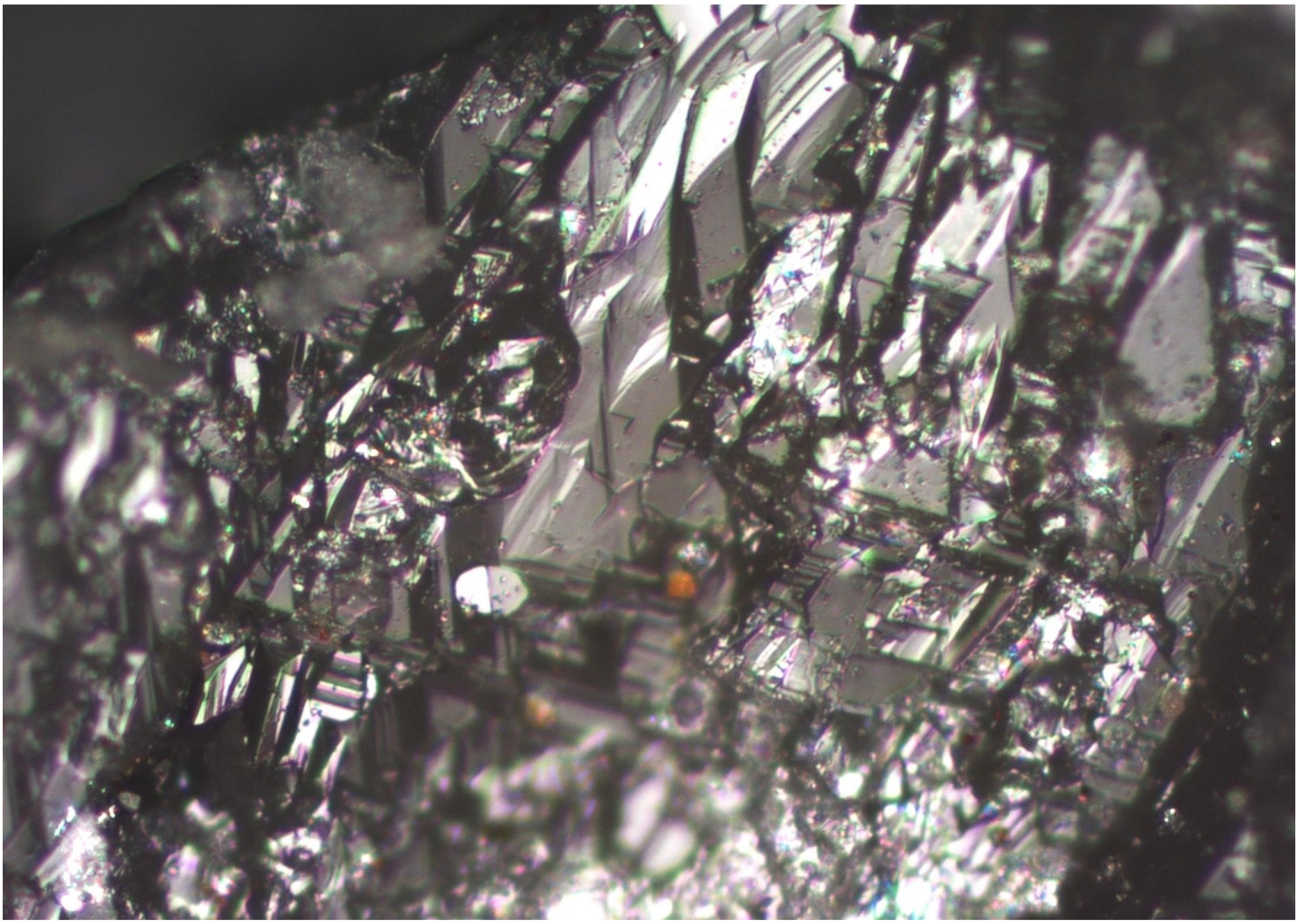
Indication for a shock event are the shifts of the marked Quartz spectral lines towards 463, 261, 205 and 127



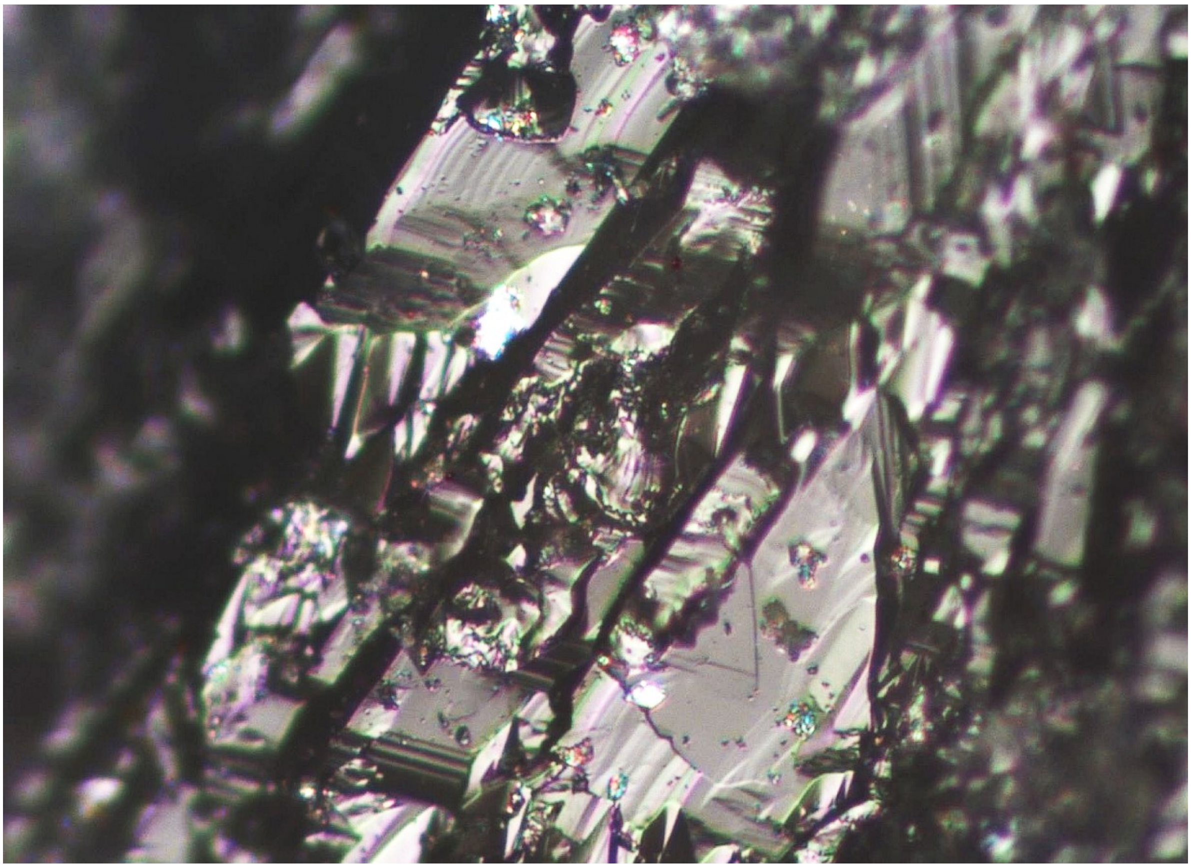
Microscopic Images : Sample from Site 50 → original state (no preparation for analysis)

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

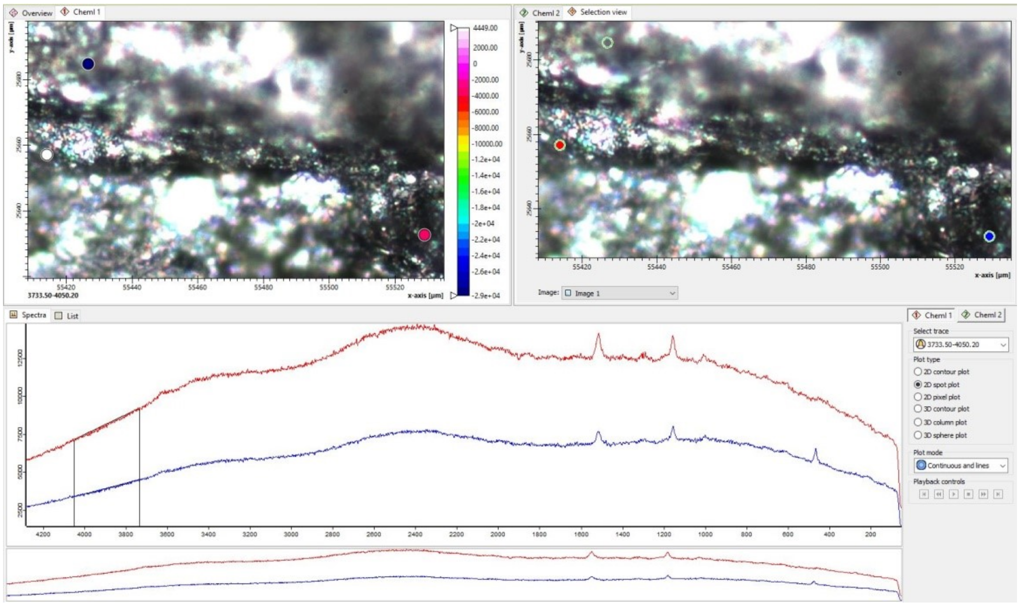
Note the exceptional fracture pattern visible in the quartz sample !



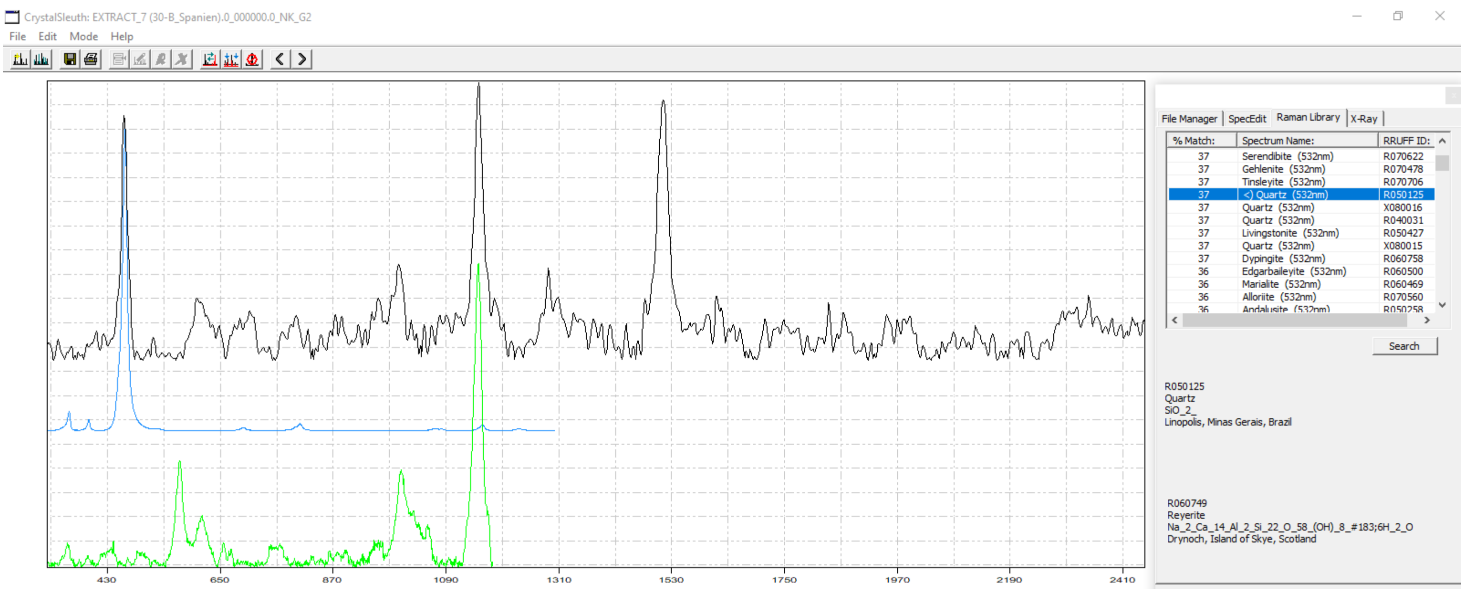
Sample Site 50 : Stone 1_spectra 1 indicates : Quartz - Image size : ~ 300 x 200 µm



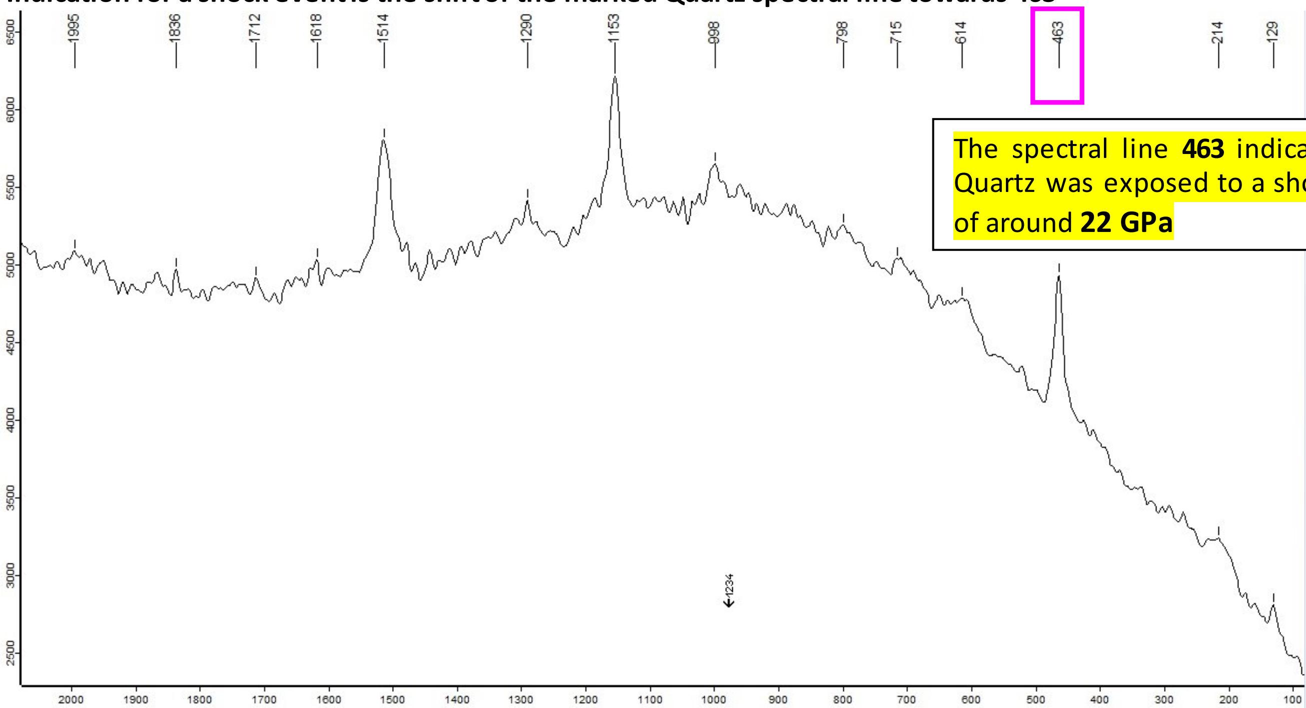
Sample Site 30-B : Stone 1_spectra 1 indicates : Quarz, Reyerite (→ see RRUFF_search results)



Sample :

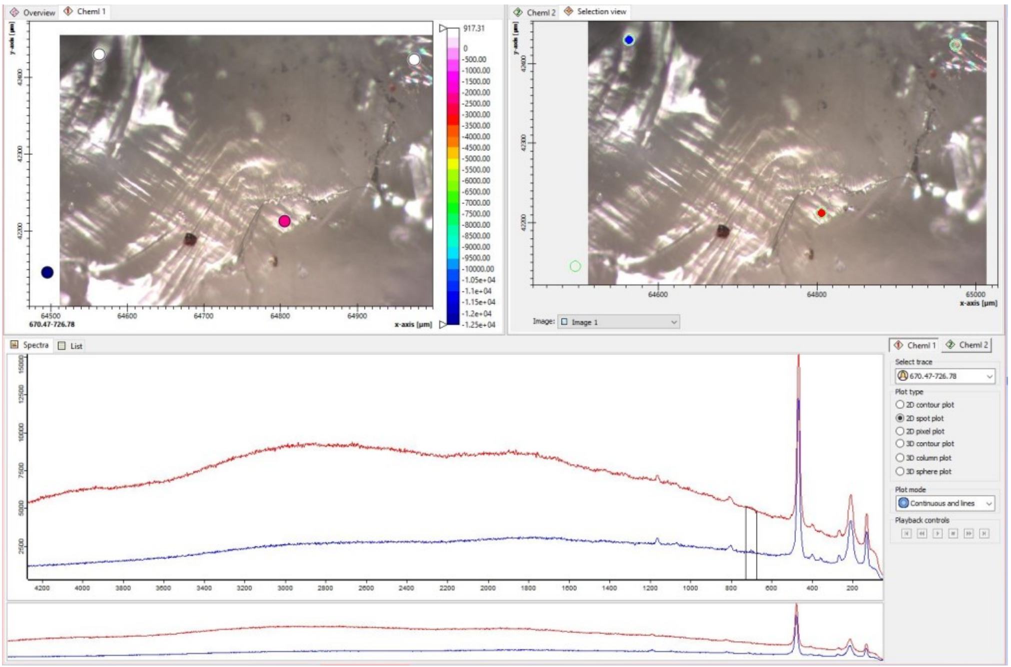


Indication for a shock event is the shift of the marked Quartz spectral line towards 463

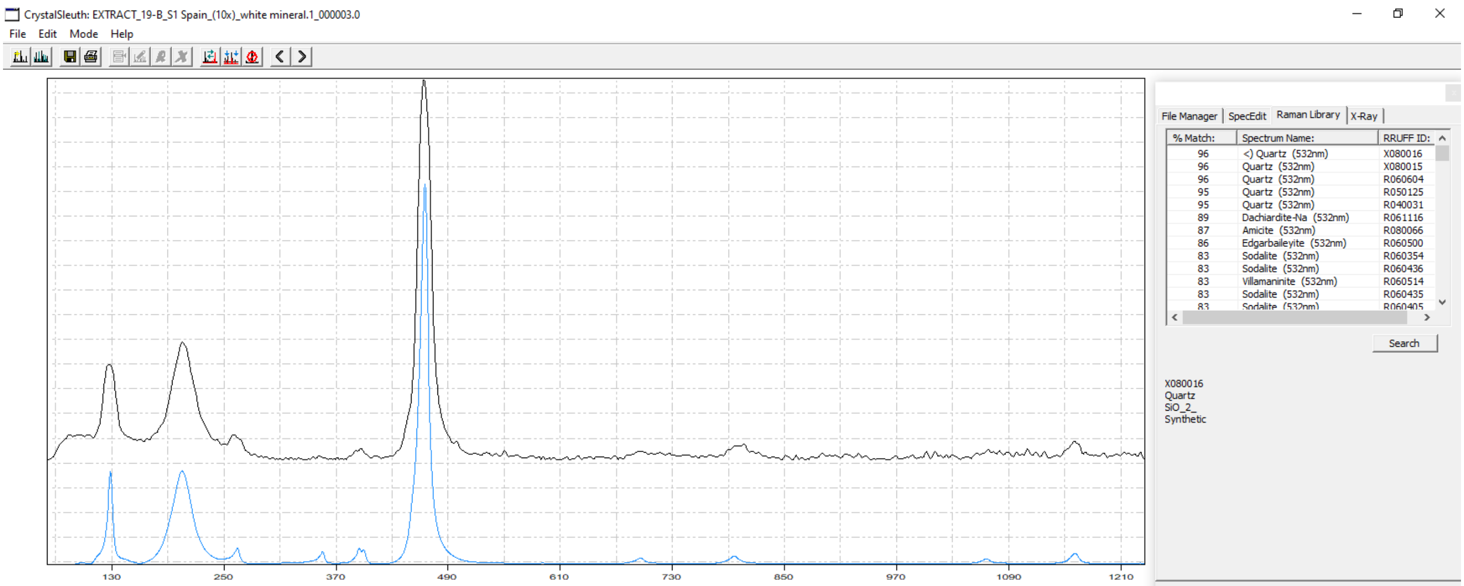


The spectral line **463** indicates that the Quartz was exposed to a shock pressure of around **22 GPa**

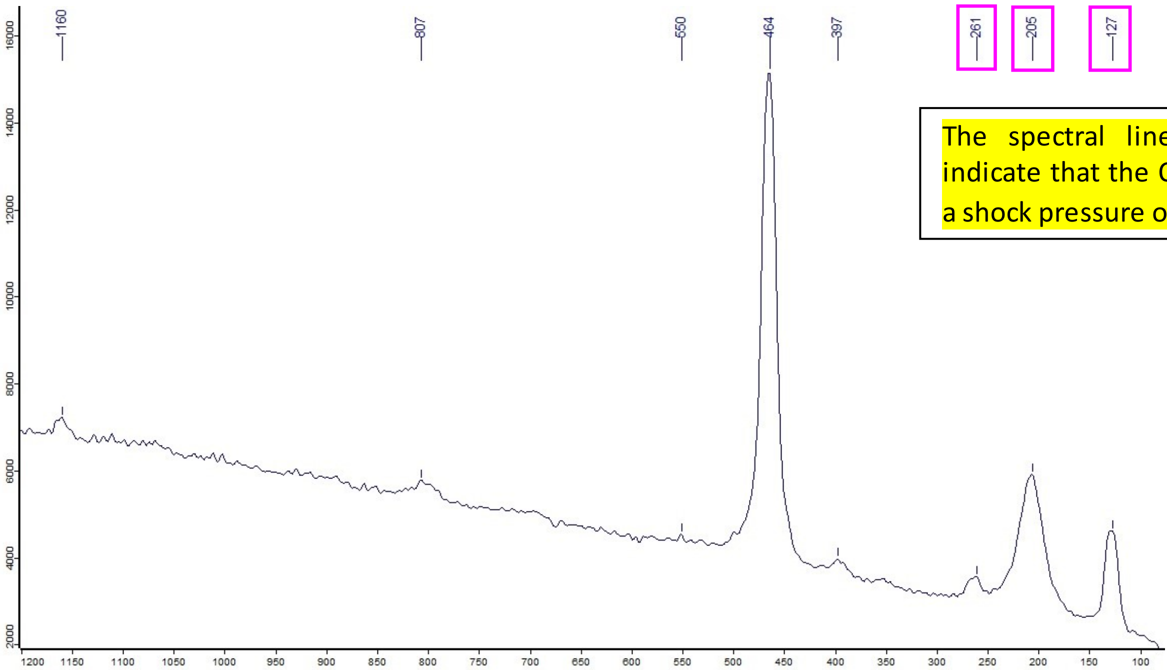
Sample Site 19-B : Stone 3_spectra 1 indicates : Quartz (→ see RRUFF_search results)



Sample :

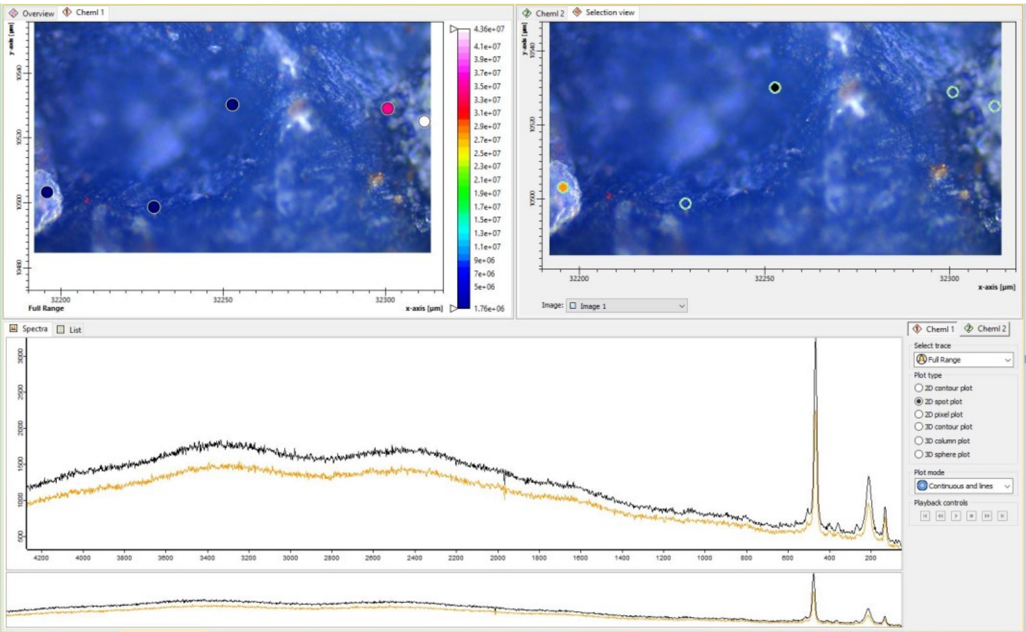


Indication for a shock event are the shifts of the marked Quartz spectral lines towards 261, 205 and 127

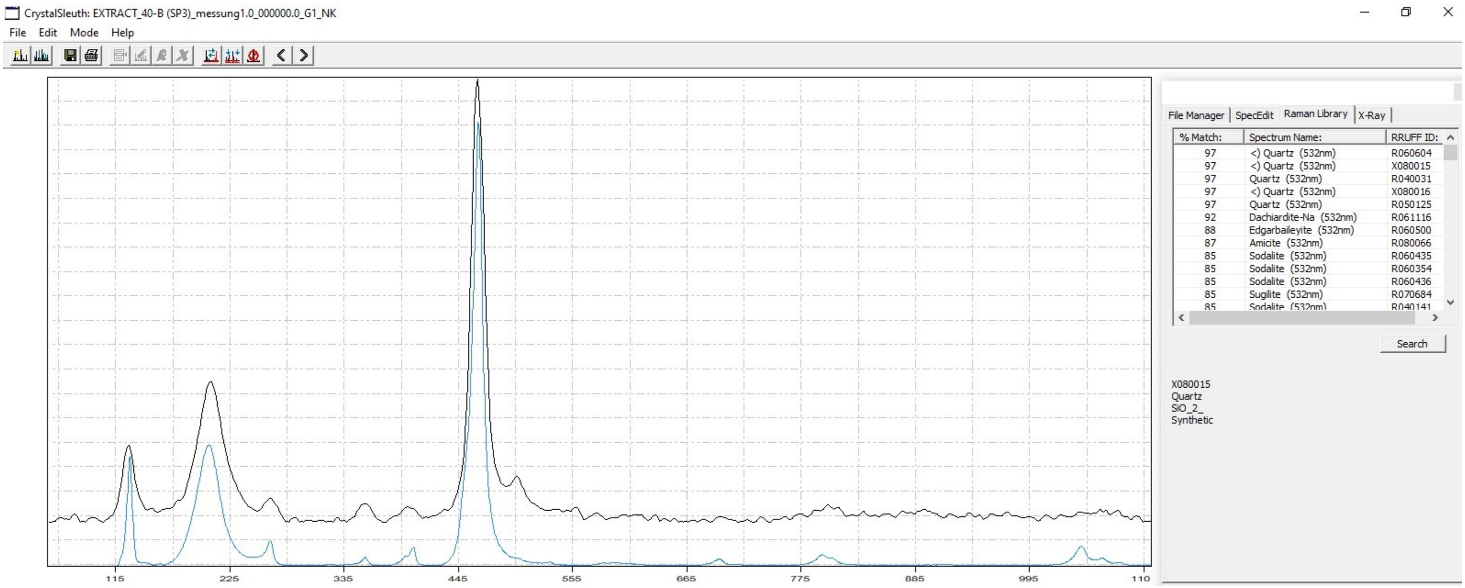


The spectral lines **261, 205** and 127 indicate that the Quartz was exposed to a shock pressure of around **20 – 22 GPa**

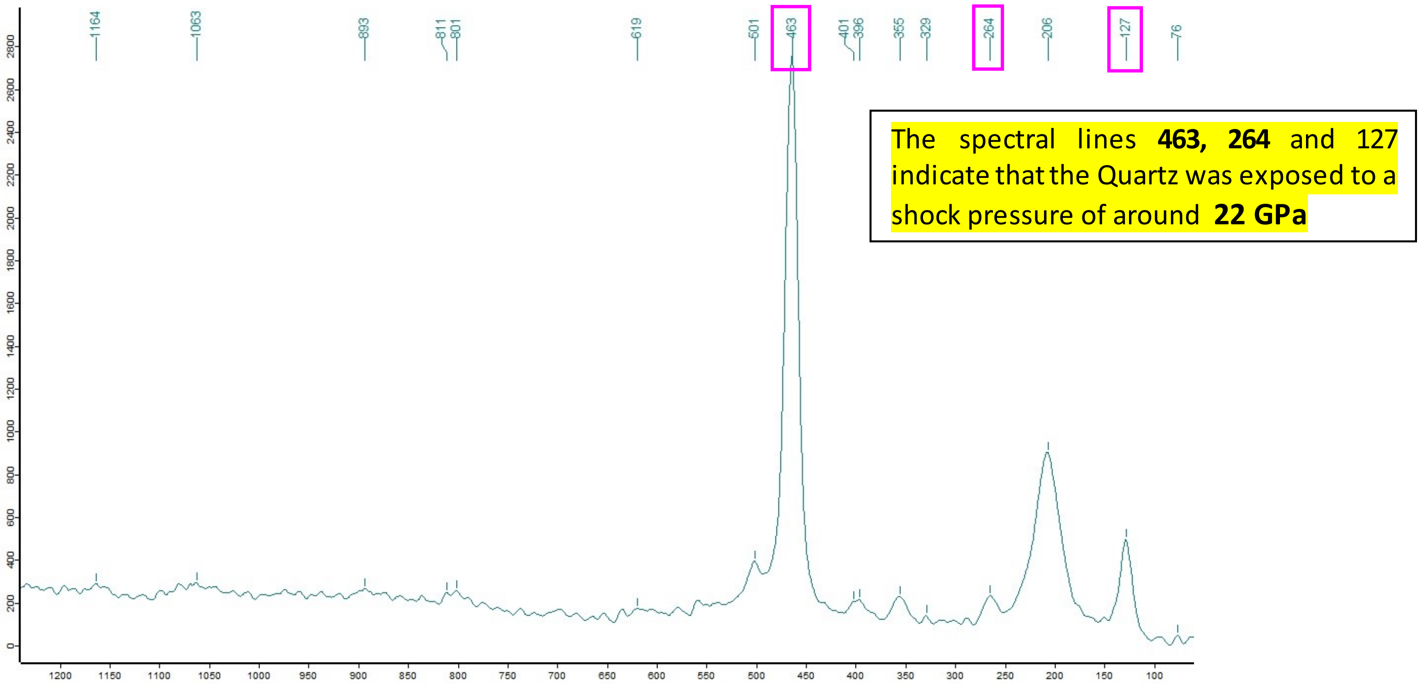
Sample Site 40-B : Stone 1_spectra 1 indicates : Quartz (→ see RRUFF_search results)



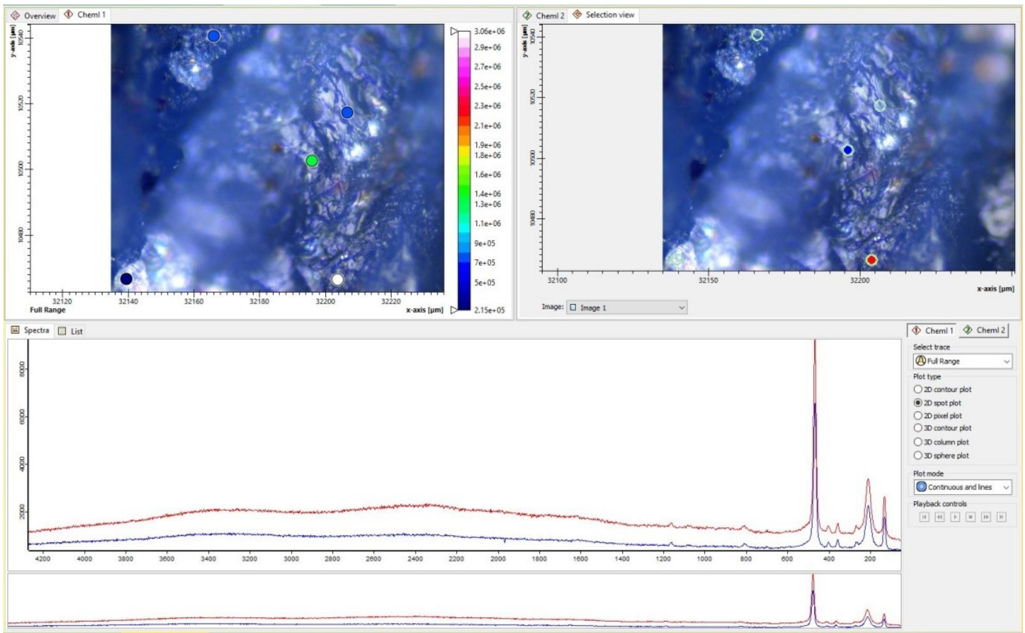
Sample :



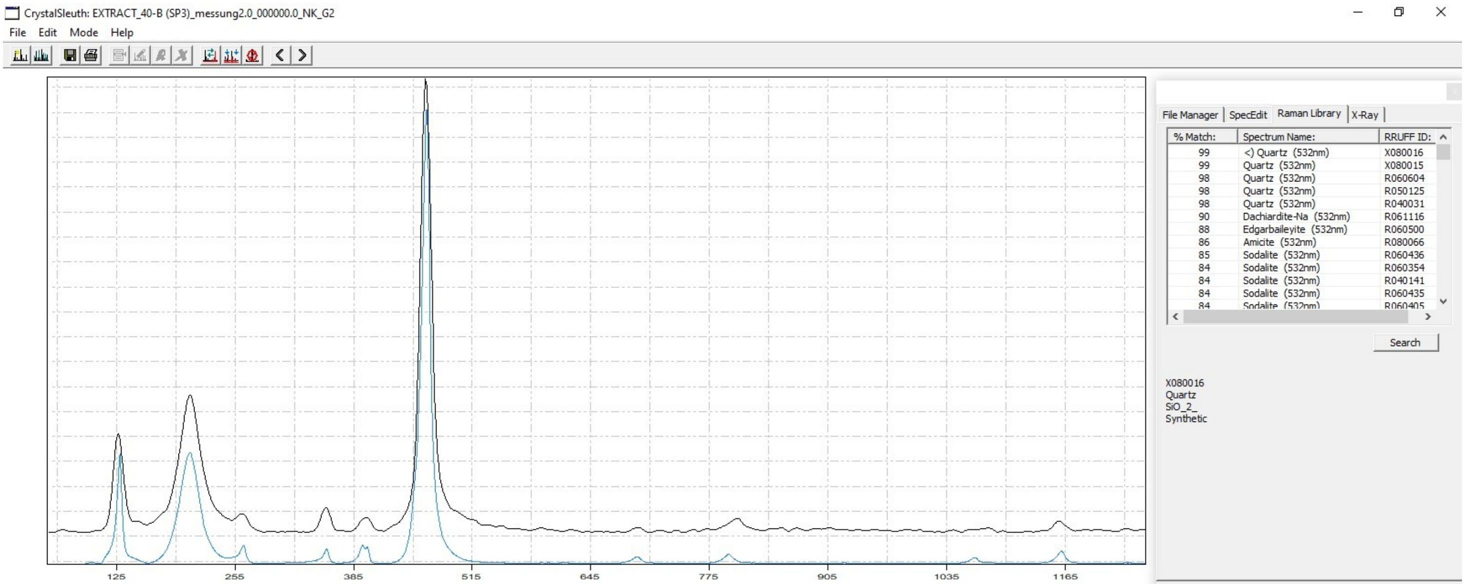
Indication for a shock event are the shifts of the marked Quartz spectral lines towards 463, 264 and 127



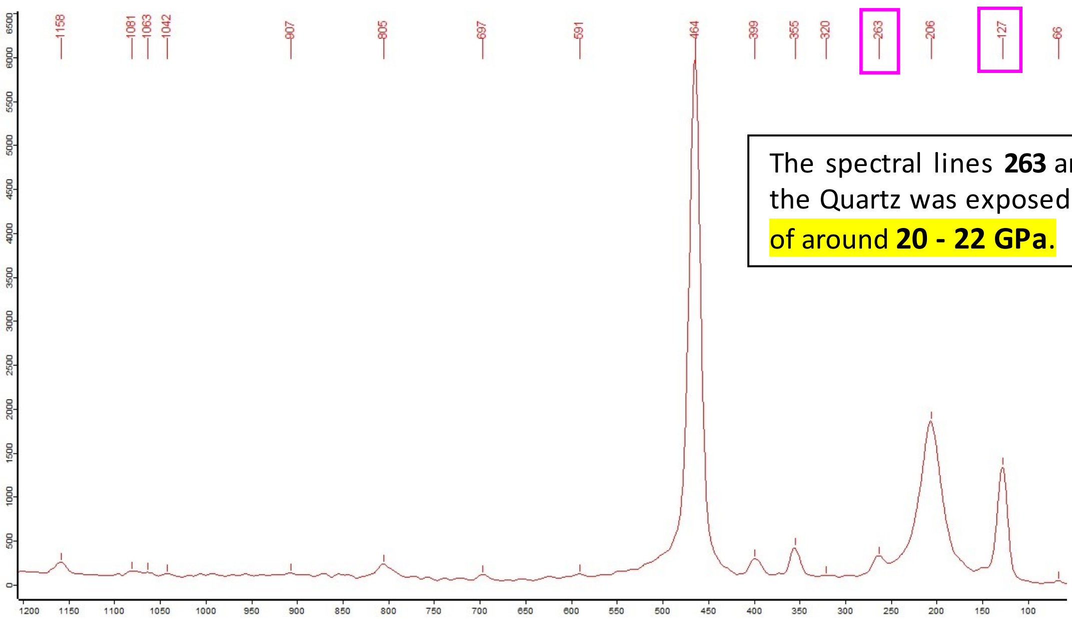
Sample Site 40-B : Stone 1_spectra 2 indicates : Quartz (→ see RRUFF_search results)



Sample :

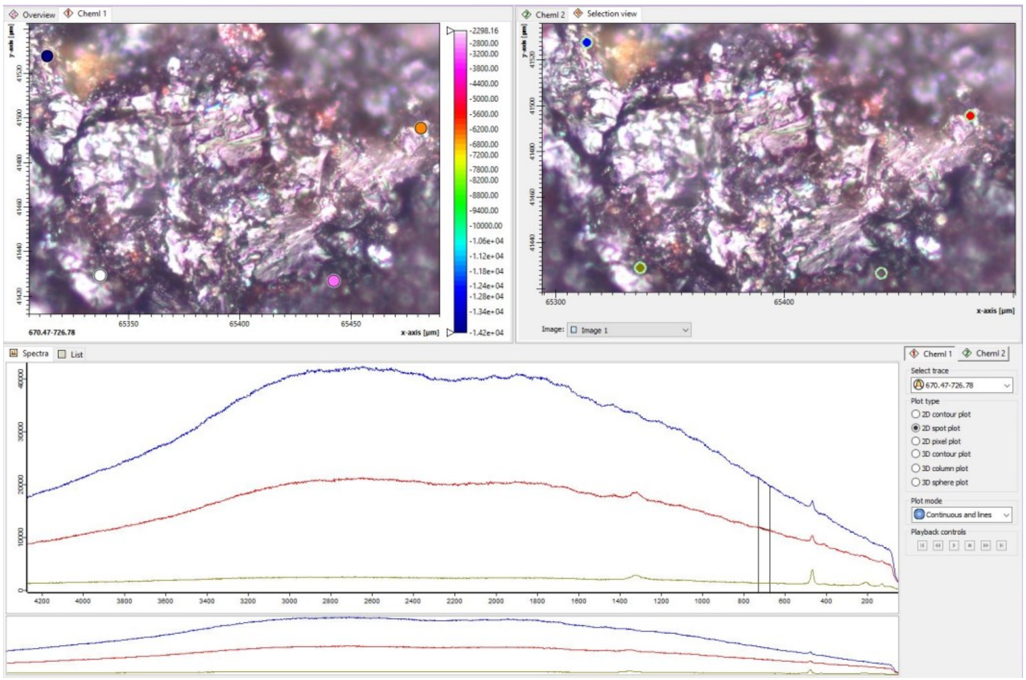


Indication for a shock event are the shifts of the marked Quartz spectral lines towards 263 and 127



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)



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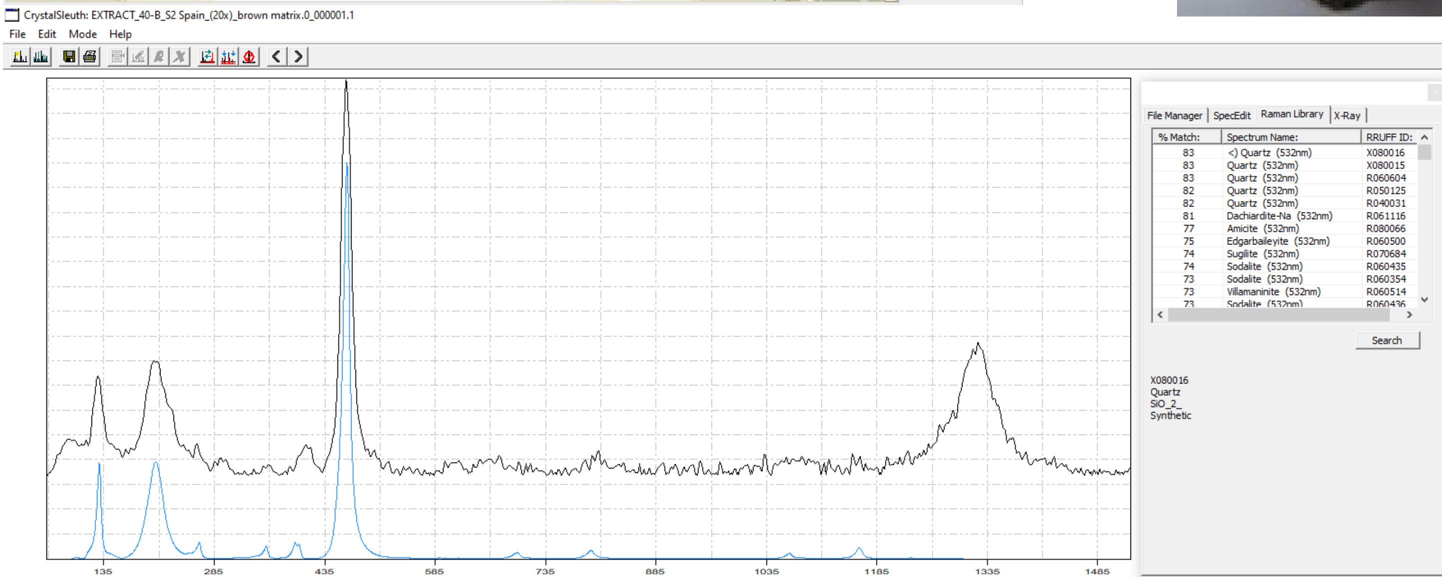
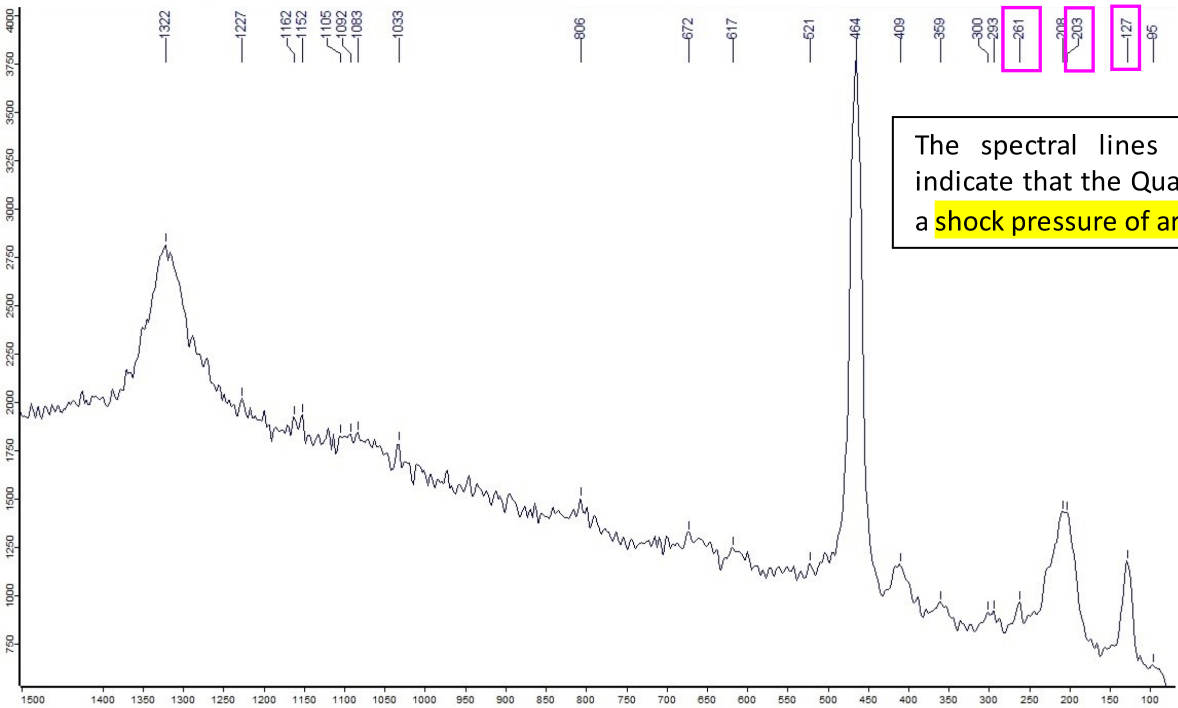
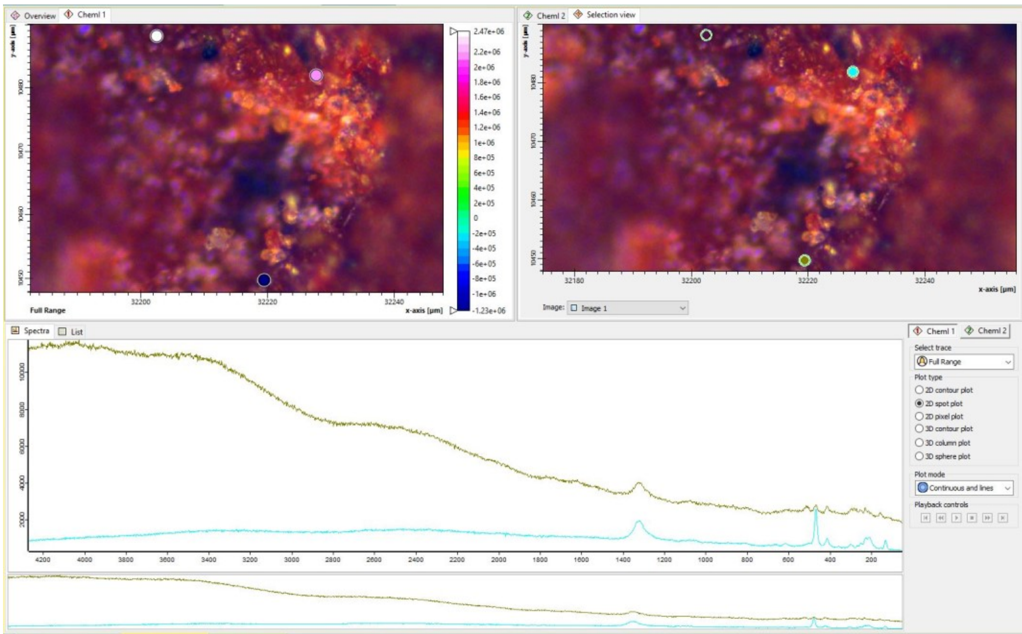


Indication for a shock event are the shifts of the marked Quartz spectral lines towards 261, 203 and 127

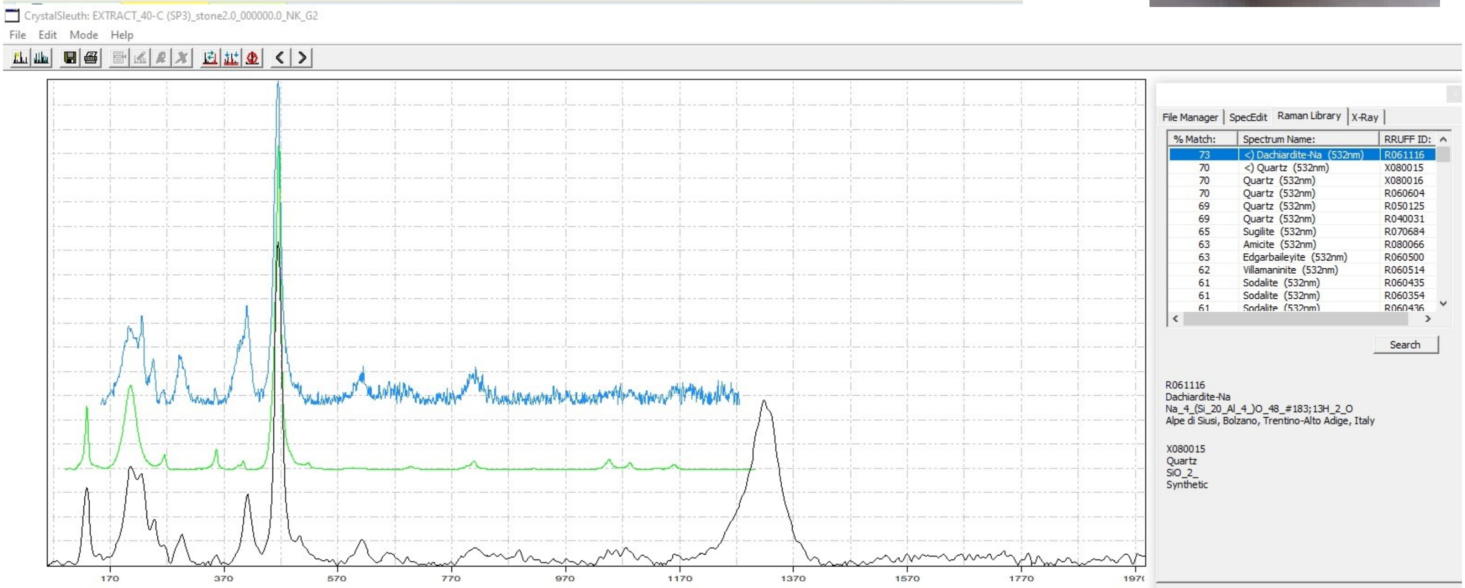


The spectral lines **261, 203** and 127 indicate that the Quartz was exposed to a shock pressure of around **20 – 22 GPa**

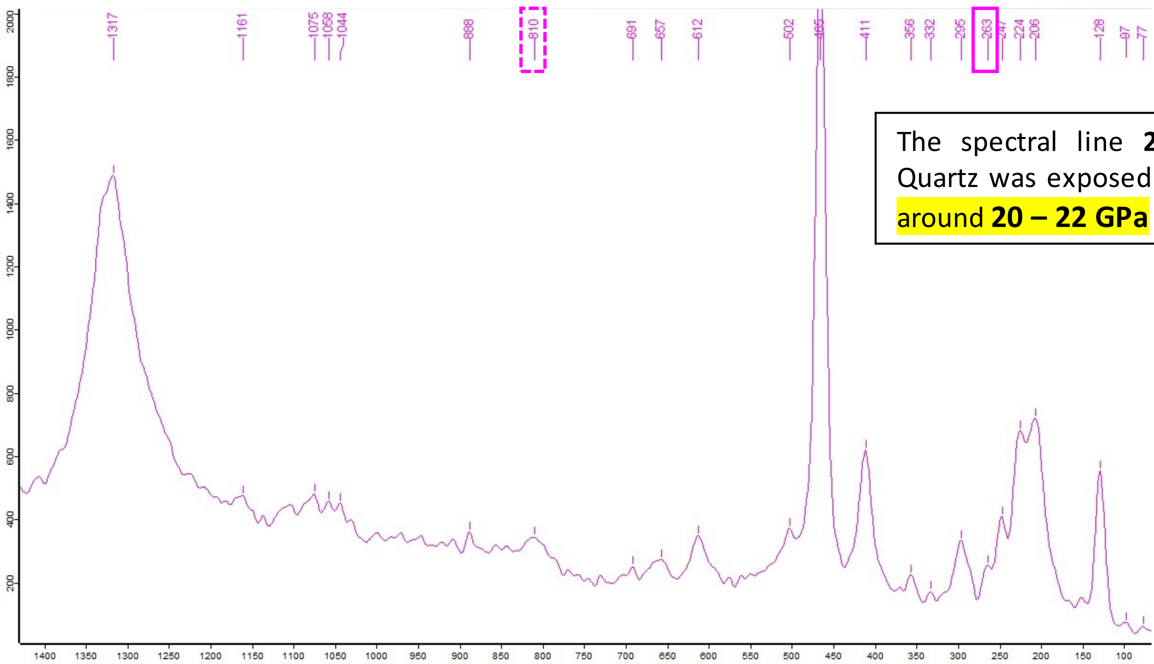
Sample Site 40-C : Stone 2_spectra 1(brown mineral) indicates : Quartz, Dachiardite-Na (→RRUFF)



Sample :



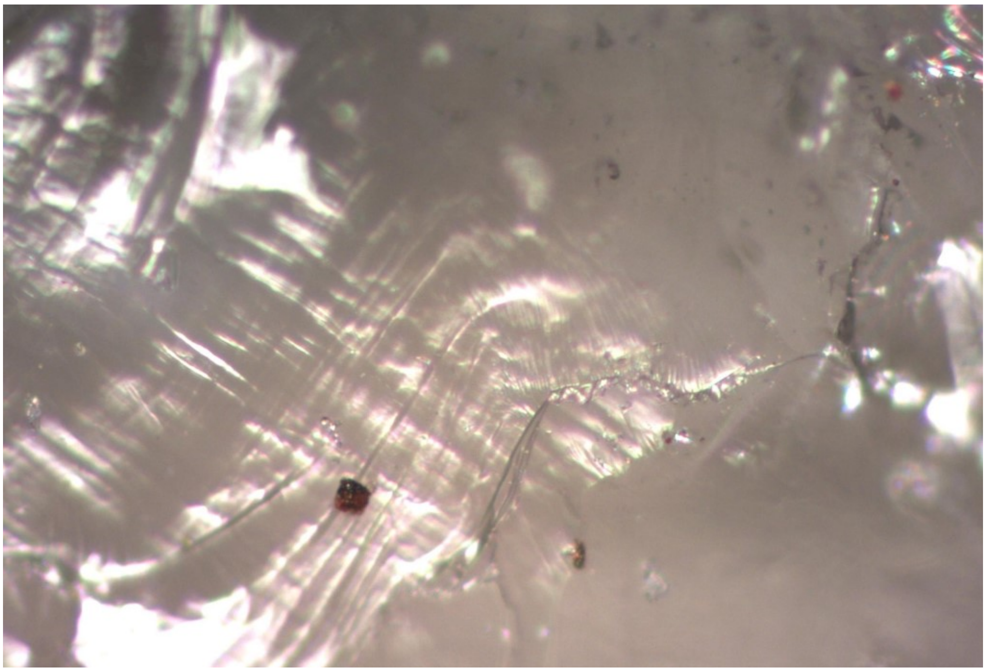
Indication for a shock event are the shifts of the marked Quartz spectral line towards 263



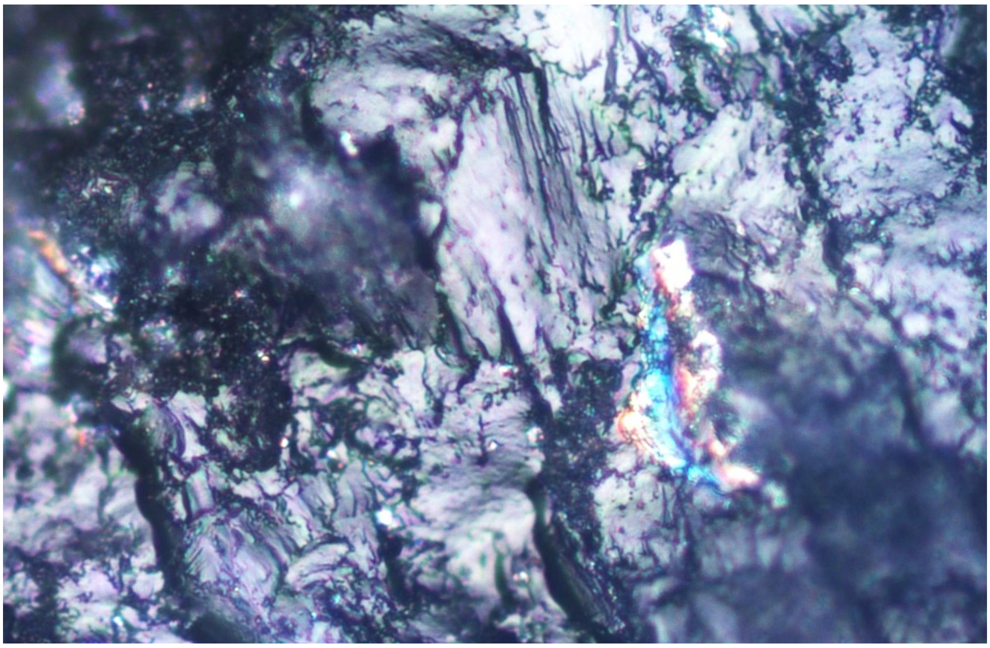
The spectral line **263** indicates that the Quartz was exposed to a shock pressure of around **20 – 22 GPa**

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

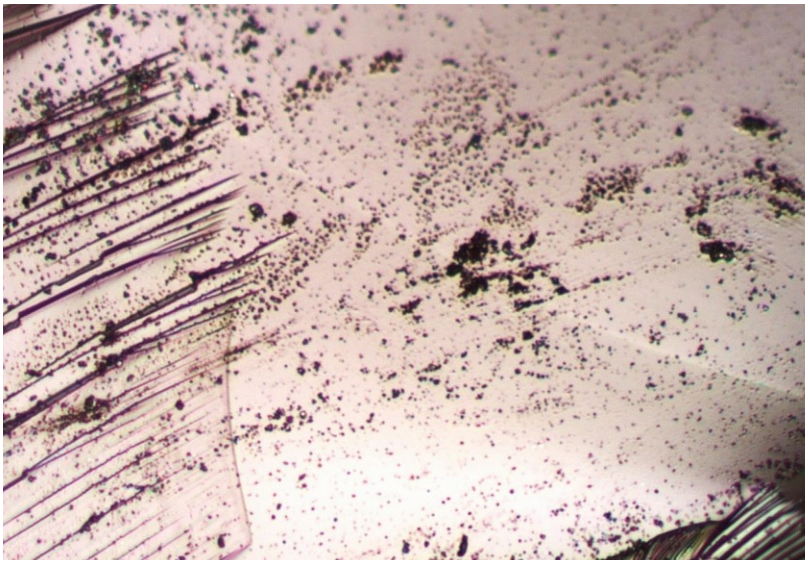
Sample Site 19-B : Stone 3_spectra 1 : Quartz - Image size : ~ 400 x 300 µm



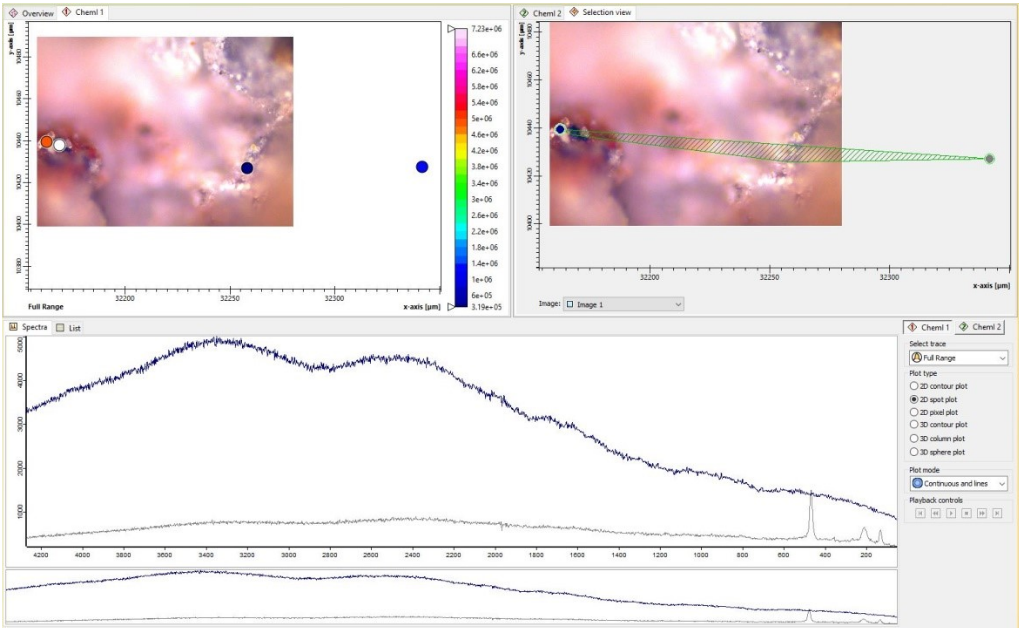
Sample Site 40-B : Stone 1_spectra 2 : Quartz - Image size : ~ 400 x 300 µm



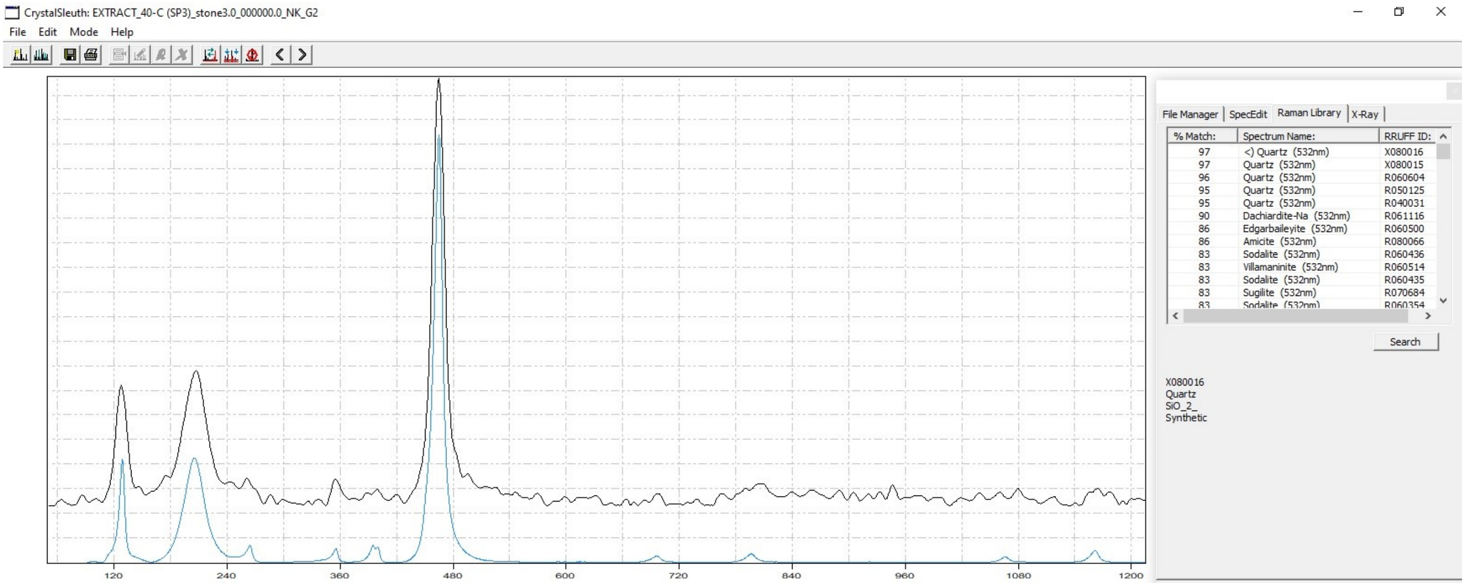
Sample Site 40-C : Stone 2 : Quartz, : ~ 300 x 200 µm



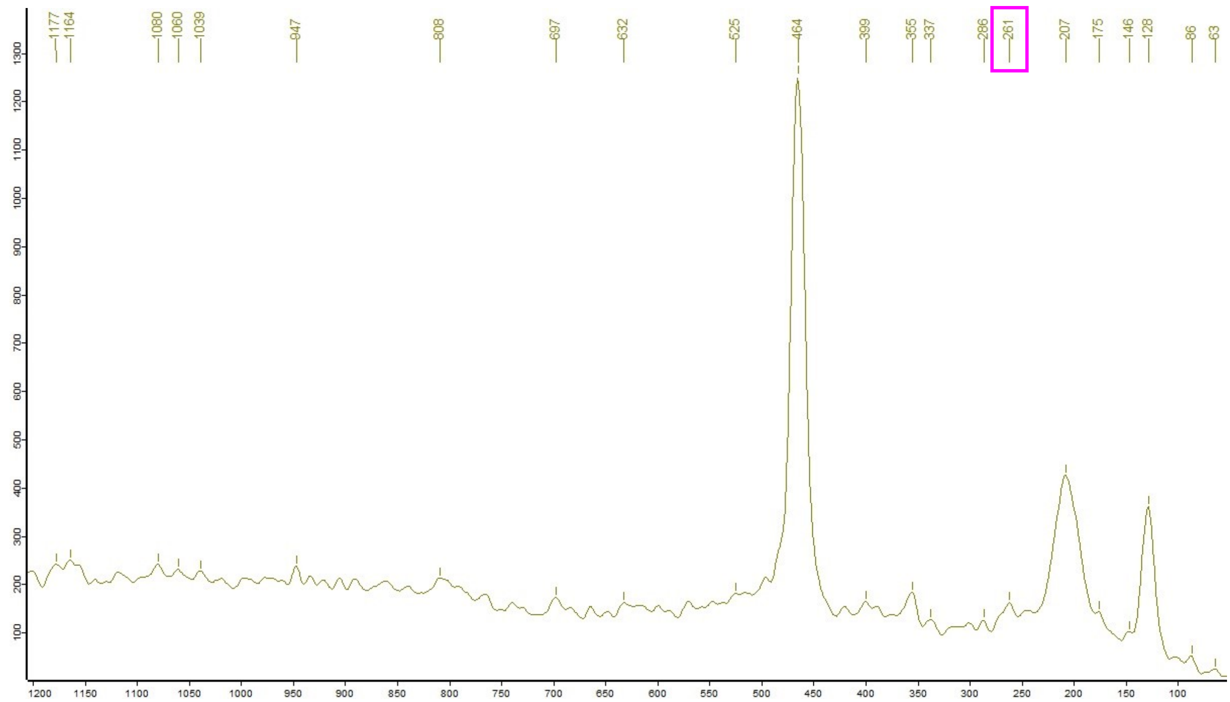
Sample Site 40-C : Stone 3_spectra 1 indicates : Quartz (→ see RRUFF_search results)



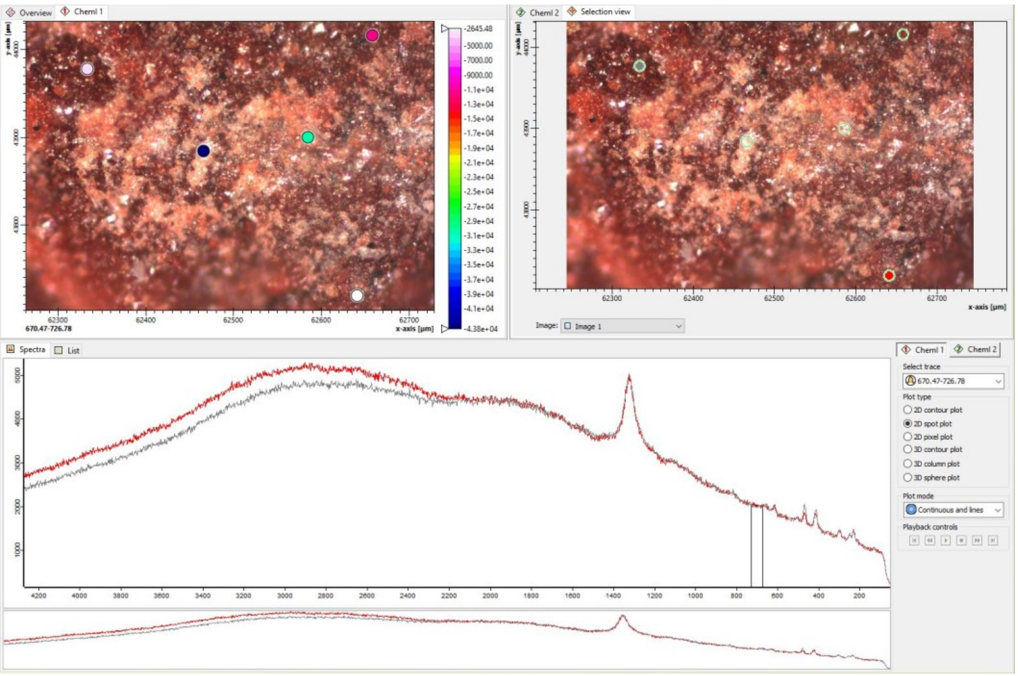
Sample :



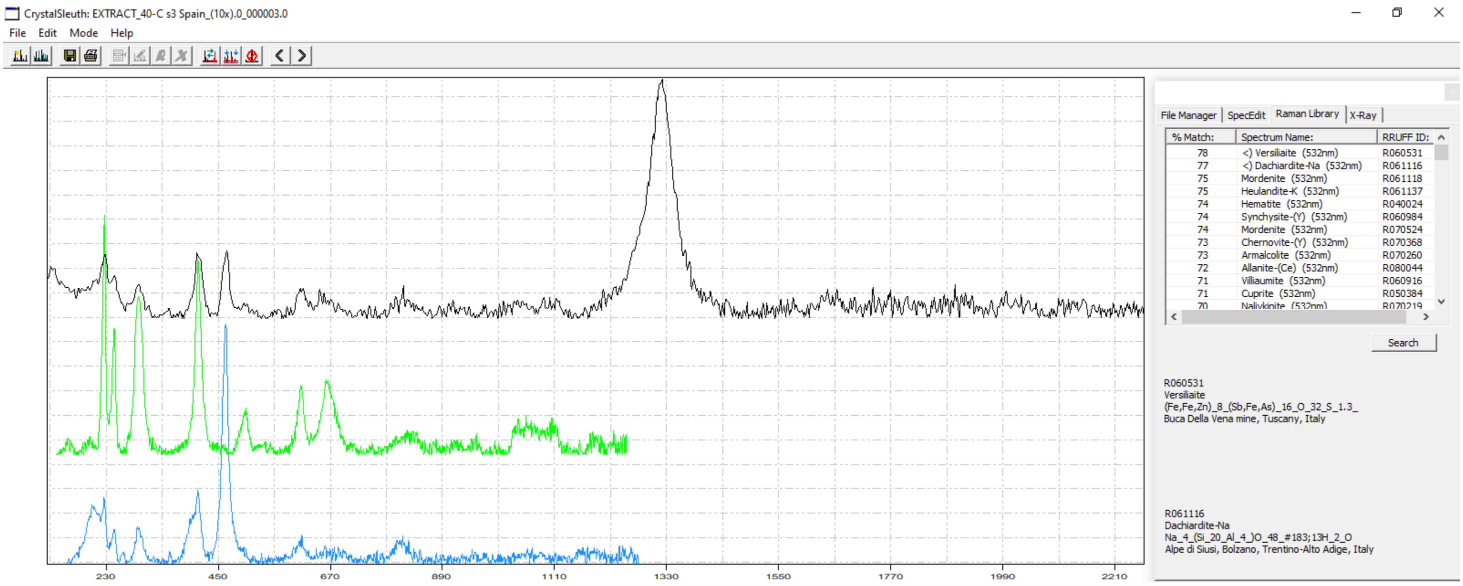
Indication for a shock event are the shifts of the marked Quartz spectral lines towards 261

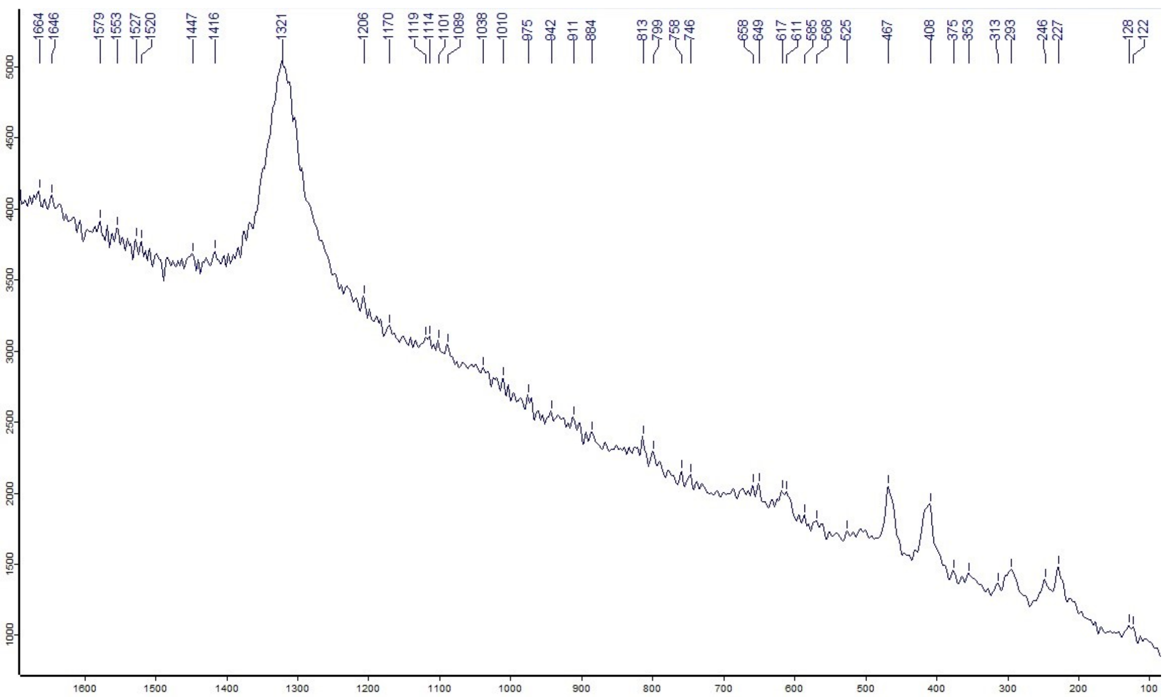


Sample Site 40-C : Stone 3_spectra 2 indicates : Dachiardite-Na, Versiliaite (→ see RRUFF_search results)



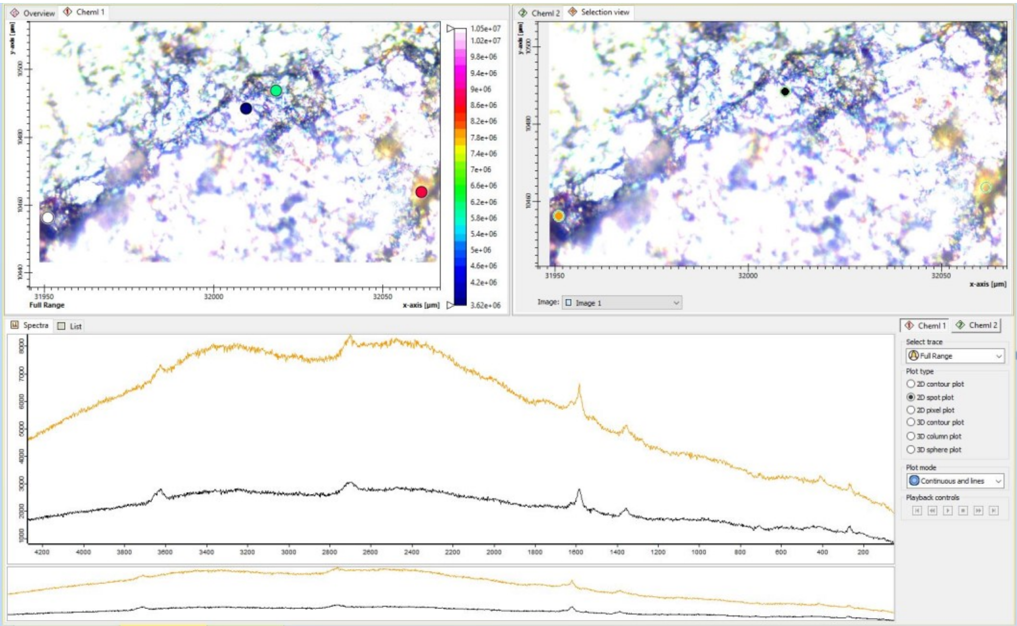
Sample :



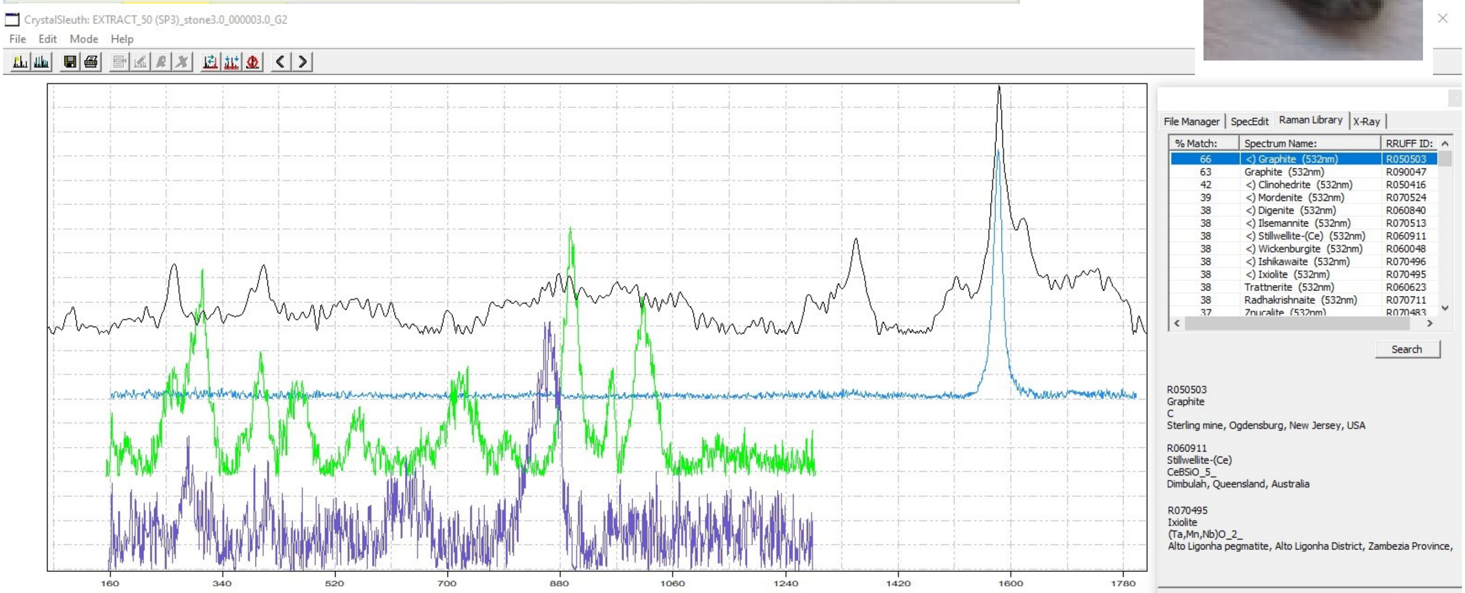


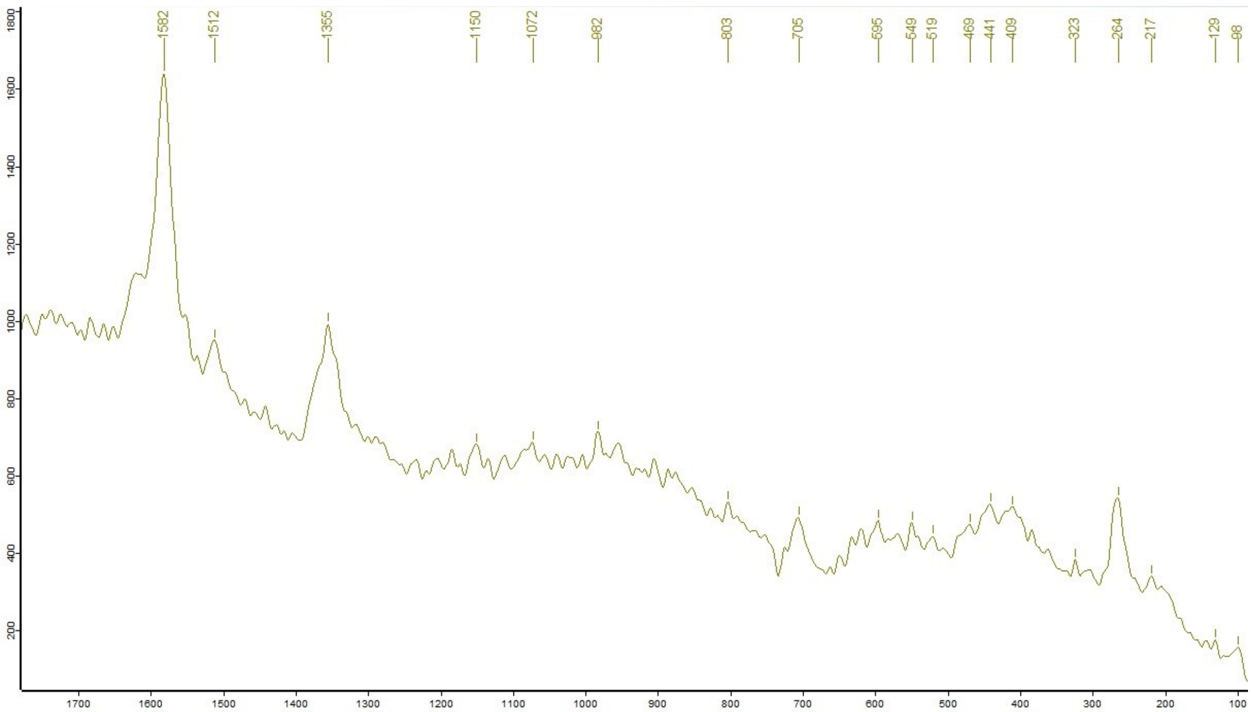
Sample Site 50 : Stone 3_spectra 1 indicates : Graphite (less probable : Stillwellite , Ixiolite) (→RRUFF)

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

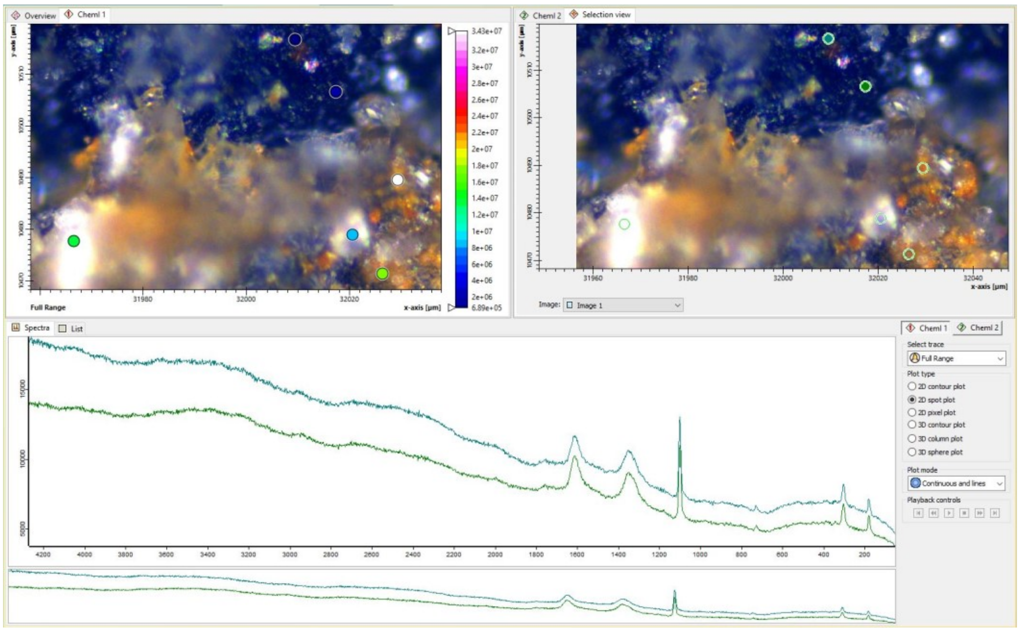


Sample :

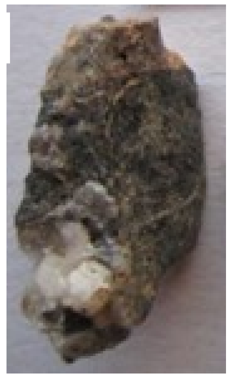


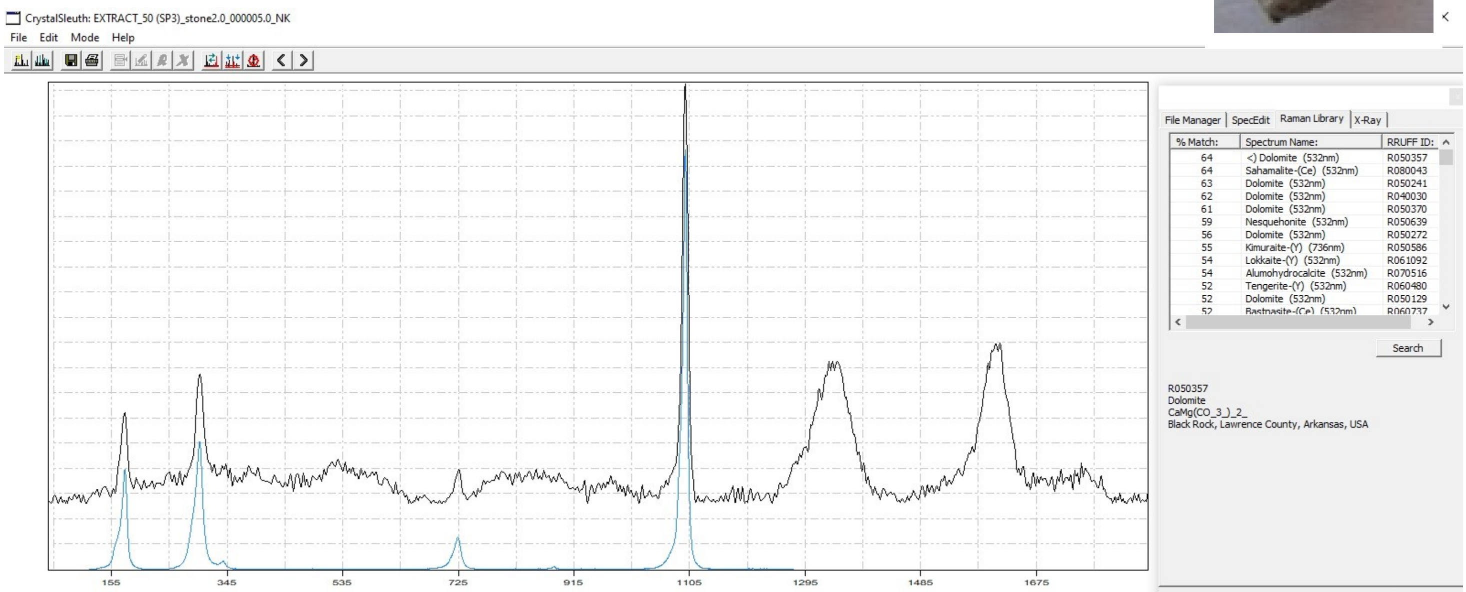


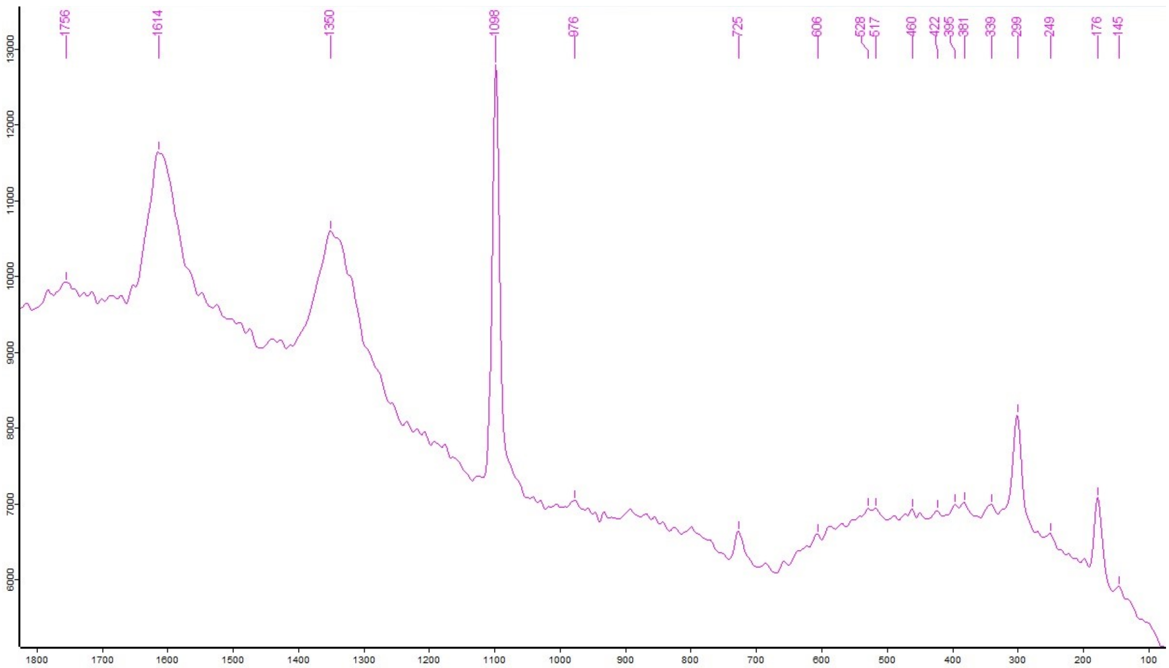
Sample Site 50 : Stone 2_spectra 1 indicates : Dolomite (→ see RRUFF_search results)



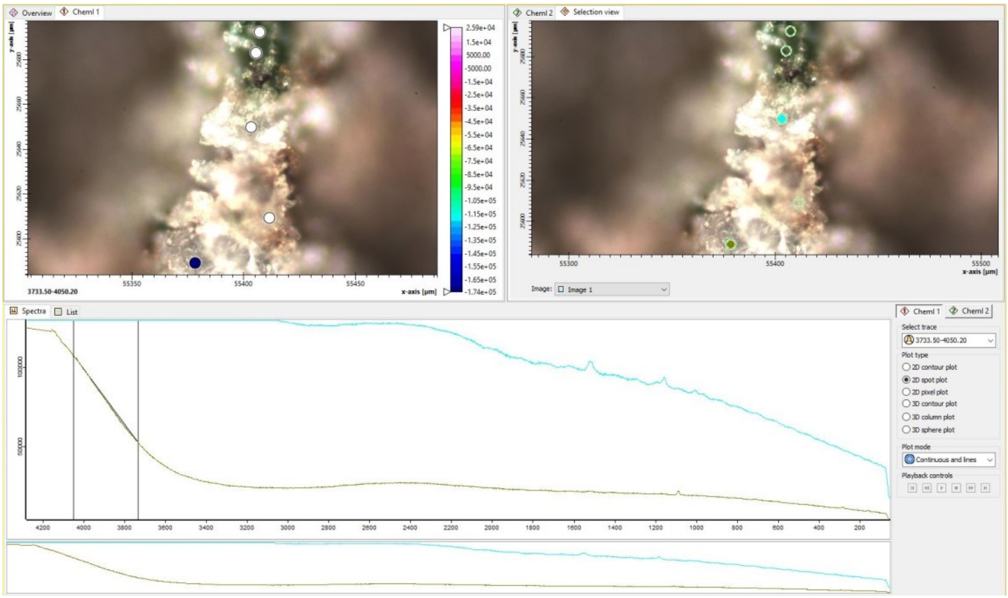
Sample :







Sample Site 19-B : Stone 1_spectra 1 indicates : Reyerite (→ see RRUFF_search results)



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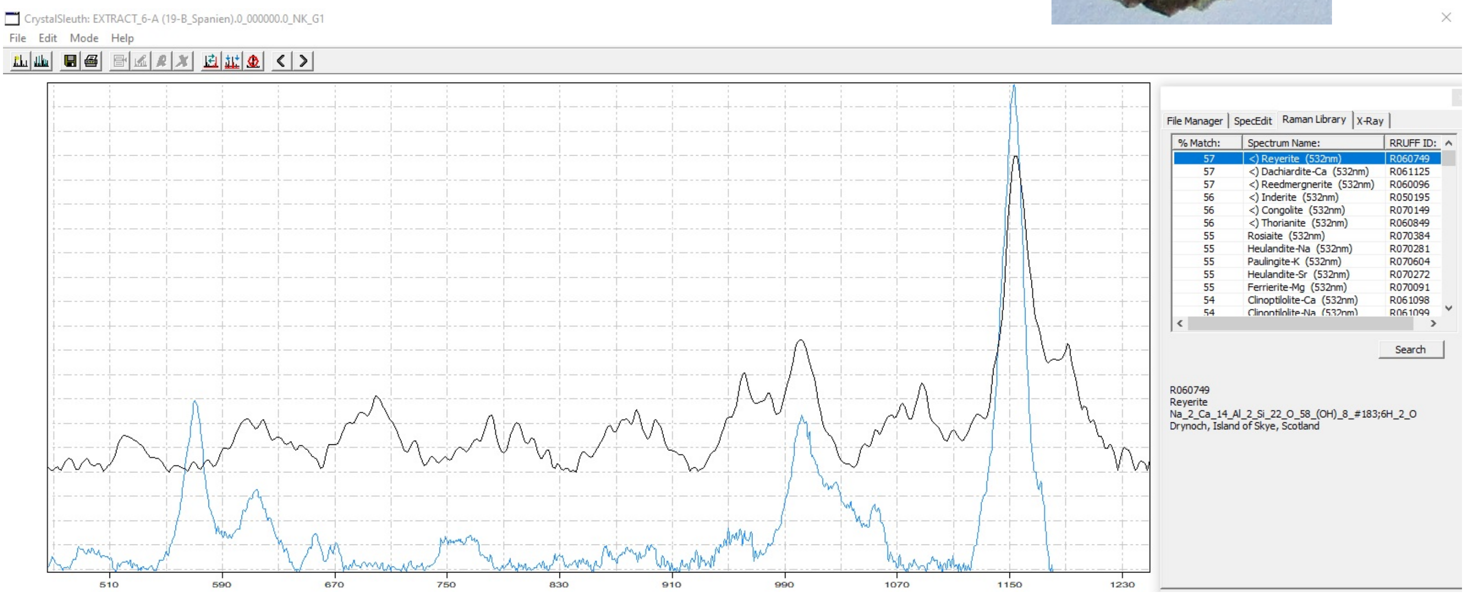
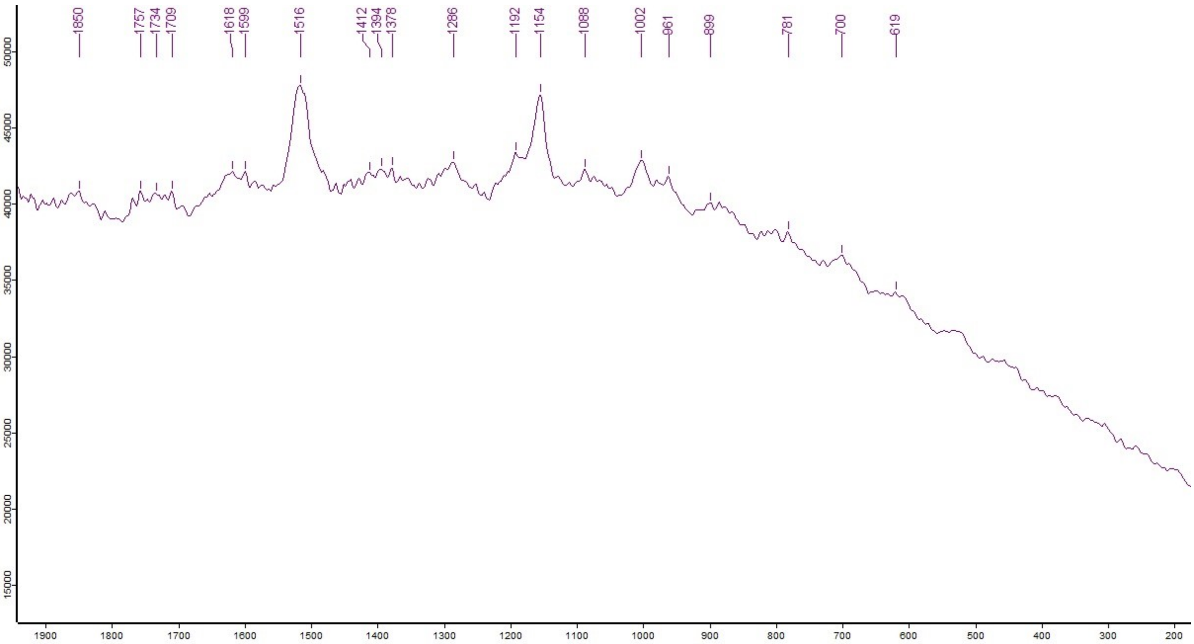
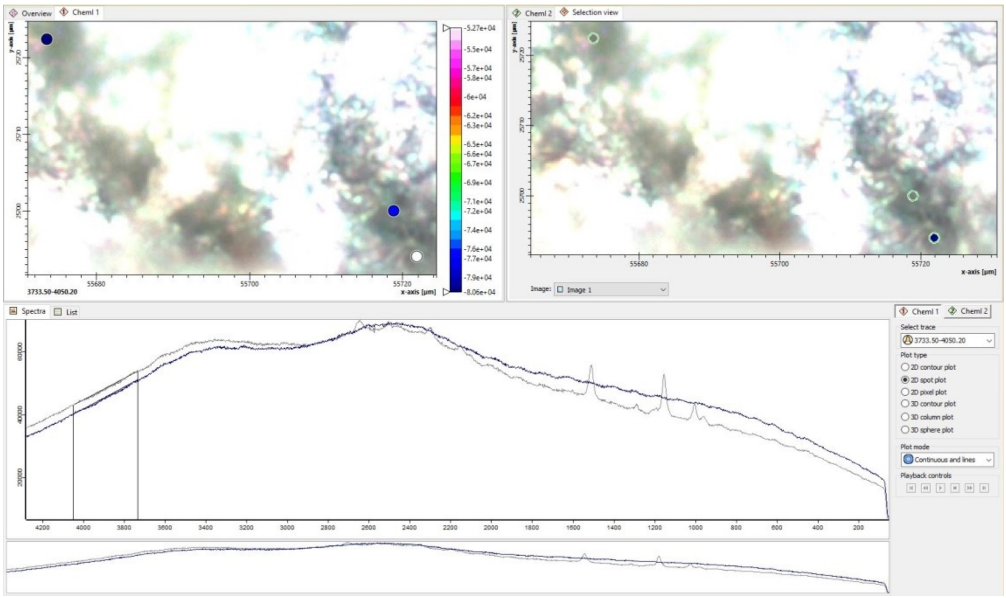




Sample Site 19-B : Stone 2_spectra 1 indicates : Reyerite (→ see RRUFF_search results)



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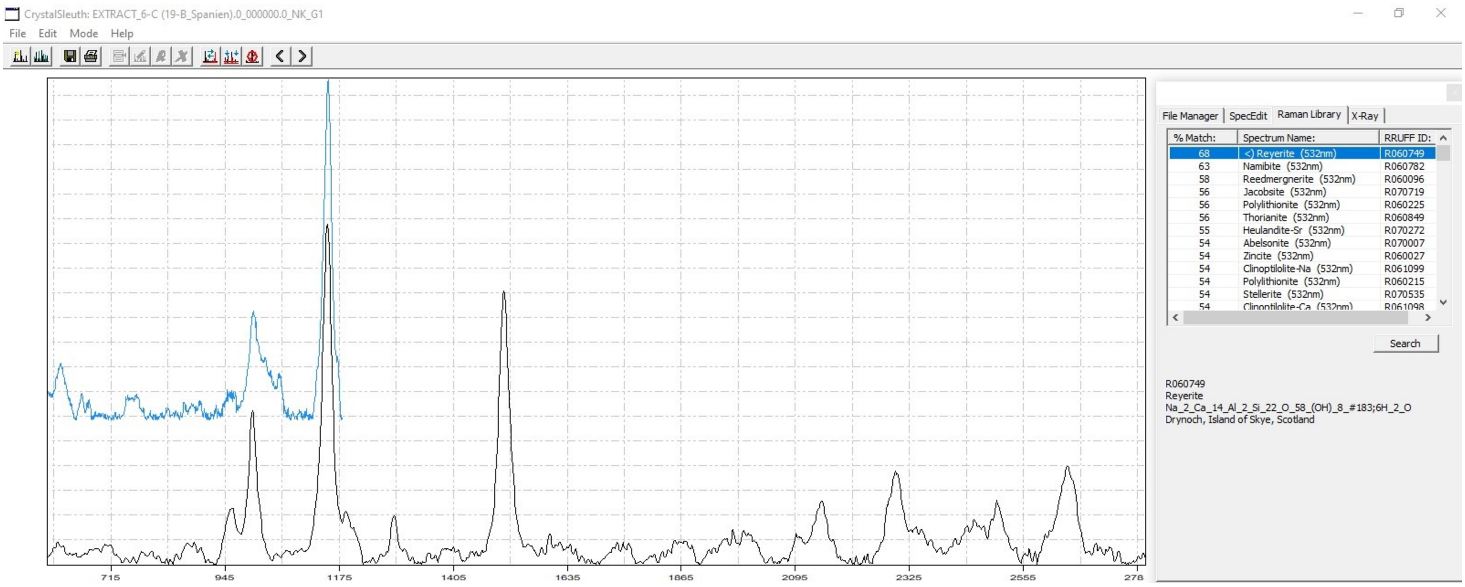
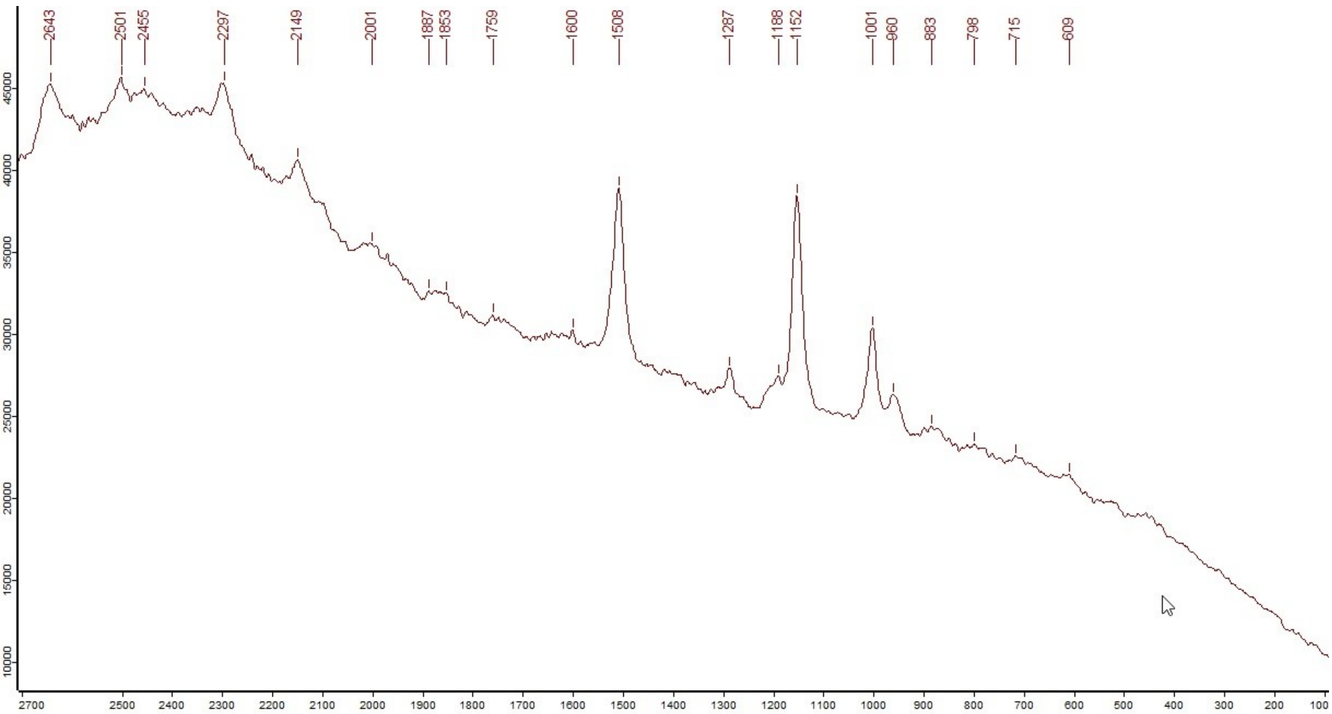
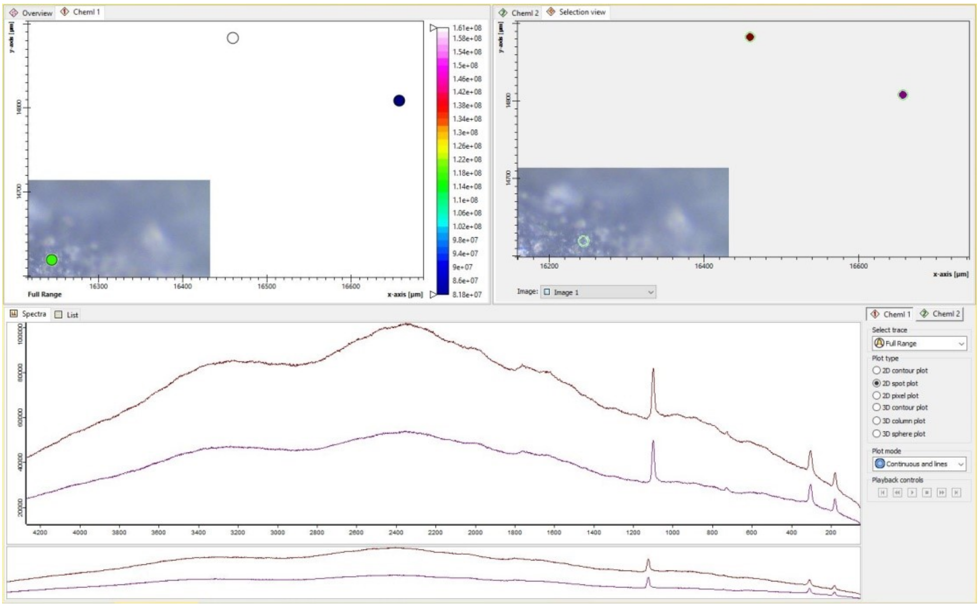




Sample Site 19-B : Stone 3_spectra 2 indicates : Sahamalite , Dolomite (→ see RRUFF_search results)



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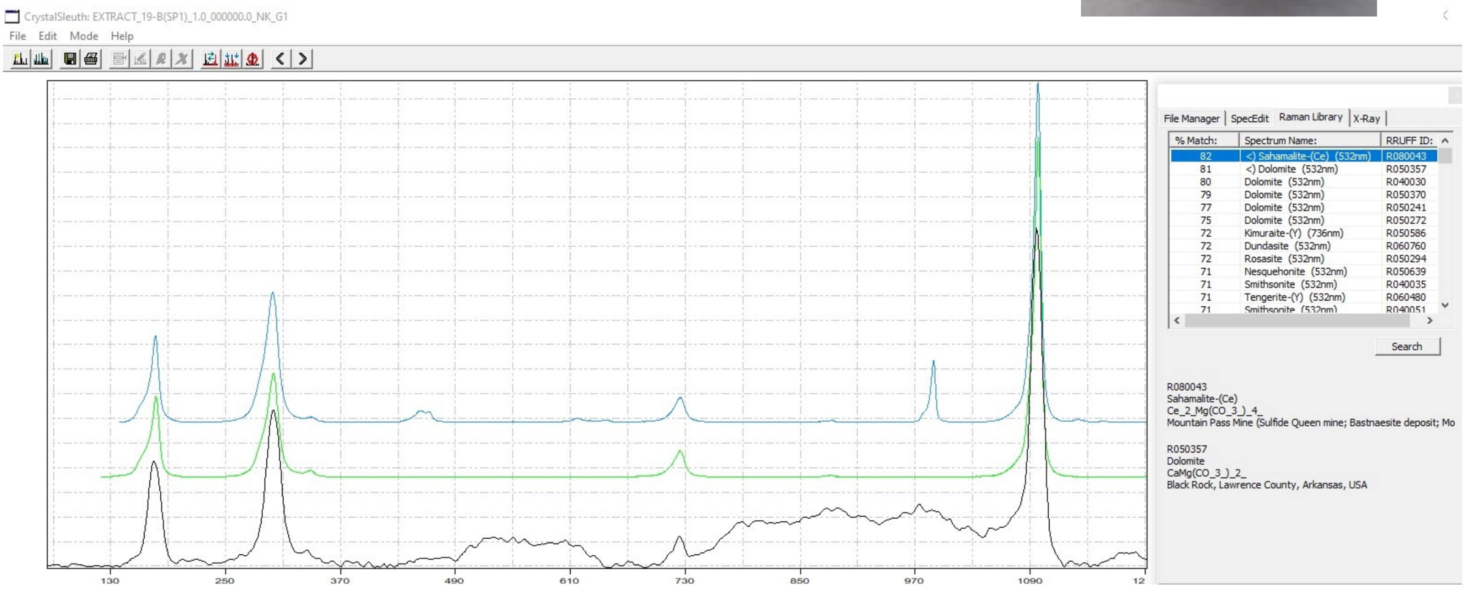
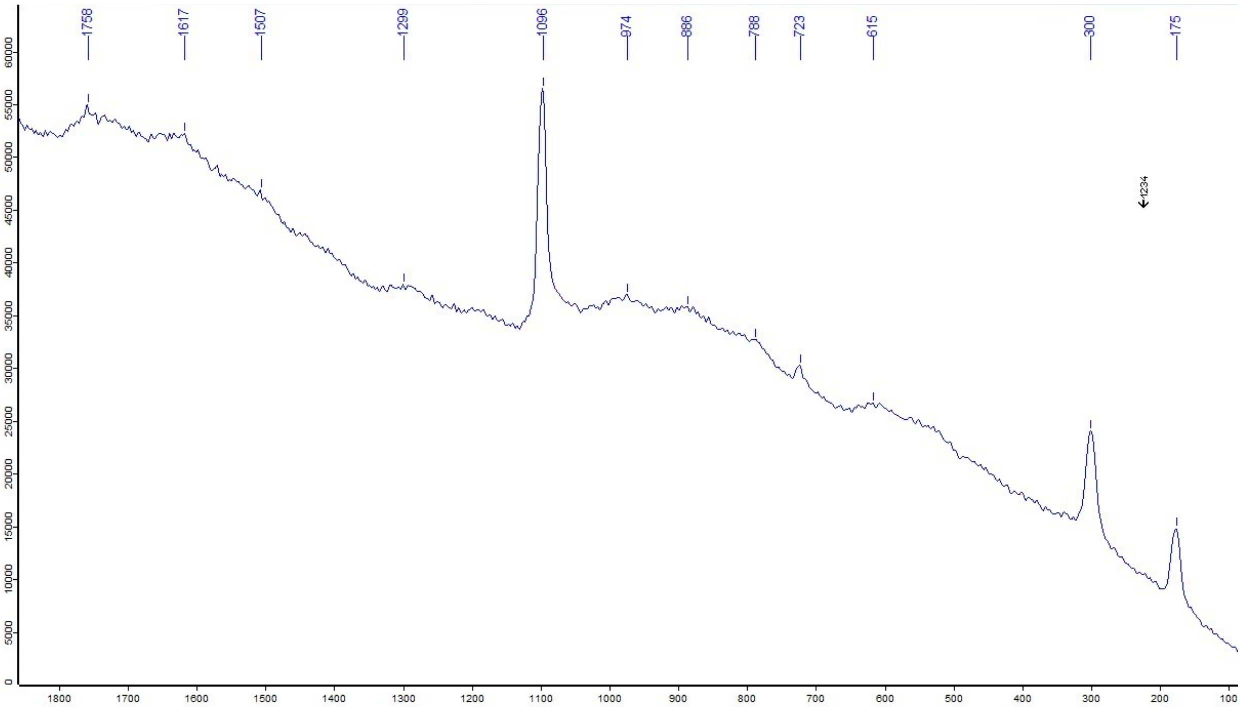
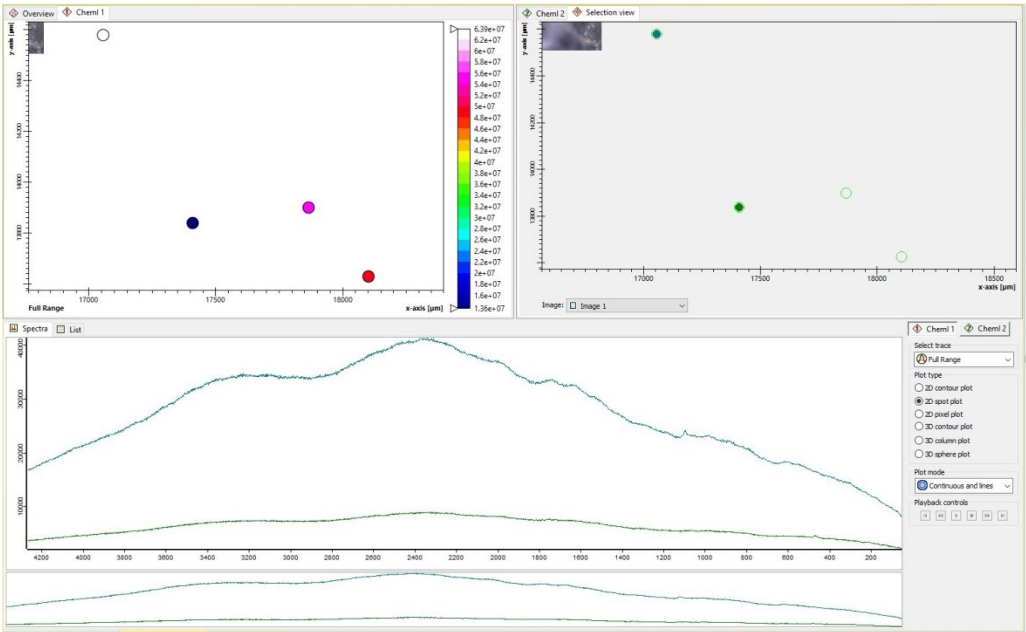




Sample Site 19-B : Stone 4 :   no usable search result



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

Site is accessible over the Highway AP7 (but a long stop on the side-strip of the highway isn't recommended !)

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

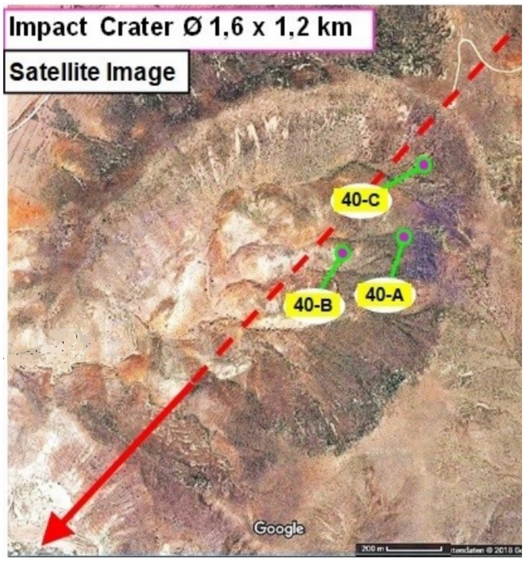

30-B 37° 25,708 N 1° 29,882 W 10 m Spain - (Southern Area)

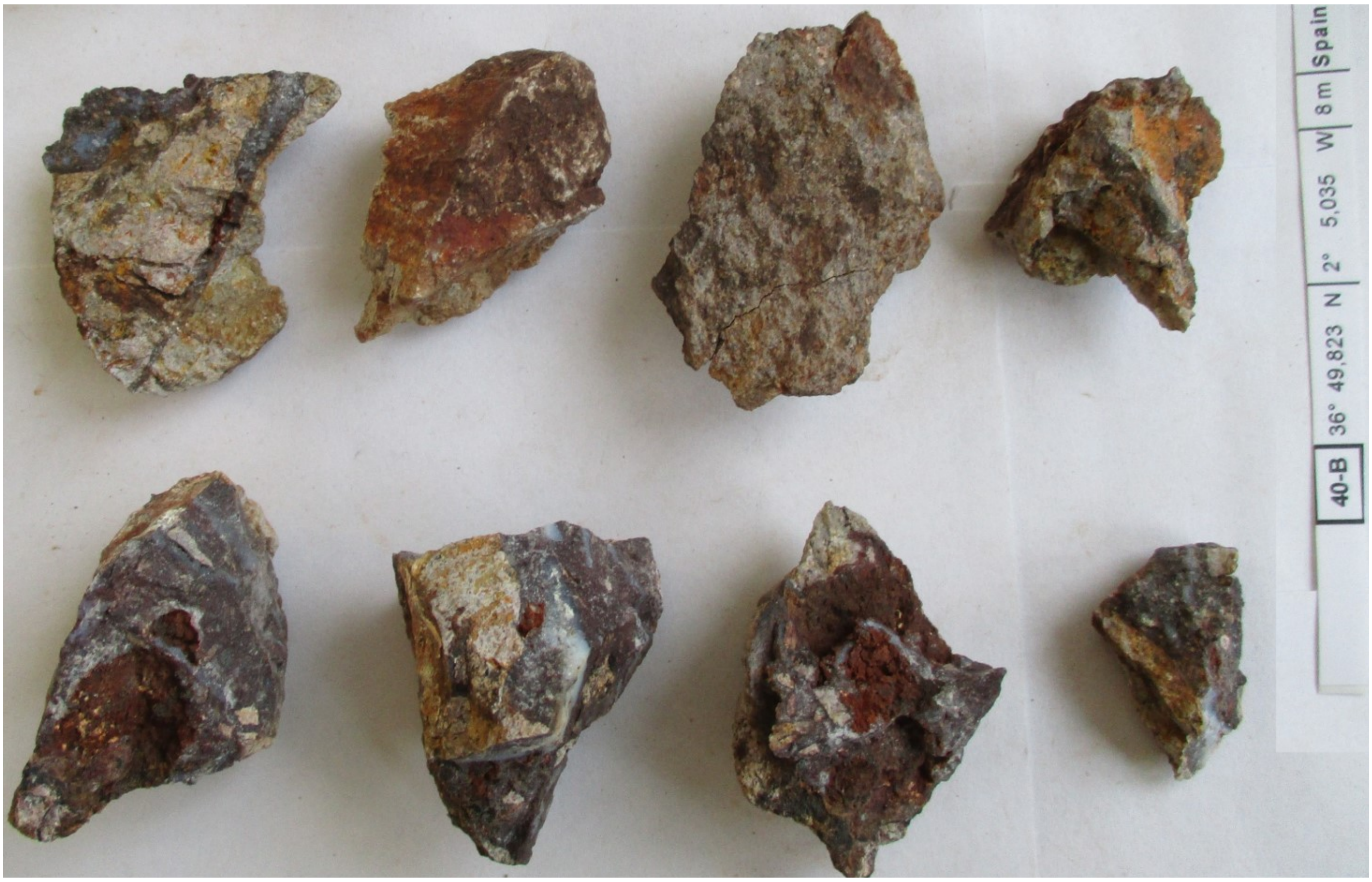
19


19-B 37° 26,086 N 1° 28,945 W 10 m Spain - (Southern Area)

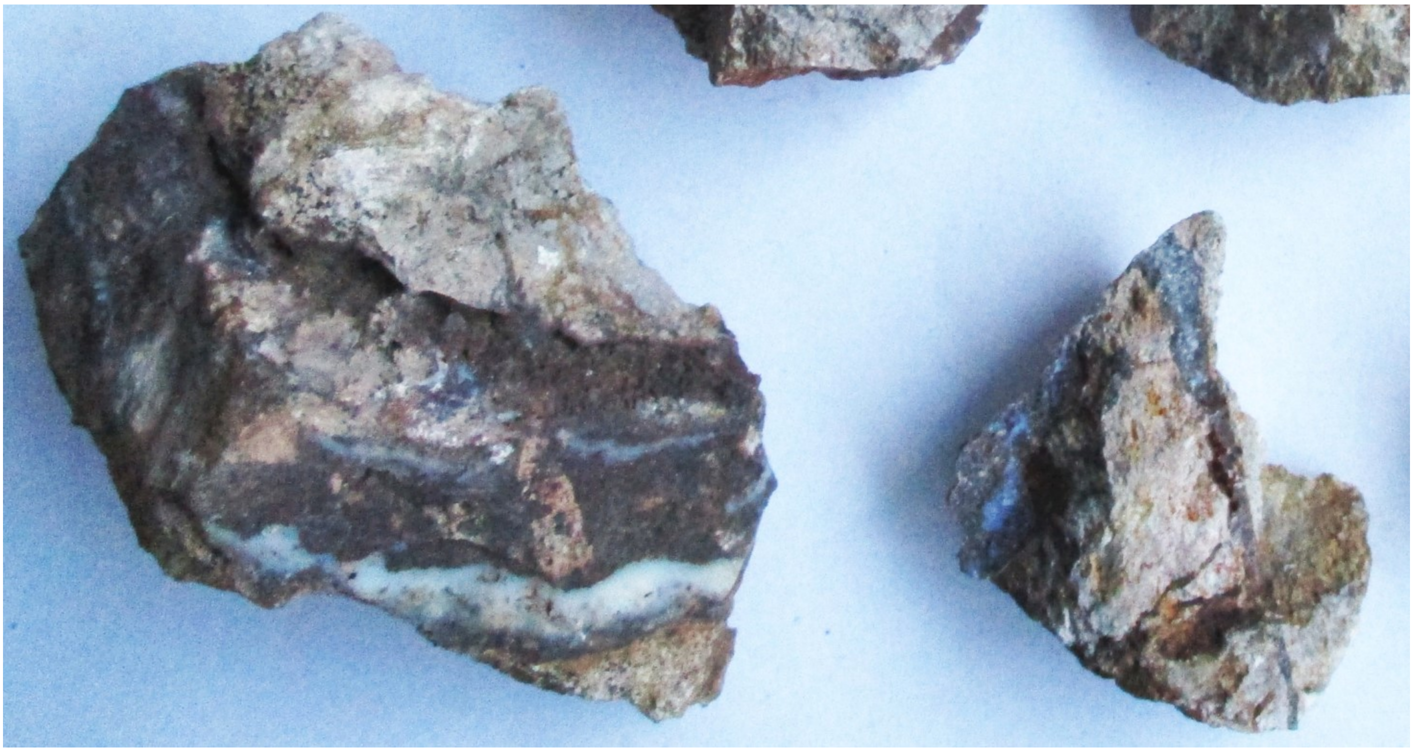
<u>Please note :</u> The rock samples 40-B were collected close to the center of an elliptical Crater Ø 1.6 x 1.2 km that is completely unknown to impact research yet !

All photos of the samples site here **40-B** (or alternatively available here : 40-B) (→**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 exitof the highway tunnel justoutside of the crater-wall

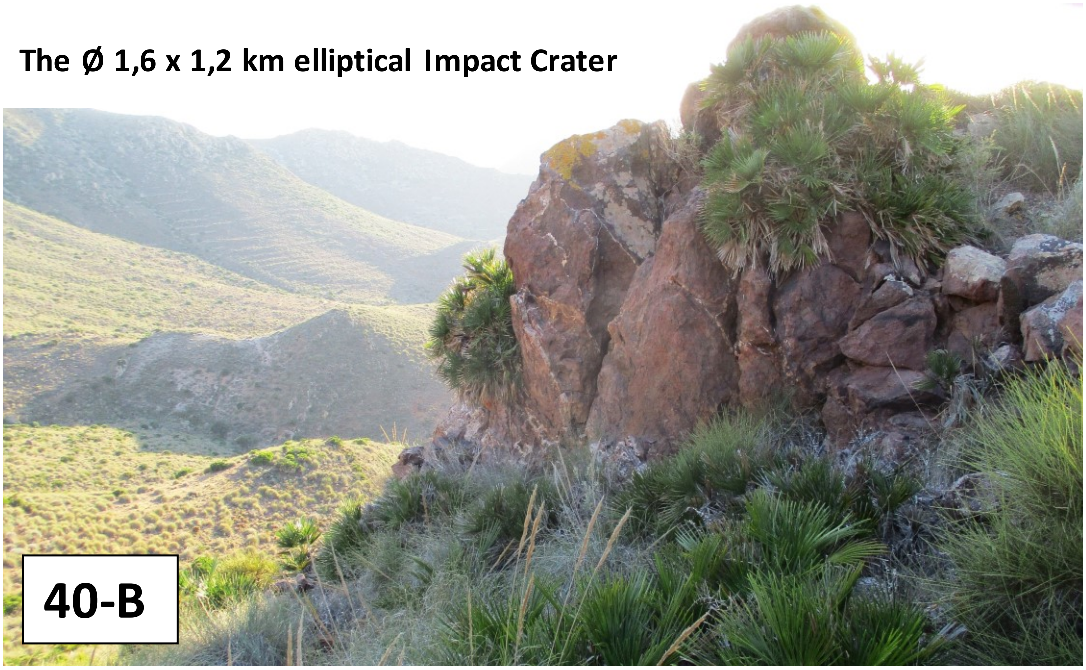
Site 19-B :

The site is very easy accesible by road.
From a little parking area on the coast it‘s a 300 m walk to the Impact-effected rocks

The image shows the rocks in the fore-ground.
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 Ø 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 fore-ground an outcrop of impact breccia is visible
The crater is accesible over an unsealed road.
But there is a radar station on the crater rim. Permission may be required for a expedition



The Ø 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

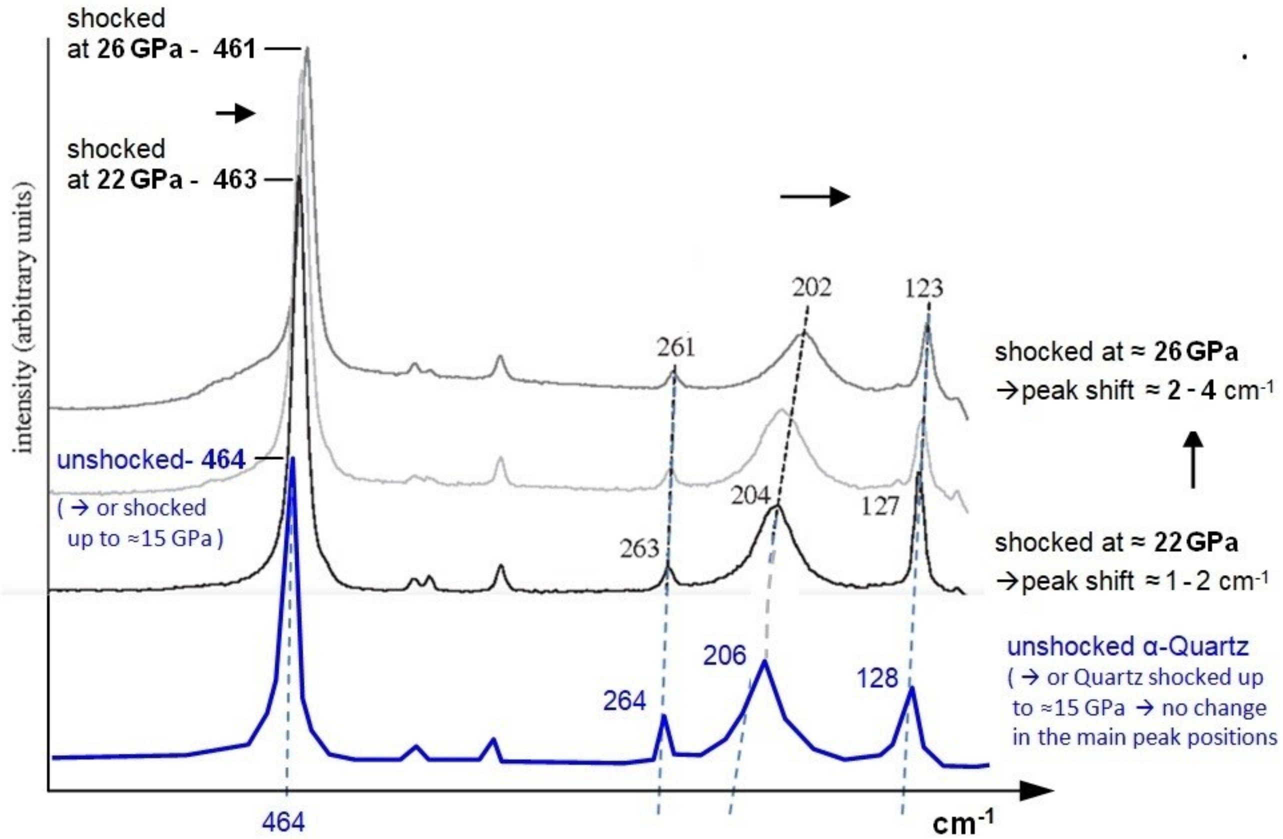
In order to verify a sample site as an impact site or impact structure, shock-metamorphic effects must be discovered in the rocks of the sample site. This can be done by different methods.

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.

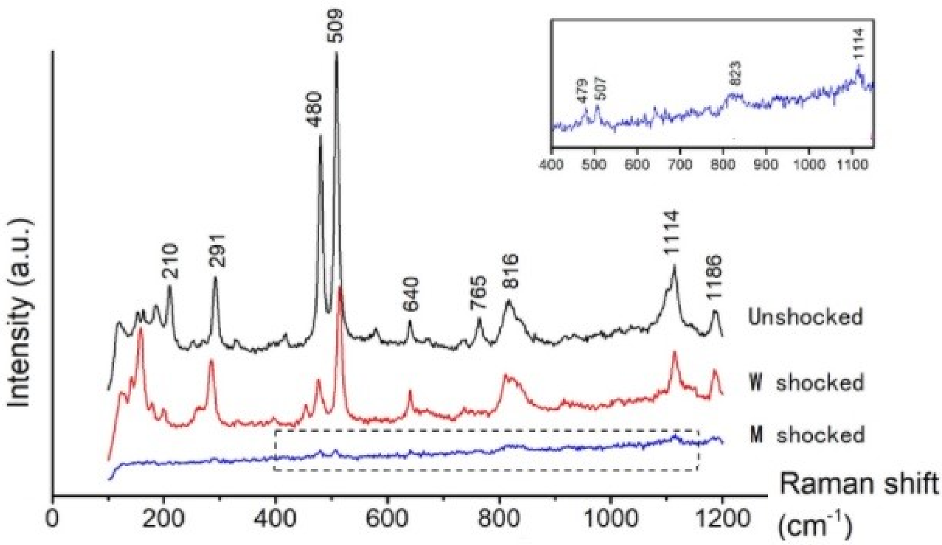
Mc Millan et al. (1992) and others have shown that the main RAMAN-peaks of Quartz shift towards lower frequencies if the Quartz was exposed the a shock-pressure > 15 GPa. → see diagram below

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

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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**

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