The Ø 130 x 110 km “Bay of Lyon“ Crater (France)

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

Summary :

Raman spectra of quartz samples collected at sample site **27-B** near Cabo de Creus (Cape „de Creus“) at the Bay of Lyon in NE-Spain provide strong evidence for the Ø 130 x 110 km elliptical Impact Crater described in my hypothesis, which is responsible for the formation of the semi-circular Bay of Lyon.

The yet unknow Ø 130 x 110 km “Bay of Lyon“ Impact Crater (BLC) belongs to a larger Secondary Impact Crater Chain, which was caused by impacting ejecta material that was ejected by the Ø 1270 x 950 km Permian Triassic Impact Crater (PTI), located in the Arctic Sea near Alaska, according to my hypothesis. (→ weblink to my Permian Triassic Impact Hypothesis : → **Part 1** (**P1**) and **Part 2** (**P2**) of my hypothesis)

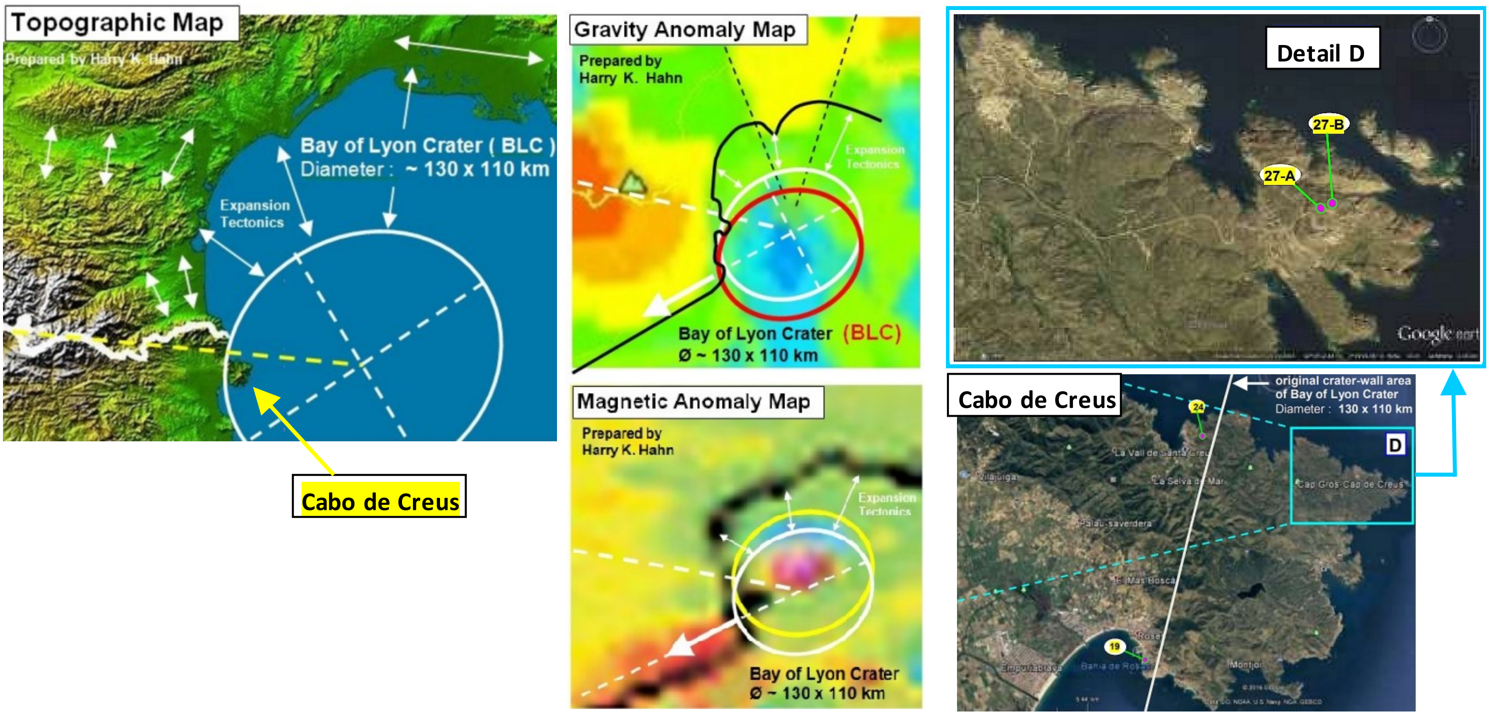
Beside the Raman spectra which I present as evidence and first verification for the existence of the impact crater, there is additional geo-physical evidence from gravity anomaly- and magnetic anomaly maps, which both show a strong anomaly in the center of the assumed Ø 130 x 110 km impact crater.

The Raman spectra of quartz from sample site **27-B** provide strong evidence for an Impact Event !
Sample Site **27-B** is the closest sample site in relation to the assumed center of the Ø 130 x 110 km Crater It is located on the last remaining (small) section of the crater-rim of the “Bay of Lyon“ Crater directly near the lighthouse at Cabo de Creus (Cape „de Creus“).
The whole rest of the Ø 130 x 110 km Crater is located on the ocean floor of the Mediterranean Sea.

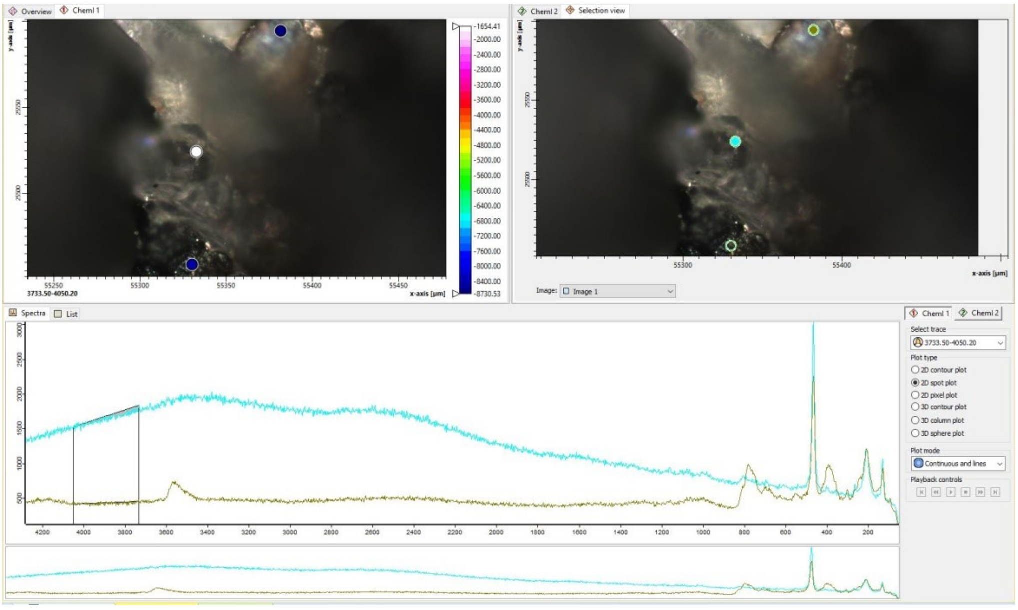
The shifts of the main Raman bands (peaks) to the lower frequencies **461** and **125 cm^{-1}** (Stone 6) and to **463, 261, 205** and **125 cm^{-1}** (Stone 3) and to **463** and **260 cm^{-1}** (Stone 2) which are visible in the Raman Spectra of these 3 quartz-samples from sample site 27-B, clearly indicate that the quartz was exposed to a **shock pressure in the range of 22 – 24 GPa**. (see explanation in the Appendix at page **16**)

A shock pressure of 22 GPa far exceeds every pressure caused by normal terrestrial metamorphism. Therefore the quartz from the sample site 27-B was clearly shocked by an impact event. The indicated shock pressure of 22-24 GPa is lower than the shock pressure that occured in other large impact craters on Earth, which can reach 100 GPa. This points towards an oblique impact. That means the impactor which formed the impact crater (→ possibly a big fragment of the PTI-Impactor) impacted in a very shallow angle of probably less than 10 degree, with a relatively low impact velocity of < 10 km/s.

→ Images of the analysed rock samples and photos of the sample sites are in the Appendix at page **13**.
→ 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 27-B : Stone 6_spectra 1 indicates : Quartz, Dachiardite-Na, Sugilite, Amicite (RRUFF database)



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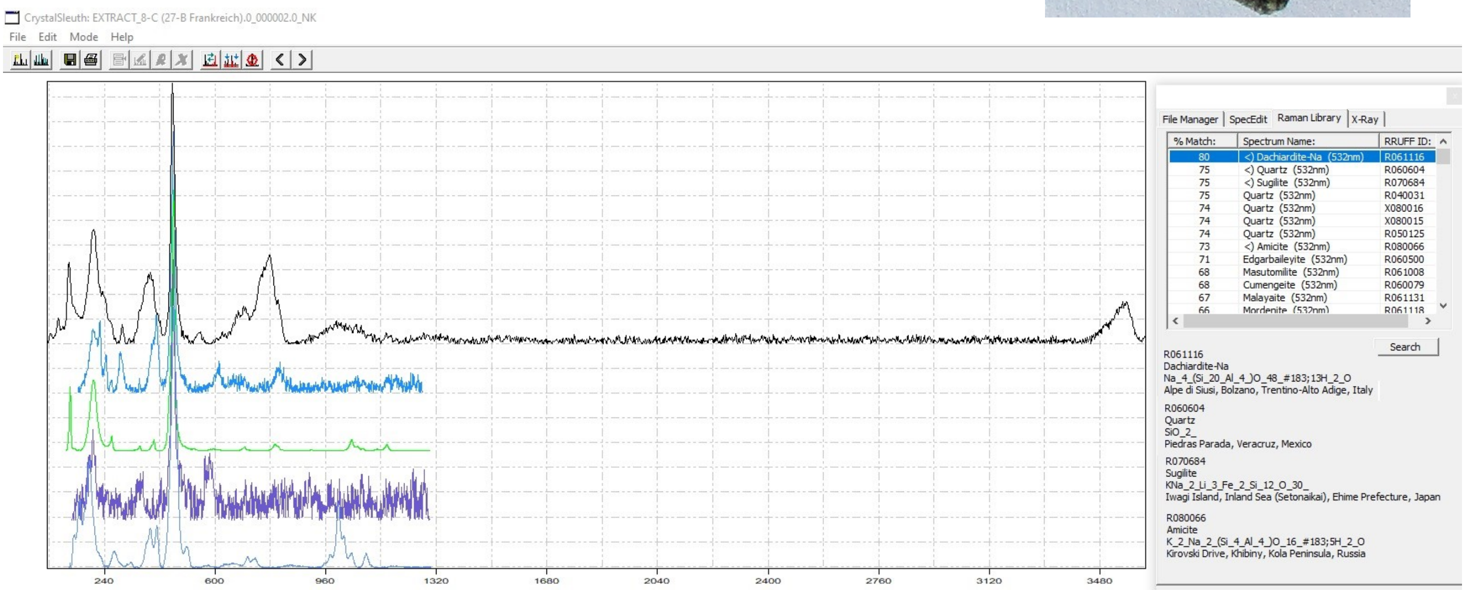
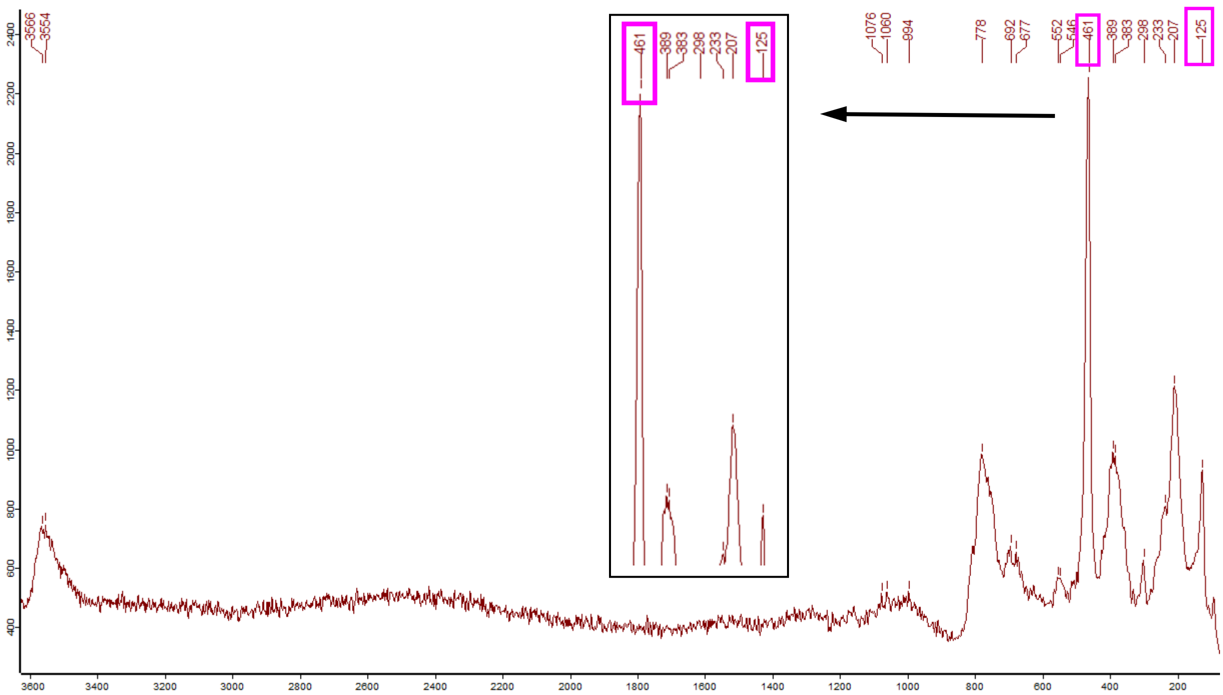
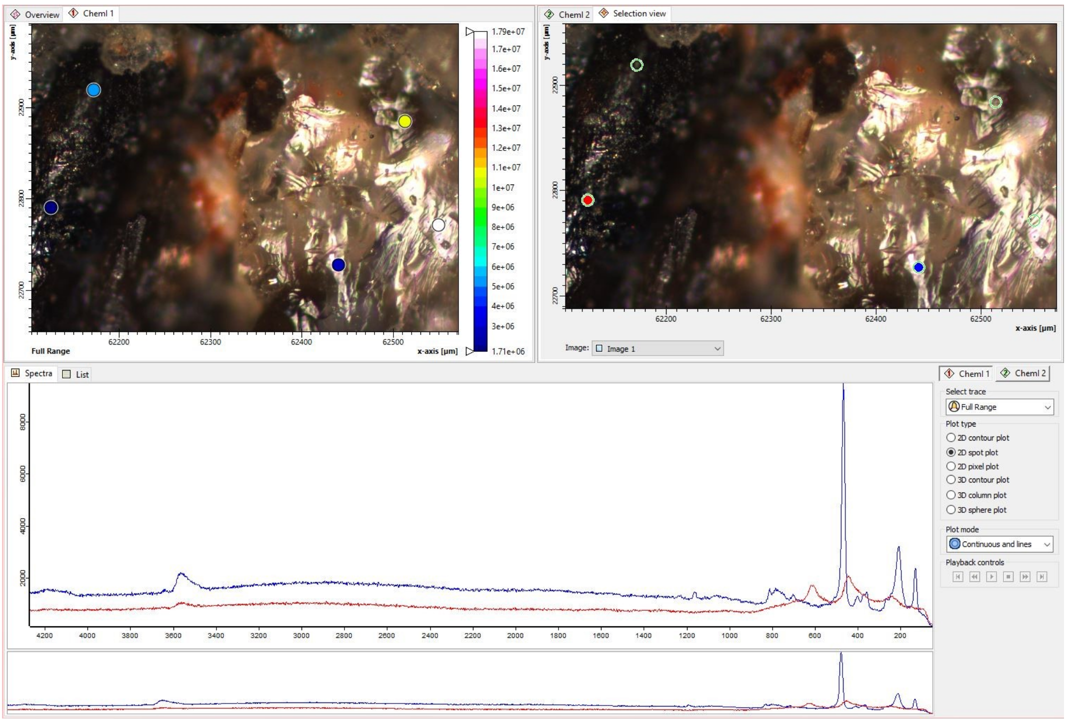


The shift of the main spectral line of the Quartz towards 461 in the sample indicates a shock pressure of around 24 GPa



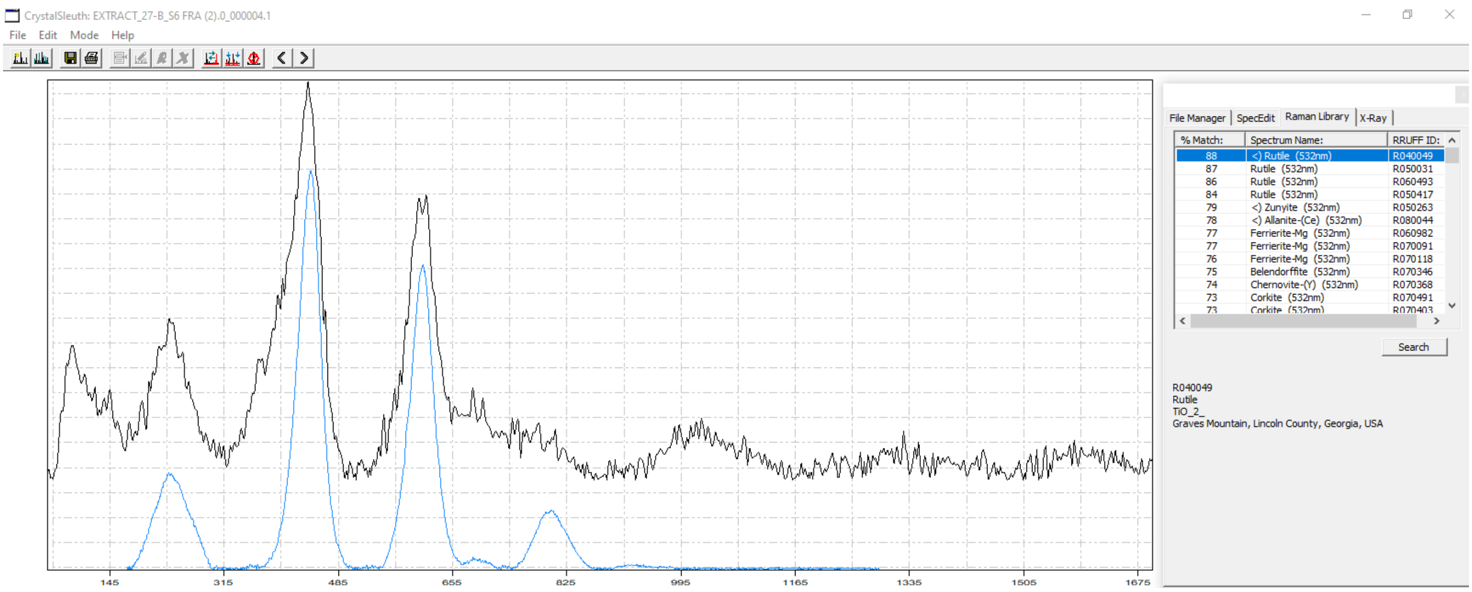
Sample Site 27-B : Stone 6_spectra 2 indicates : Rutile (= Titan Dioxid) (RRUFF database search result)

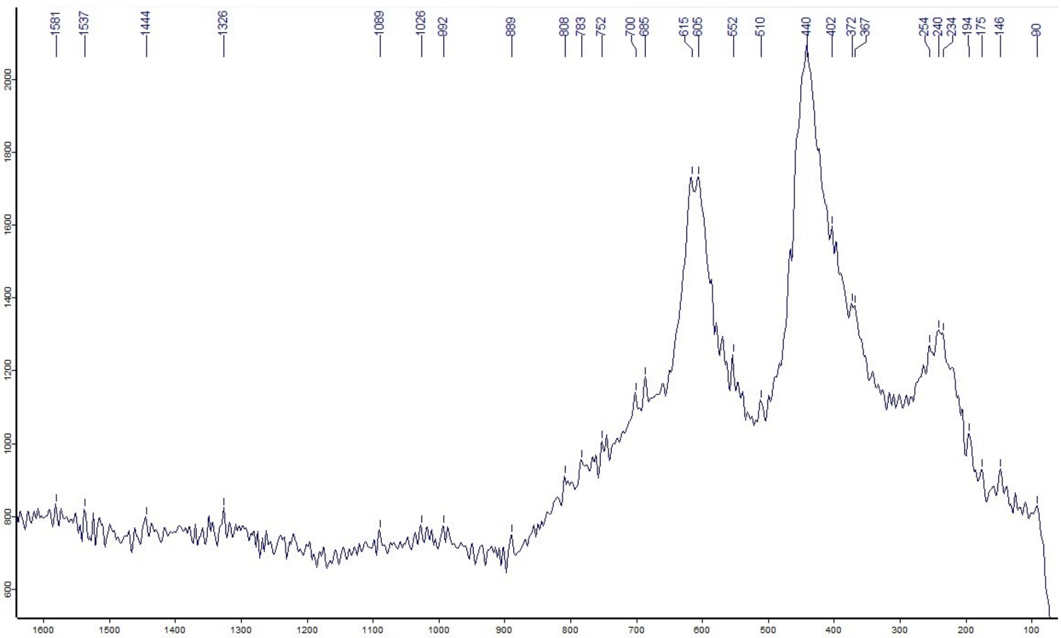


Note : Rutile forms under high-pressure or high-temperature conditions !

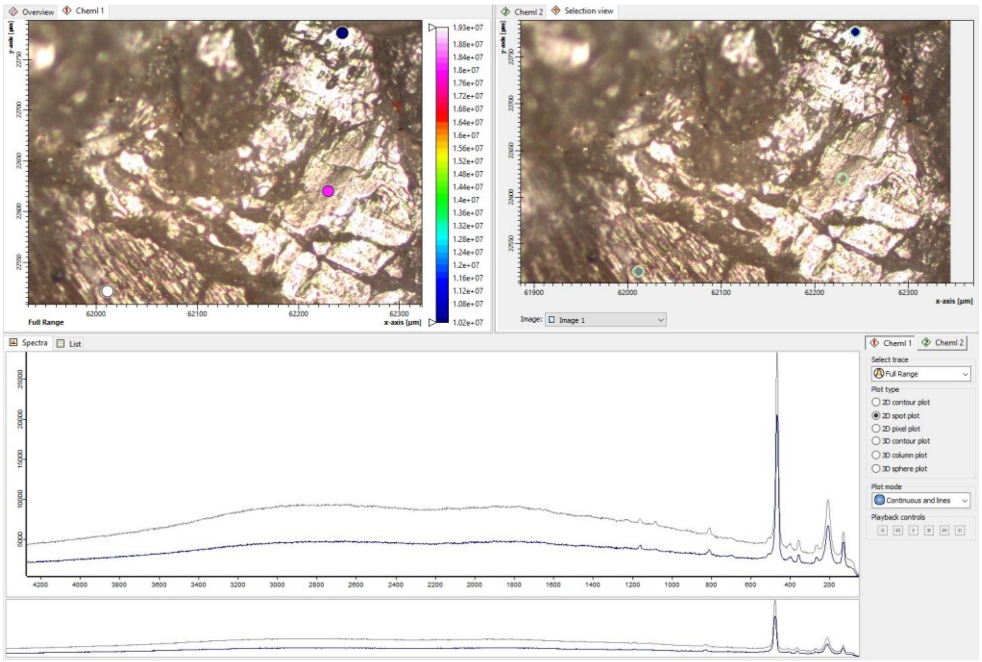
(below 500°C > 10 GPa is needed for its formation out of Anatase , above 600°C it forms under atmospheric Pressure)

Sample :





Sample Site 27-B : Stone 3_spectra 1 indicates : Quartz (→ see RRUFF database search result)



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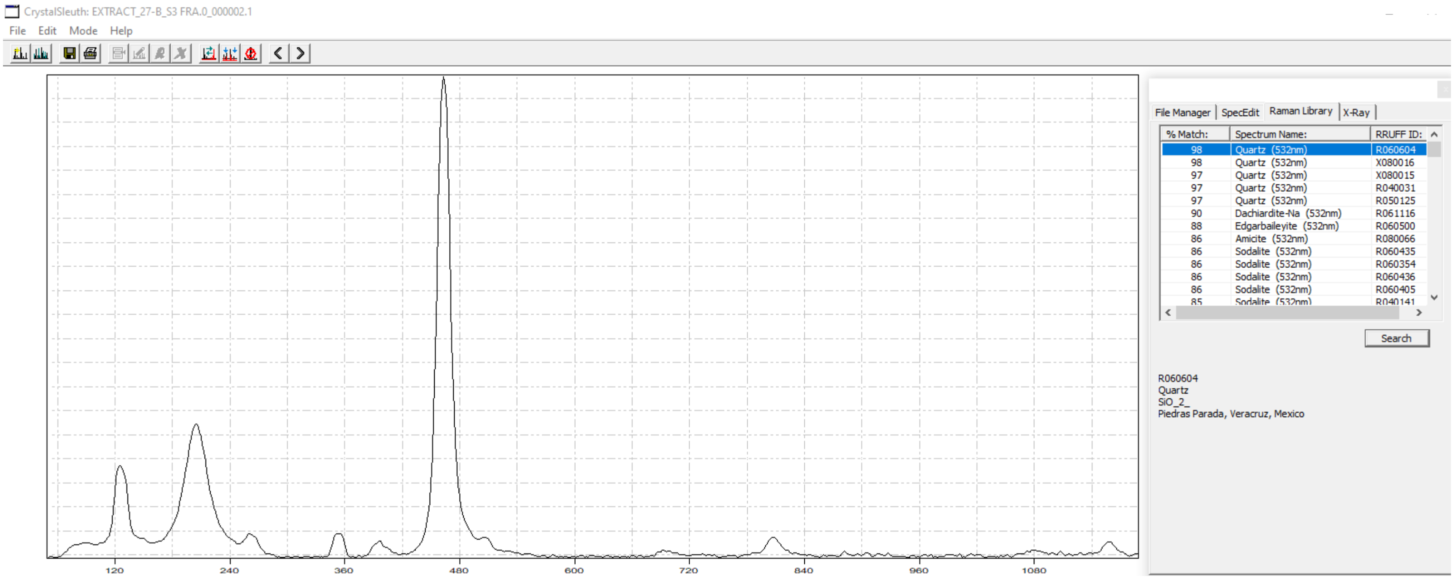
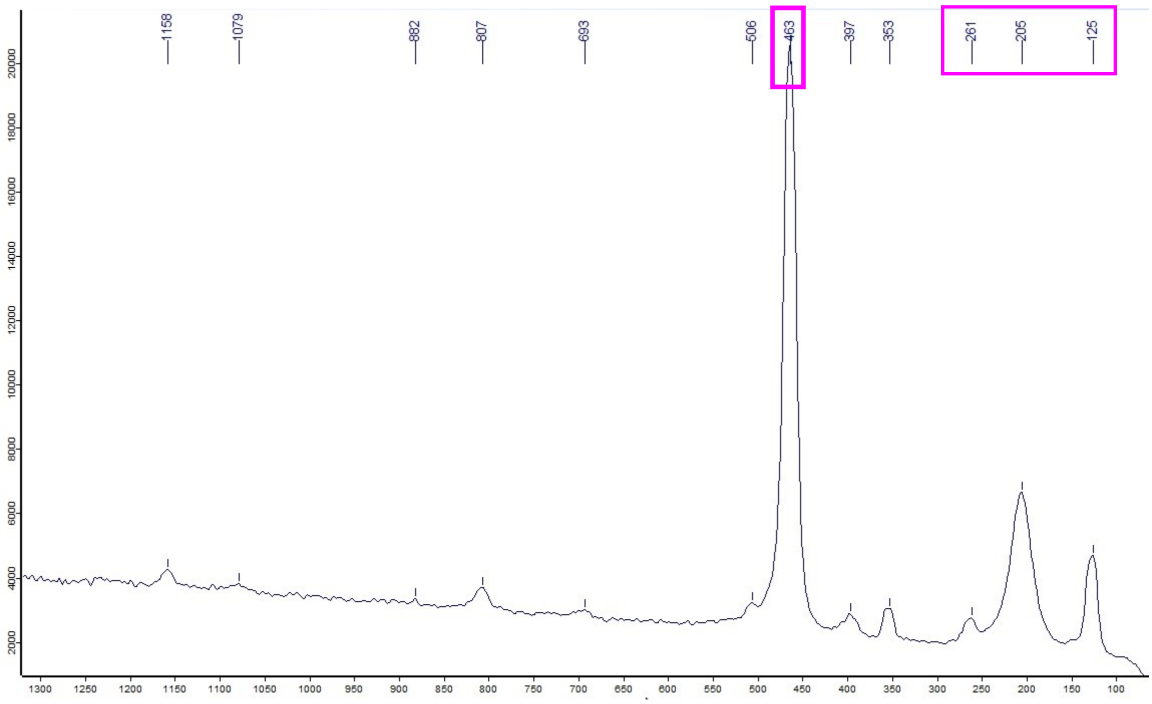
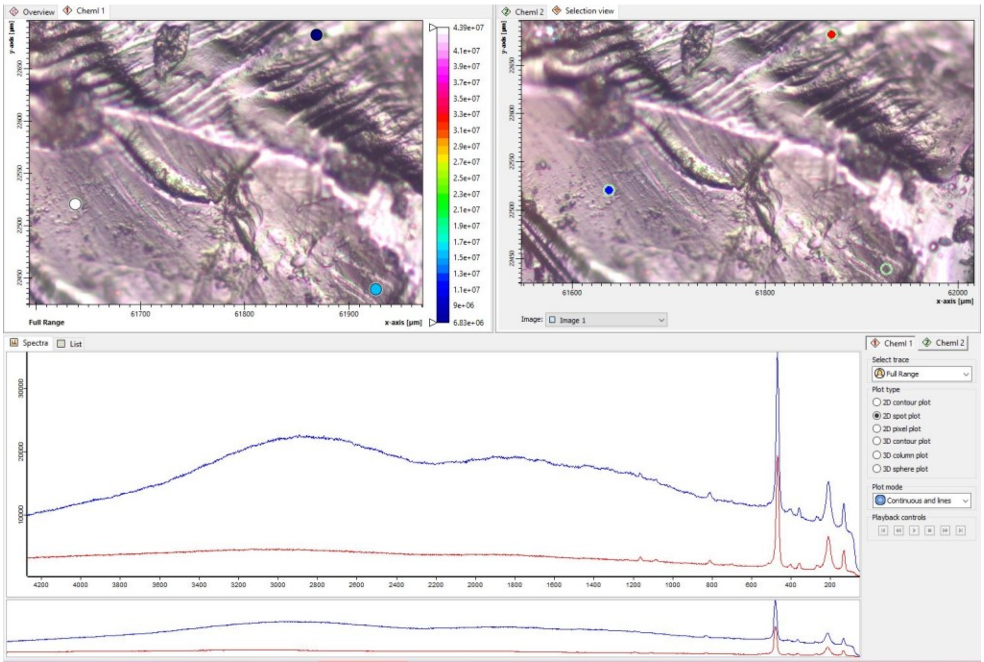


The shift of the main spectral line of the Quartz towards 463 in the sample indicates a shock pressure of around 22 GPa

Further indication for the shock event are the shifts of the marked Quartz spectral lines towards 261, 205 and 125



Sample Site 27-B : Stone 2_spectra 1 indicates : Quartz (→ see RRUFF database search result)



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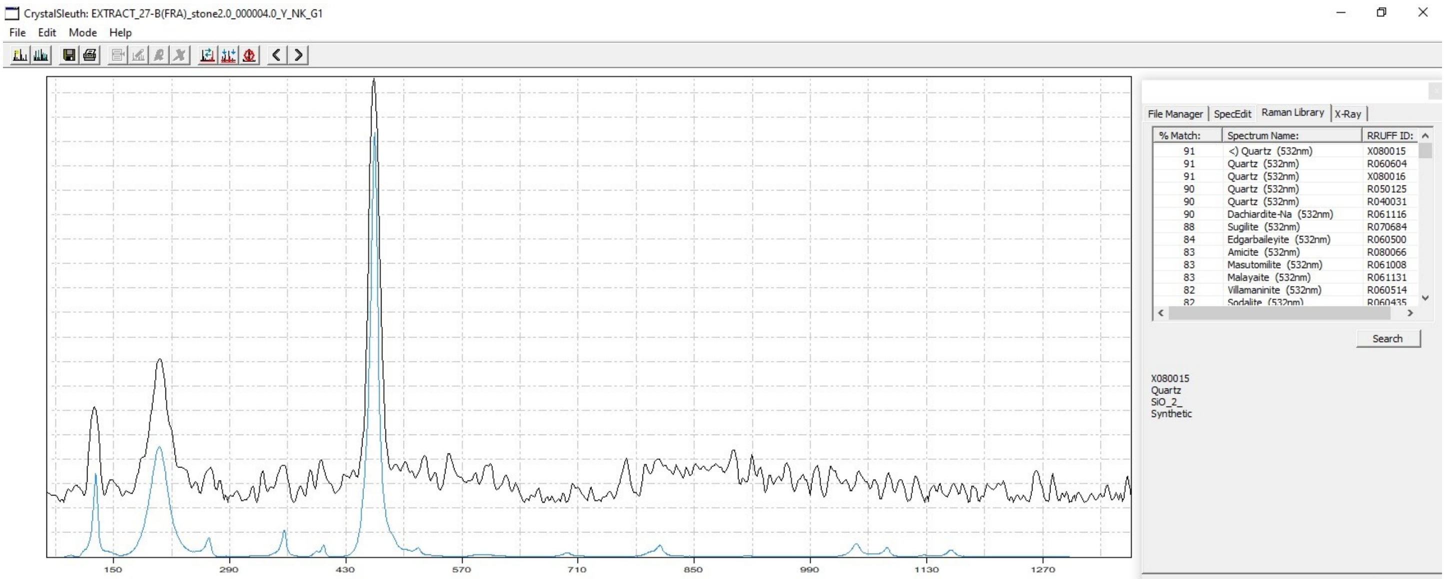
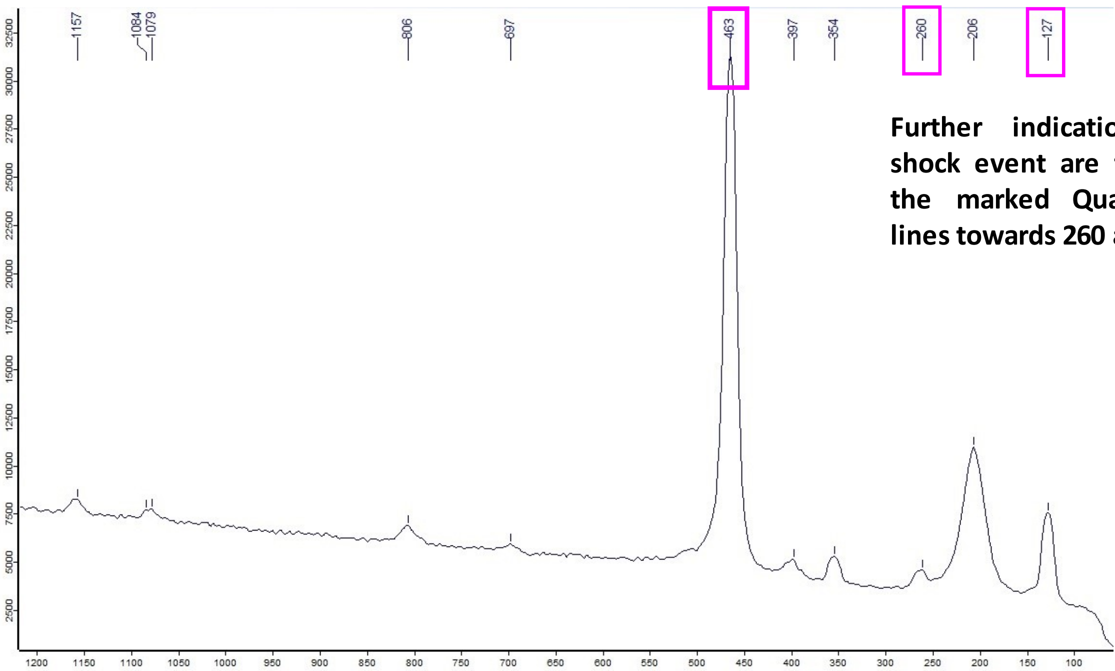


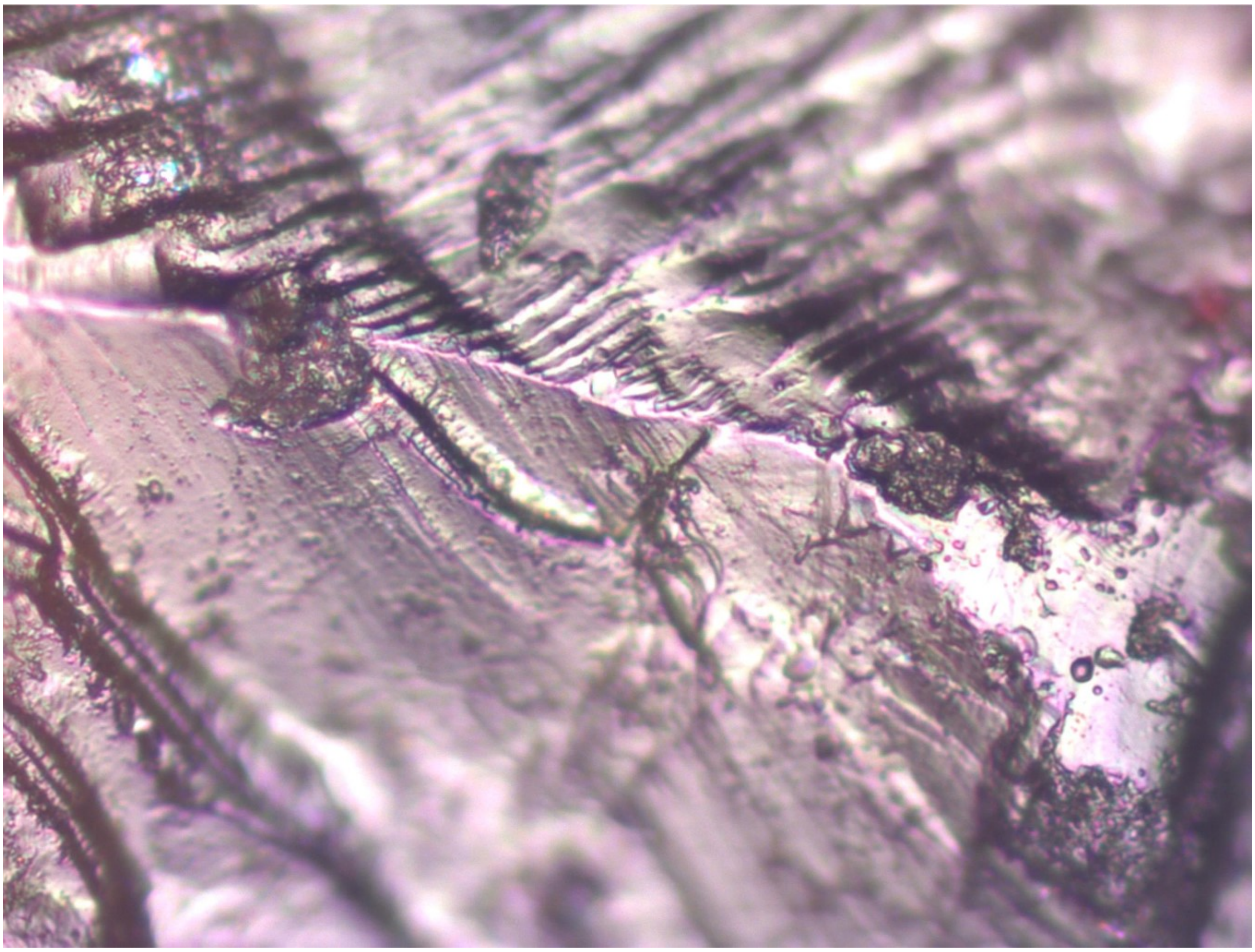
The shift of the main spectral line of the Quartz towards 463 in the sample indicates a shock pressure of around 22 GPa



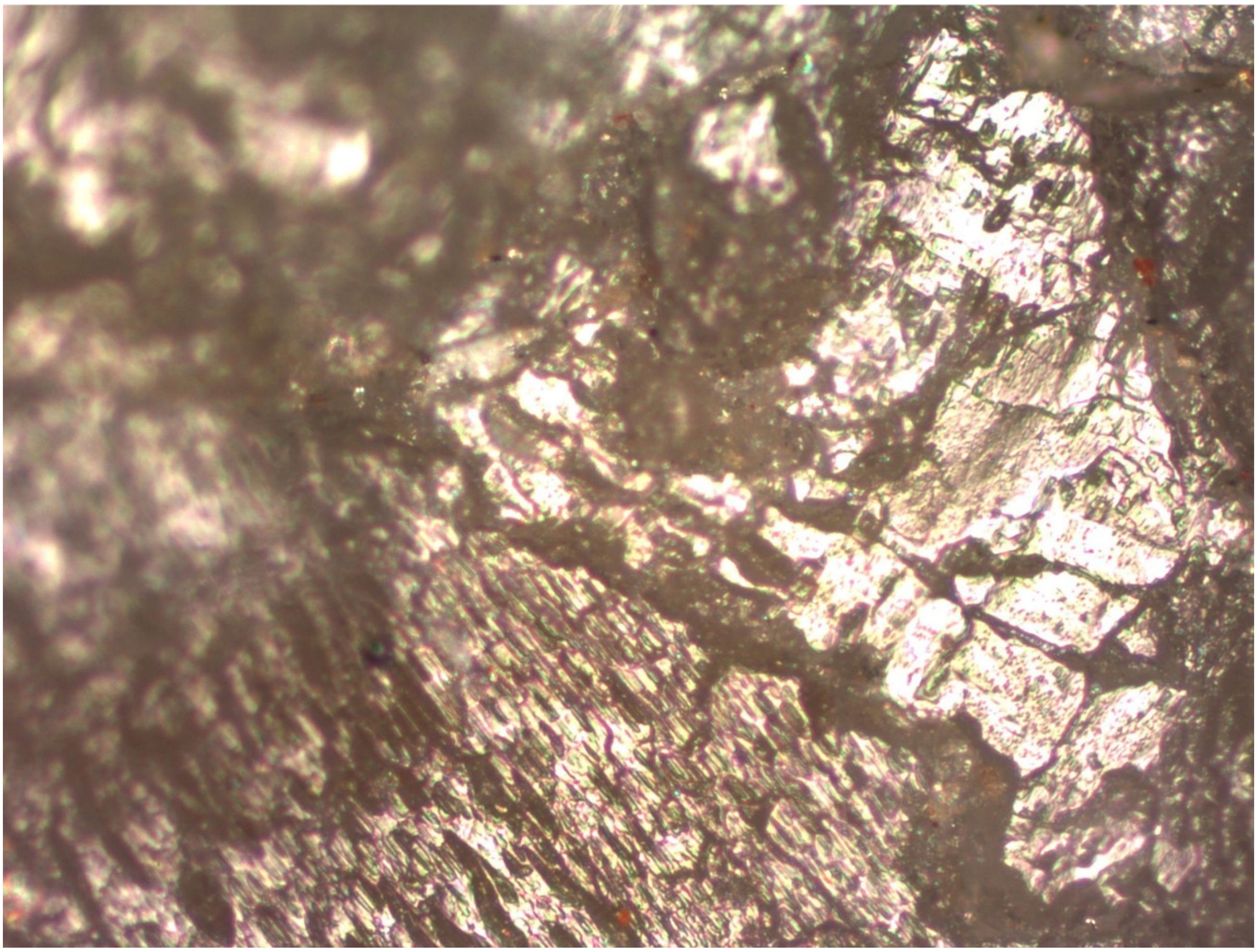
Further indication for the shock event are the shifts of the marked Quartz spectral lines towards 260 and 127

Microscopic Images : Sample from Site 27-B → original state (no preparation for analysis)

Sample Site 27-B : Stone 2_spectra 1 indicates : Quartz - Image size : ~ 400 x 300 µm

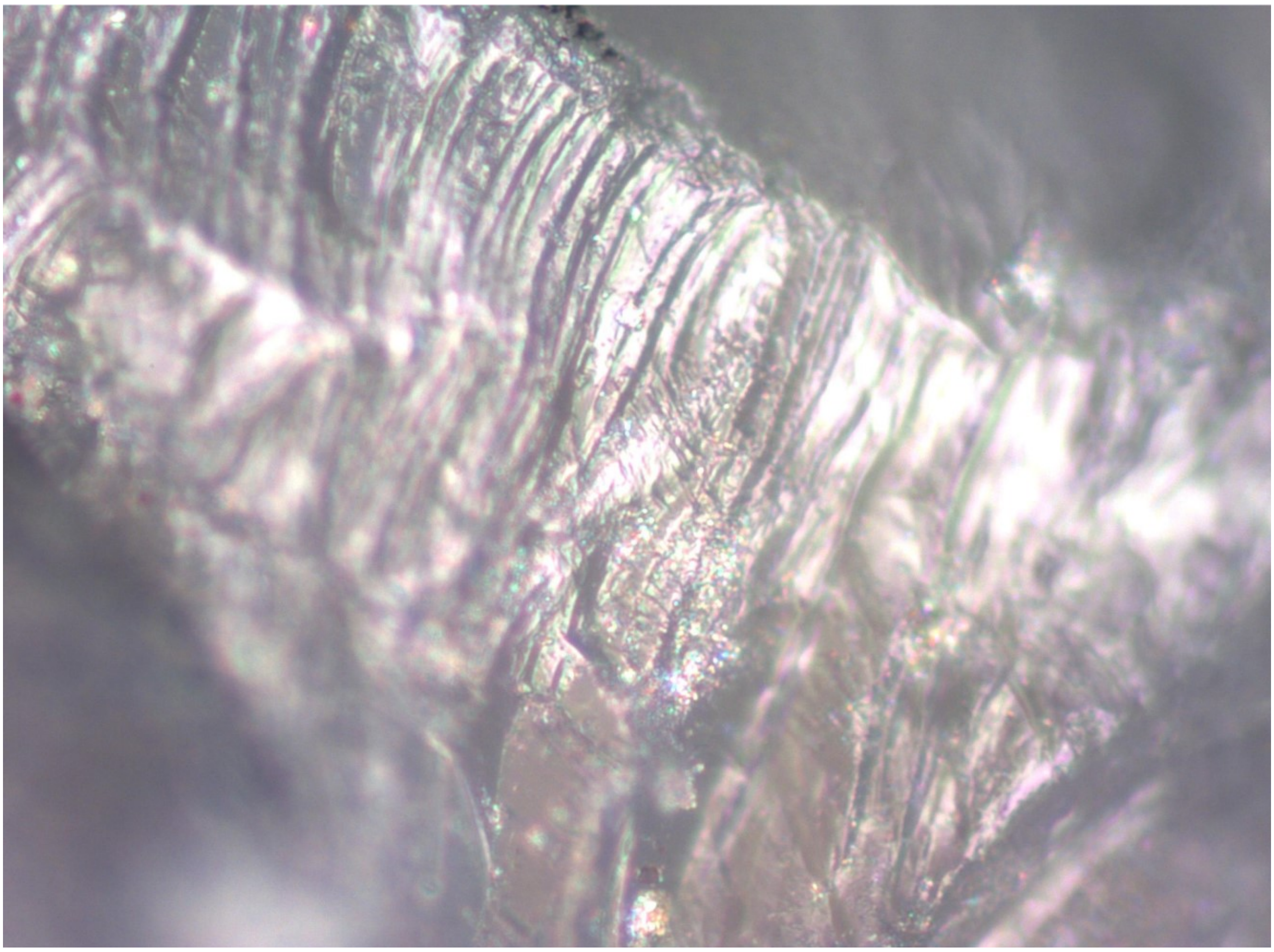


Sample Site 27-B : Stone 3_spectra 1 indicates : Quartz - Image size : ~ 400 x 300 µm



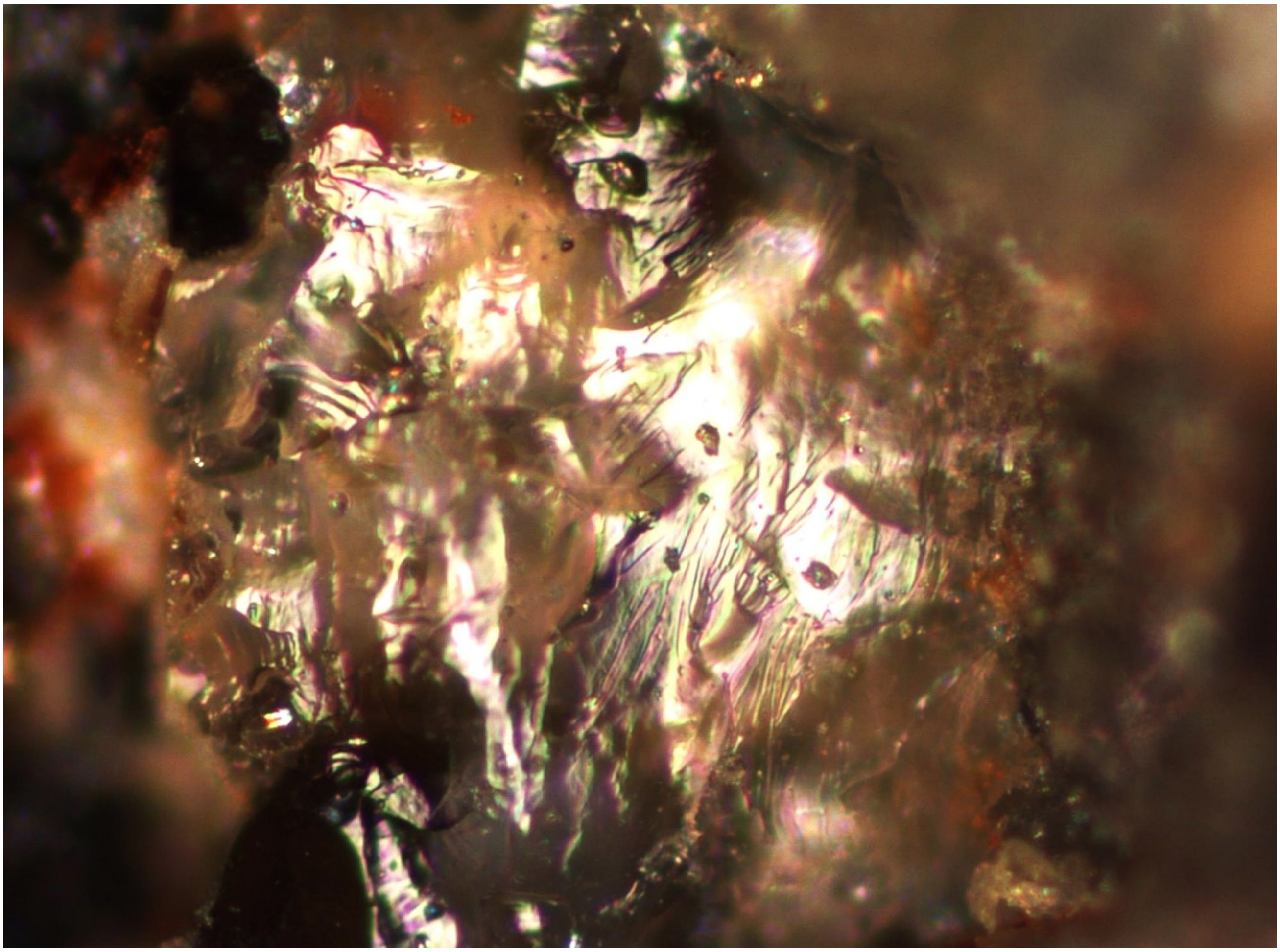
Microscopic Images : Sample from Site 27-B → original state (no preparation for analysis)

Sample Site 27-B : Stone 5_spectra 1 indicates : Quartz - Image size : ~ 400 x 300 µm

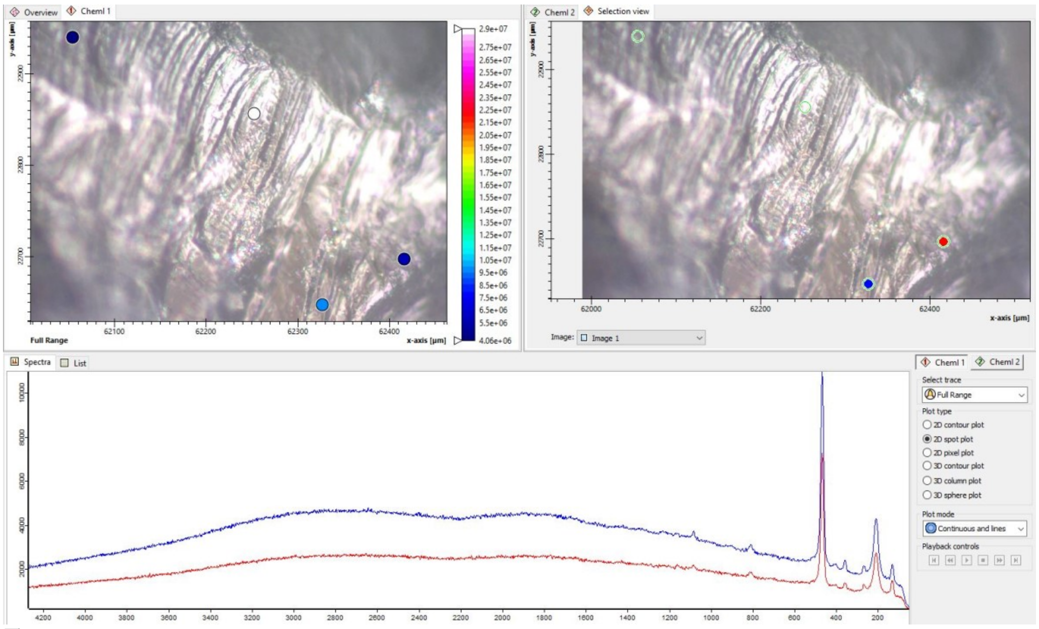


Sample Site 27-B : Stone 6_spectra 2 indicates : Rutile (= Titan Dioxid) - Image size : ~ 100 x 50 µm

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



Sample Site 27-B : Stone 5_spectra 1 indicates : Quartz (RRUFF database)



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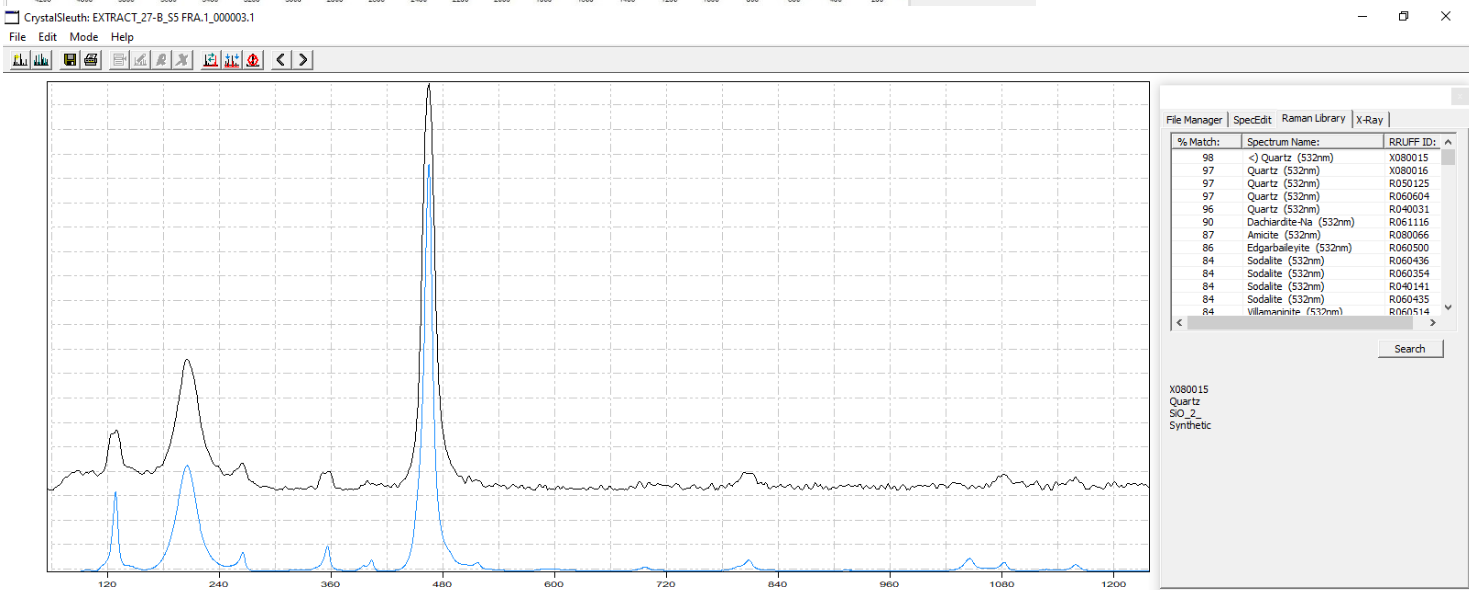
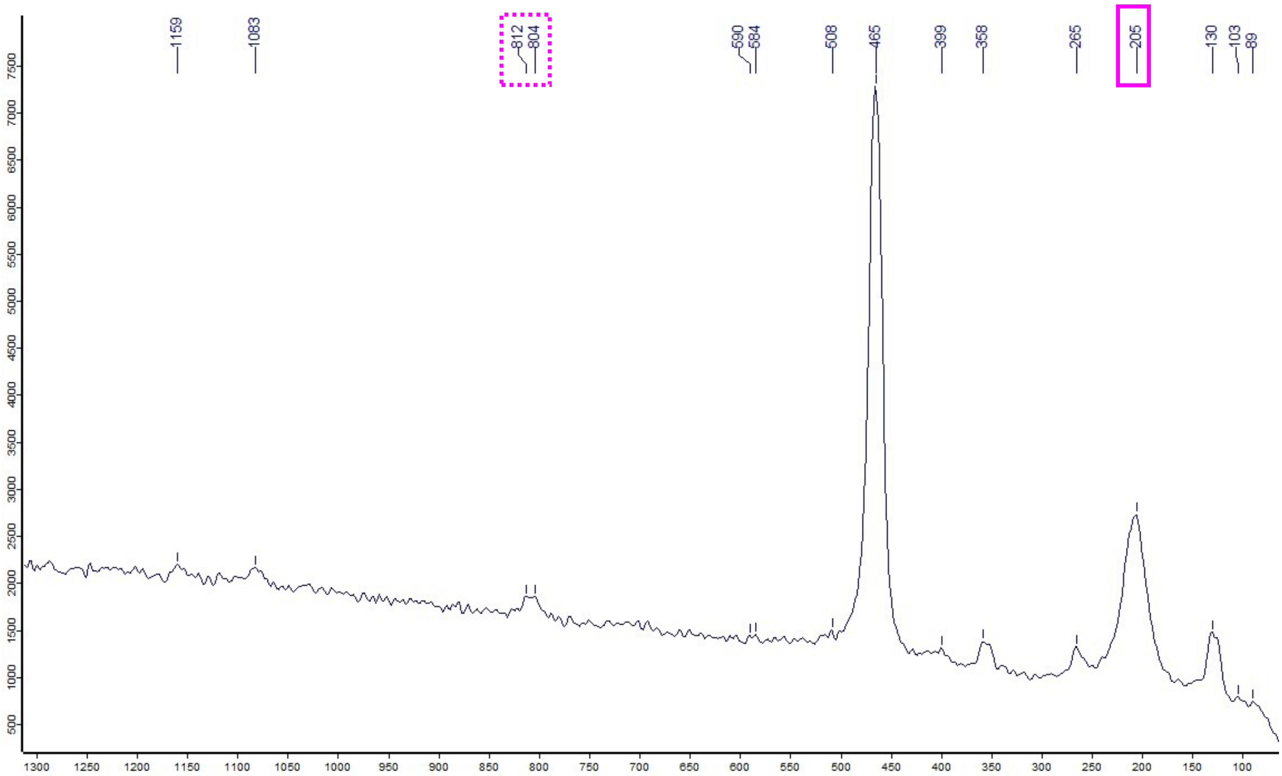
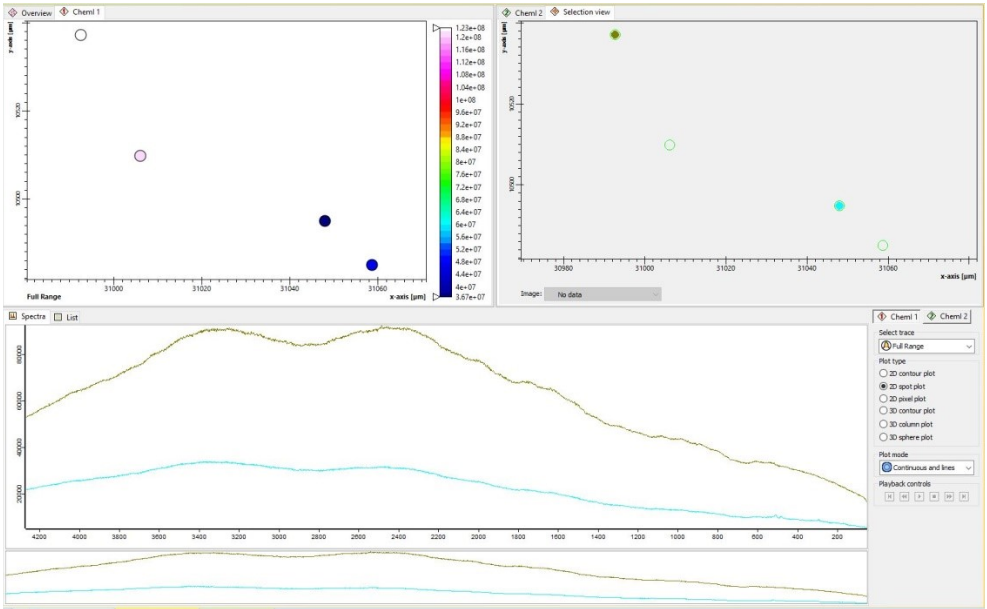


Indication for a shock event is the shift of the marked Quartz spectral line towards 205



Sample Site 27-A : Stone 1_spectra 1 indicates : Labradorite (RRUFF database)



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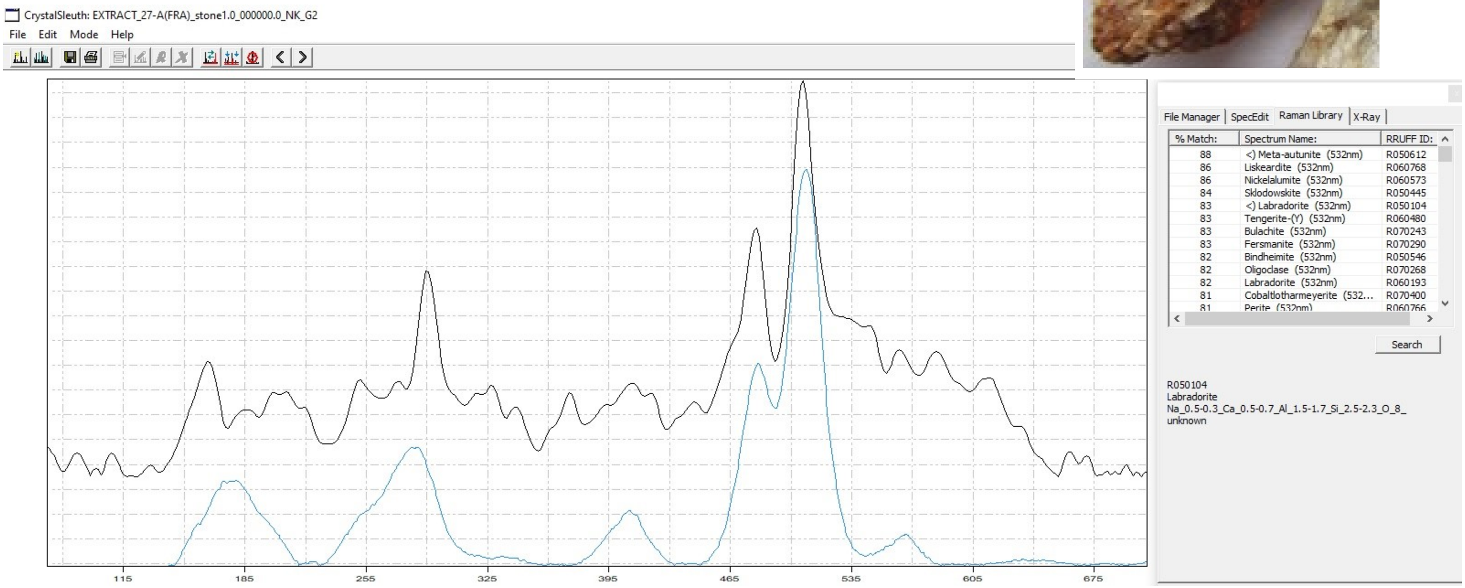
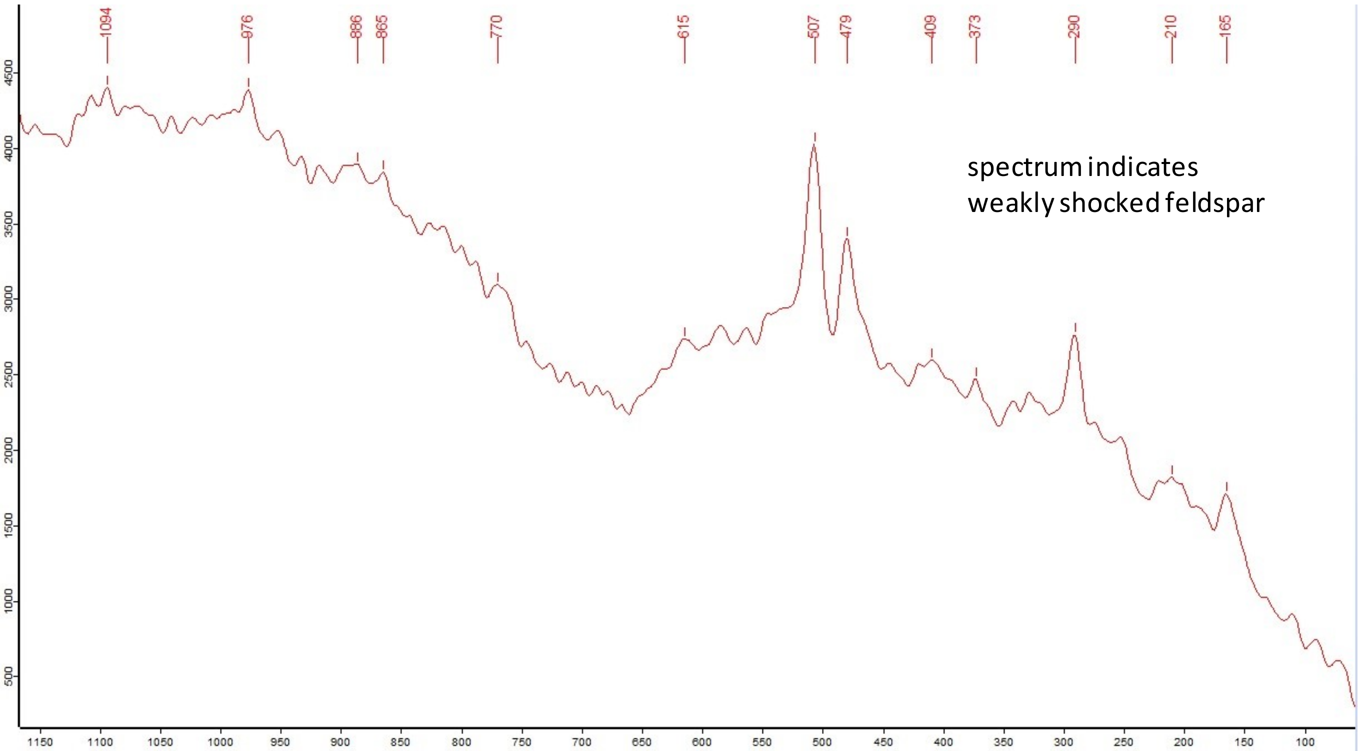
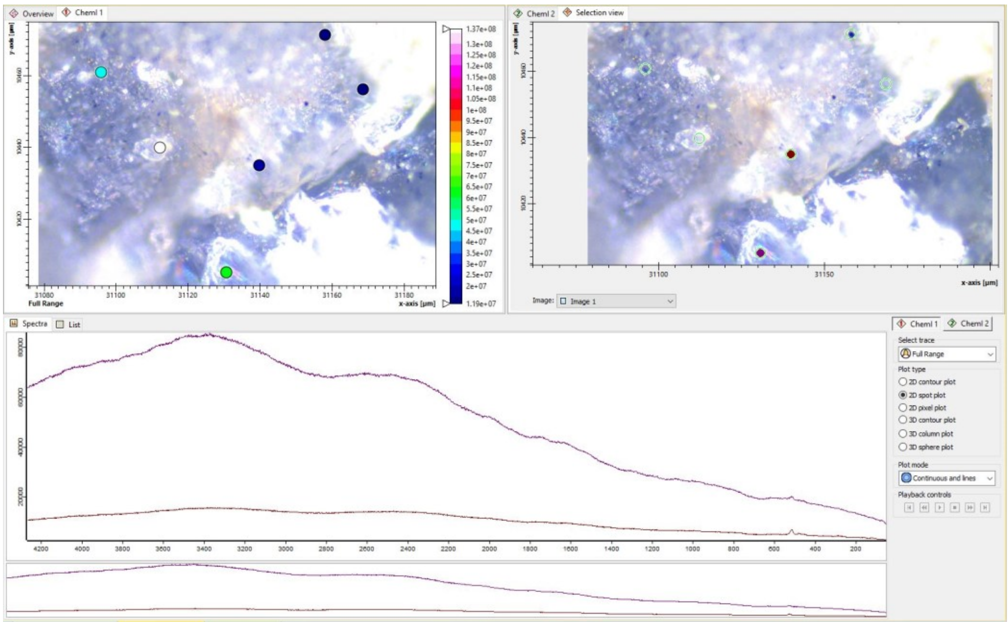




Sample Site 27-A : Stone 2_spectra 1 indicates : Orthoclase (RRUFF database)



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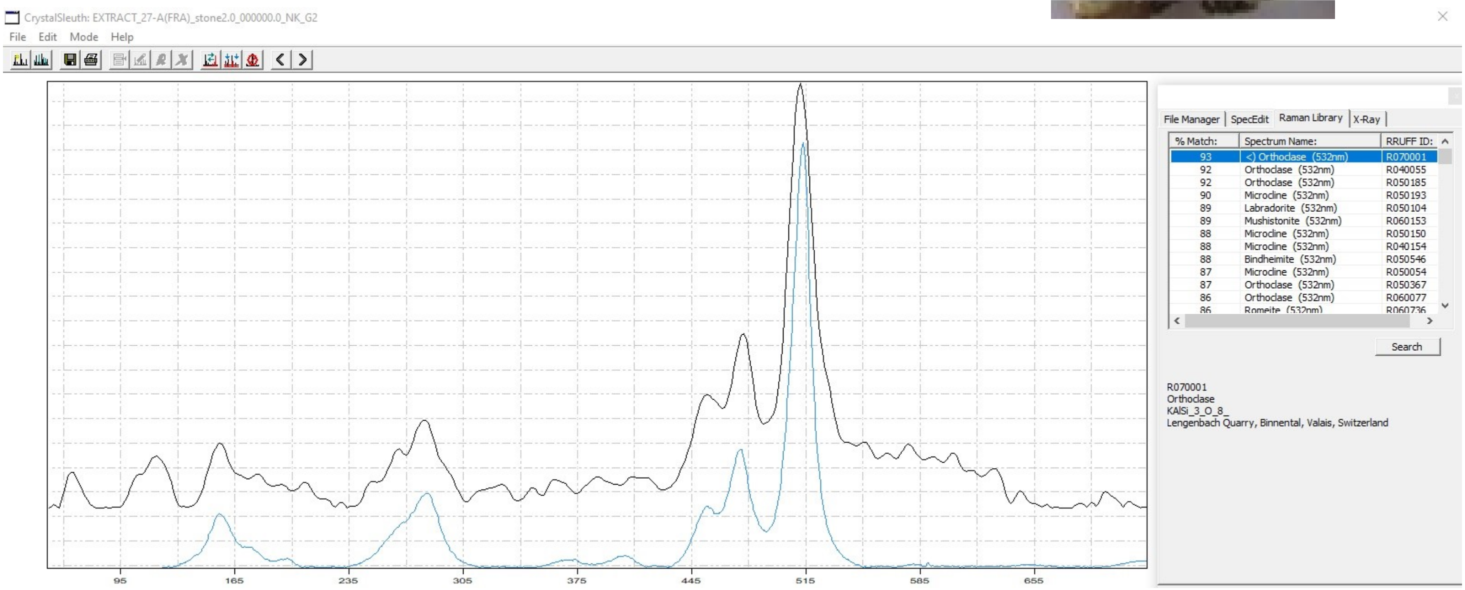
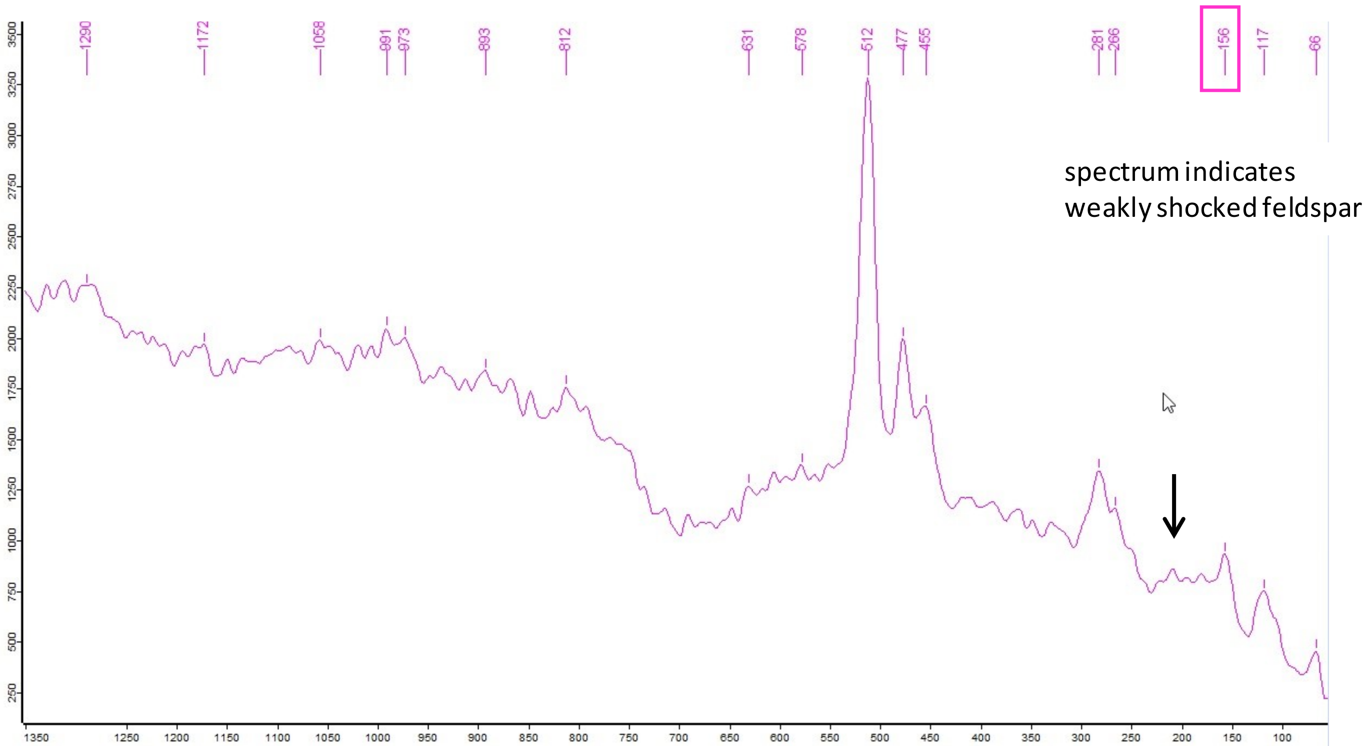
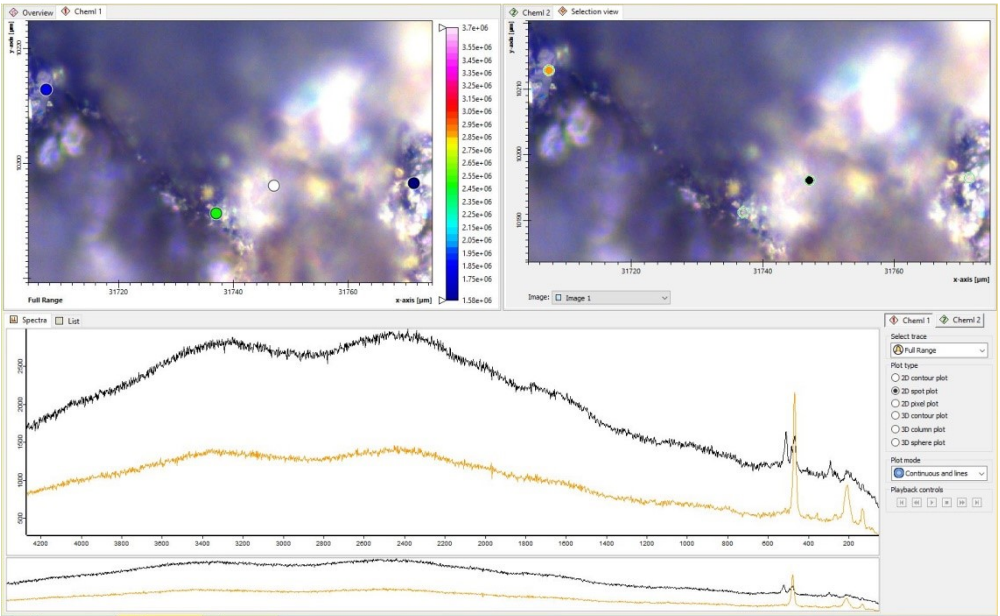




Sample Site 19 : Stone 1_spectra 1 indicates : Sugilite, Dachiardite-Na, Quartz etc. (→ see RRUFF_CS results)

Note : The 464 spectral line indicates Quartz as the most probable mineral



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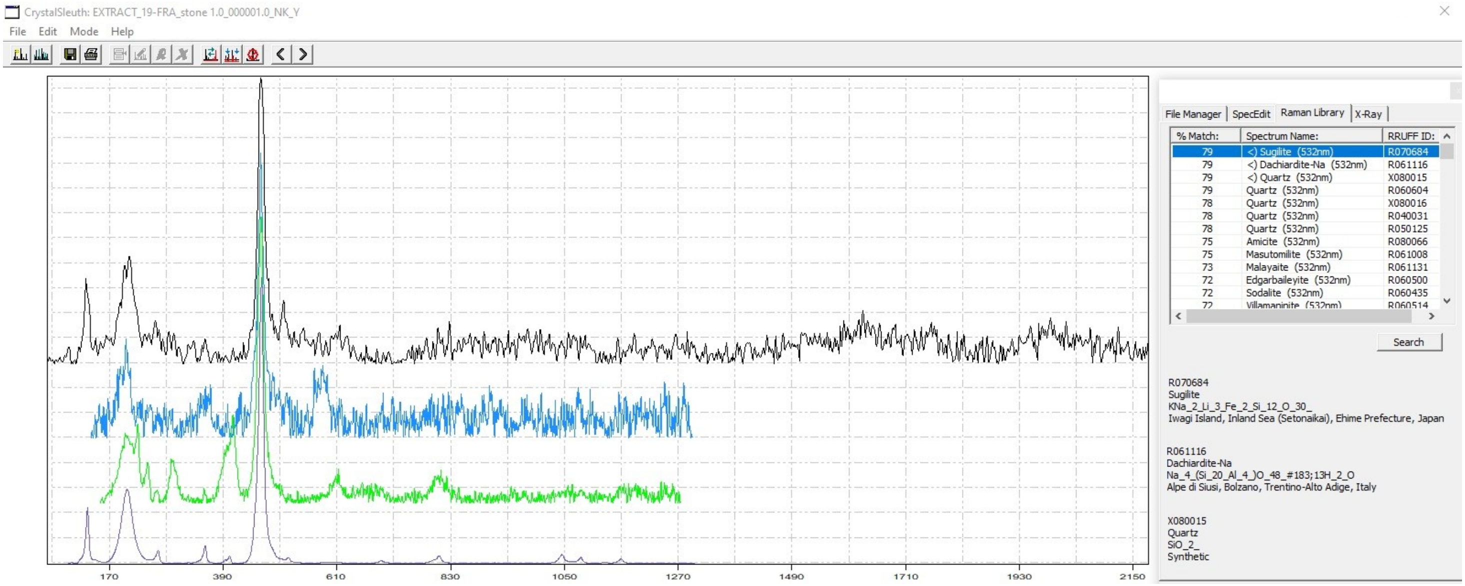
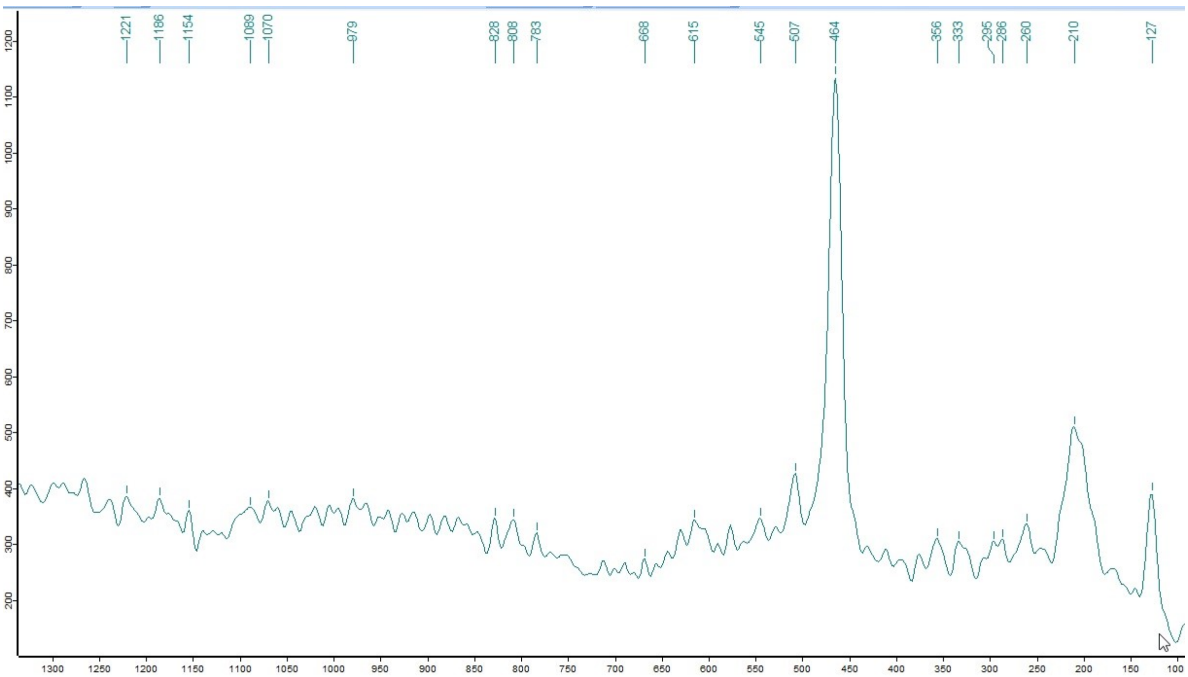
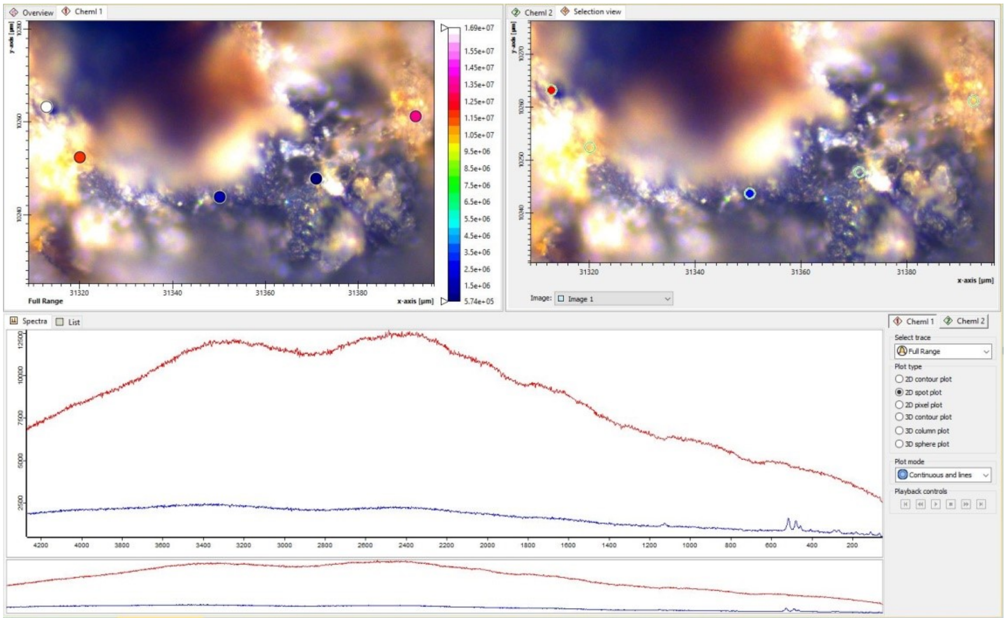




Sample Site 19 : Stone 2_spectra 1 indicates : Microcline, Orthoclase etc. (→ see RRUFF_CS results)



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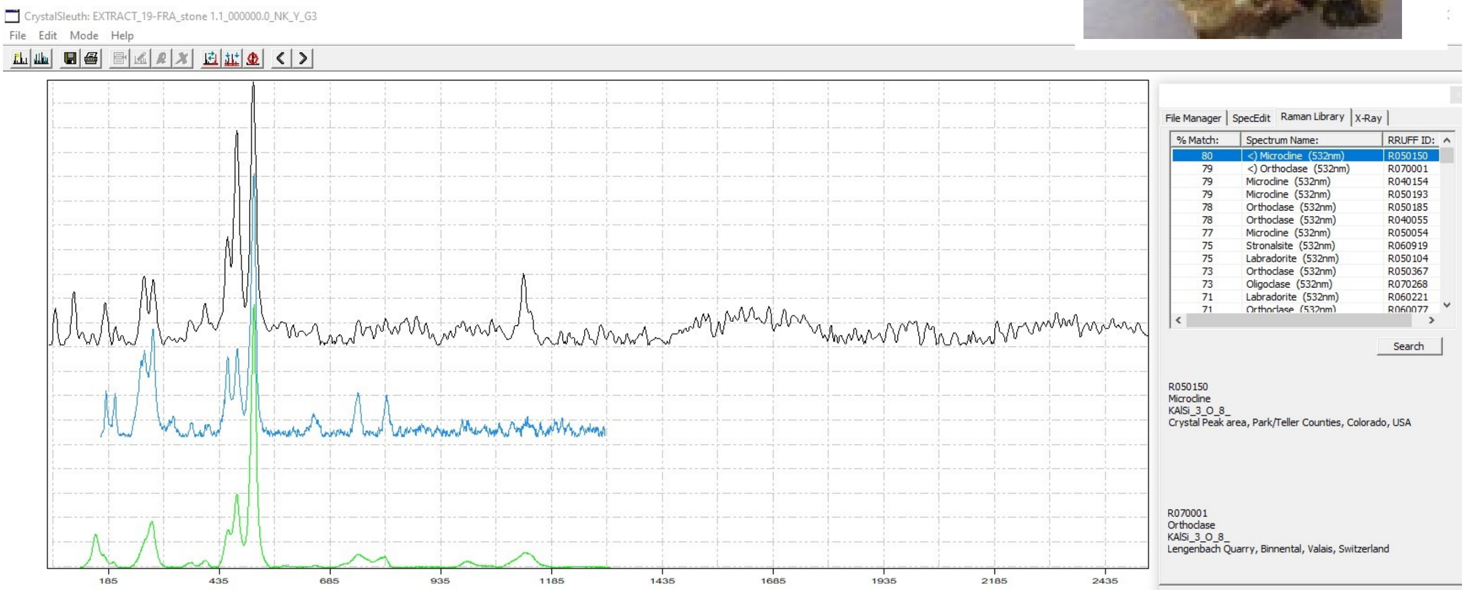
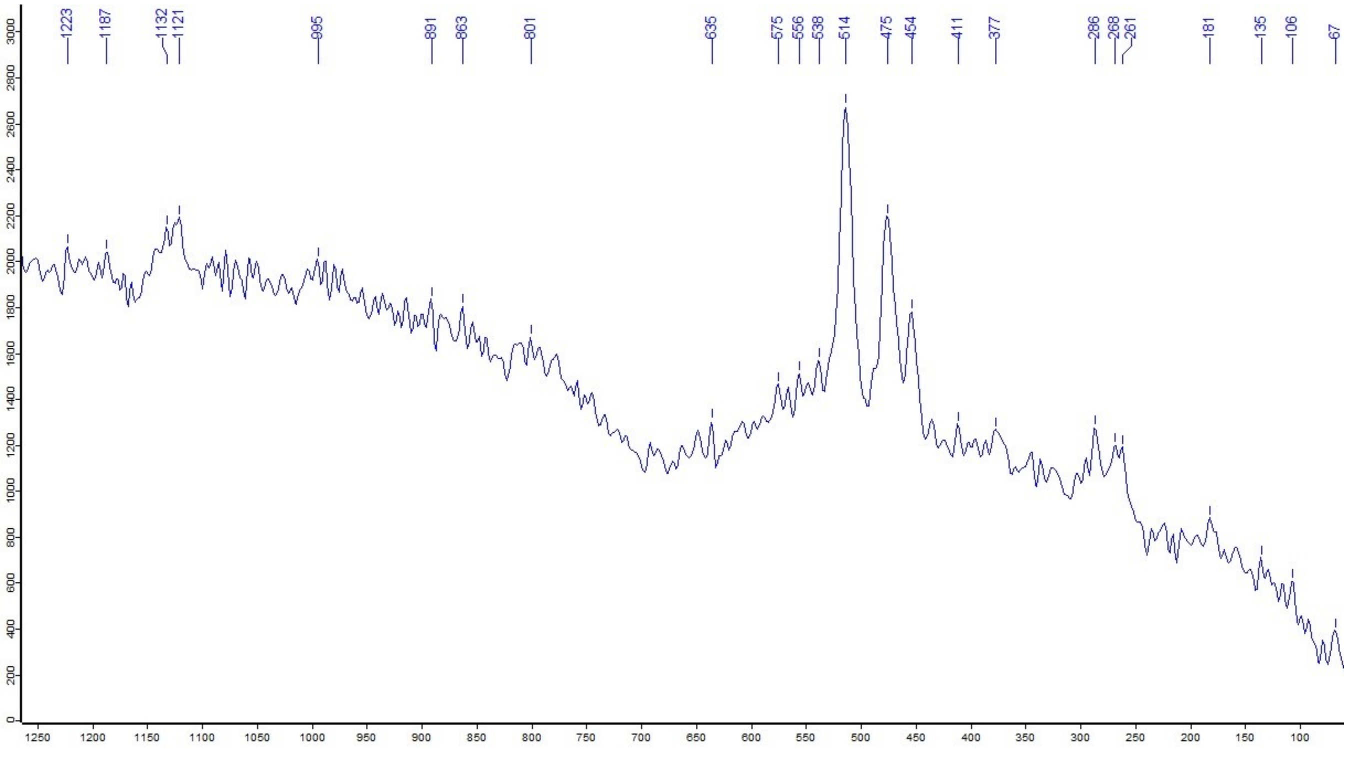
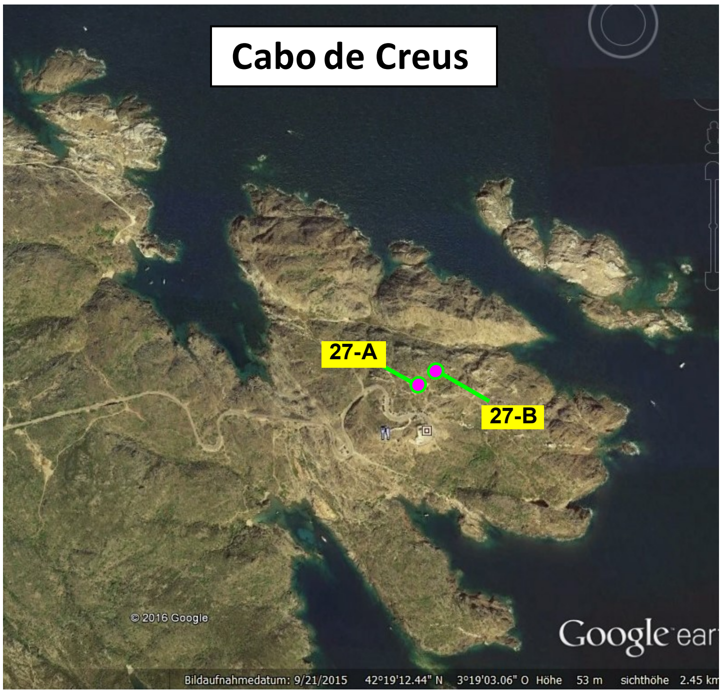




Appendix 1 : Photos of the rock samples from sample sites : 27-B, 27-A and 19

Note : Photos of the Samples Sites 27-B, 27-A and 19 and other sample sites are available on my website. → weblink : Sample Sites "Bay of Lyon Crater"



"Cabo de Creus" near sample site 27-B

Photos of the Samples Sites (alternative weblinks)
27-B, 27-A and other sites on :
Sample Sites "Bay of Lyon Crater"

27-B


27-B
27-B 42° 19,276 N 3° 19,028 E 5 m France - (South-West Area)


27-B
19,276 N 3° 19,028 E 5 m France - (South-West Area)

27-A


27-A 42° 19,274 N 3° 19,035 E 5 m France - (South-West Area)

19


19 42° 15,089 N 3° 11,212 E 10 m France - (South-West Area)

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

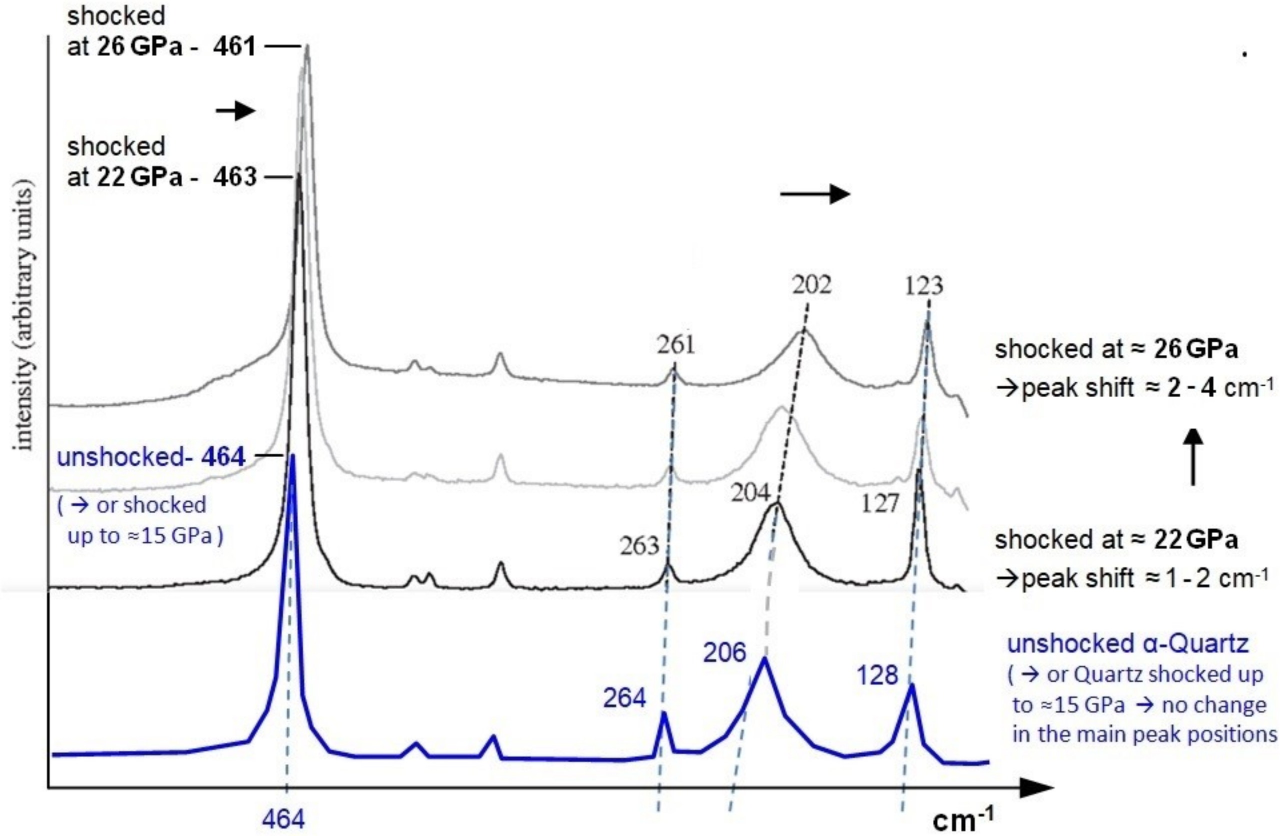
In order to verify a sample site as an impact site or impact structure, shock-metamorphic effects must be discovered in the rocks of the sample site. This can be done by different methods.

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.

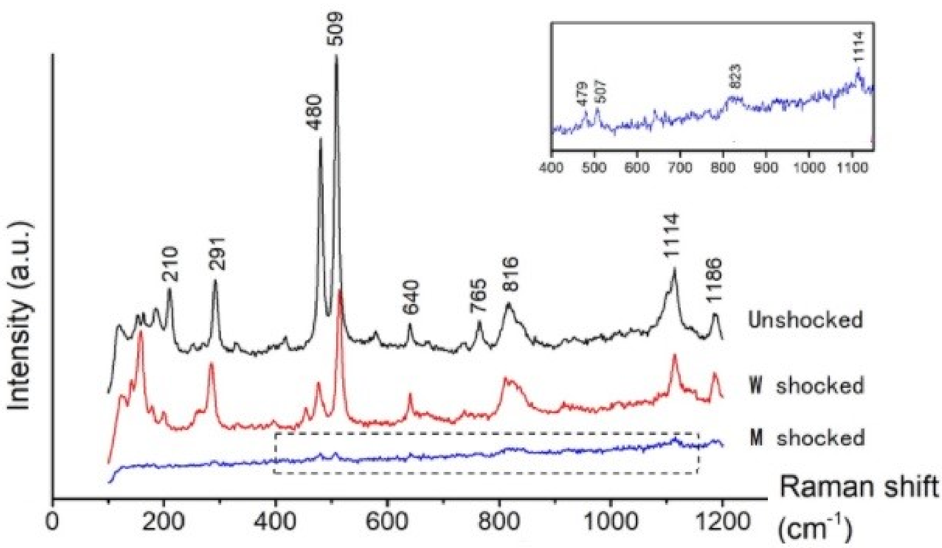
Mc Millan et al. (1992) and others have shown that the main RAMAN-peaks of Quartz shift towards lower frequencies if the Quartz was exposed the a shock-pressure > 15 GPa. → see diagram below

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 "Bay of Lyon Crater" (or: "Bay of Lyon Crater"**)**

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
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A Raman spectroscopic study of shocked single crystalline quartz - by P. McMillan, G. Wolf, Phillipe Lambert, 1992
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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
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A Raman spectroscopic study of a fulgurite – by E. A. Carter, M.D. Hargreaves, ...
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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-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
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Shock Effects in feldspar : an overview - by A. E. Pickersgill
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