The Ø 320 km Cape York Impact Crater (NE-Australia)

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

Summary :

Raman spectra of quartz from the sample sites **46, 49, 50** & **60** provide evidence that the large **Ø 320 km** circular structure visible on gravity anomaly maps, just off the coast of the Cape York Peninsula in the North-East of Australia (Queensland), was caused by an impact event !

The yet unknown **Ø 320 km** Cape York Crater (CYC) belongs to a large Secondary Impact Crater Chain, which was caused by impacting ejecta material that was ejected by the Ø1270 x 950 km Permian Triassic Impact Crater (PTI), located in the Arctic Sea near Alaska, according to my hypothesis. see my : **Study** (→ weblink to my Permian Triassic Impact Hypothesis : → **Part 1** (**P1**) and **Part 2** (**P2**) of my hypothesis)

This Secondary Impact Crater Chain of the PT-Impact Event formed the North-East Coast of Australia. It was caused by at least three to four large Secondary Impact Craters resulting from the PT-Impact.

The Raman spectra of quartz from sample site **46** provides the clearest evidence for an impact event ! Sample Site **46** is the closest sample site in relation to the Ø 320 km Cape York Crater that I could reach. It is located approximately 75 km away from the crater-rim of the Cape York Crater (see map below).

The shift of the main Raman bands (peaks) to the lower frequencies **463, 261, 203** and **126 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 ≥22 GPa**. (see explanation & references in the Appendix at **page 30/31**)

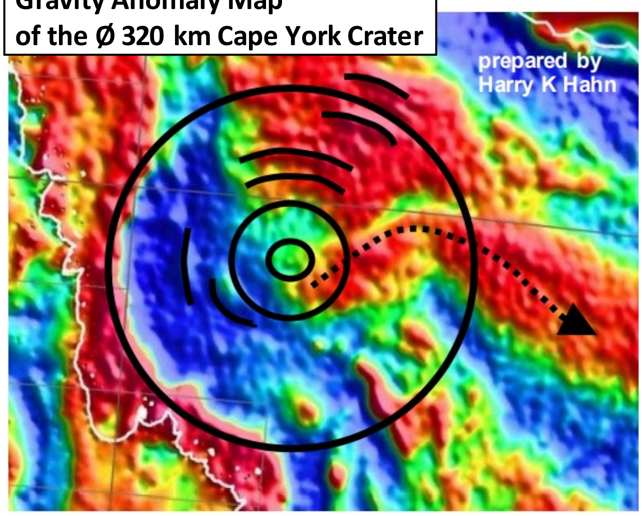
The spectra of the quartz from sample site **50** also provides evidence for the large-scale impact event. It shows similar shifts of the Raman bands of the quartz to the lower frequencies **263, 204/205** and **127 cm^{-1}**, which indicates a shock pressure of **≈ 20 - 22 GPa** which is the result of an impact event !

From quartz samples of sample sites **49** (Black Mountains) and **60** (both ≈ 180 km from the crater rim) further indication is provided for a large-scale secondary impact event. However the evidence provided by the Raman spectra is weaker than from the samples from site 46 and 50. Here the shifts of the Raman bands (peaks) to **263** and **204/205** provide indication for a shock pressure of around **20 GPa.**
All spectra were made with a **BRUKER Senterra-II Raman Microscope** (wavenumber precision <0.1 cm^{-1})

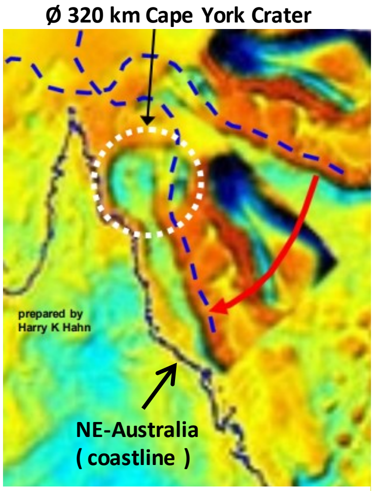
A shock pressure of 22 GPa far exceeds every pressure caused by normal terrestrial metamorphism. Therefore the quartz from the sample sites 46 and 50 was clearly shocked by an impact event. The indicated shock pressure of 22 GPa is lower than the shock pressure that occured at other large impact craters 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 27**.
→ 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

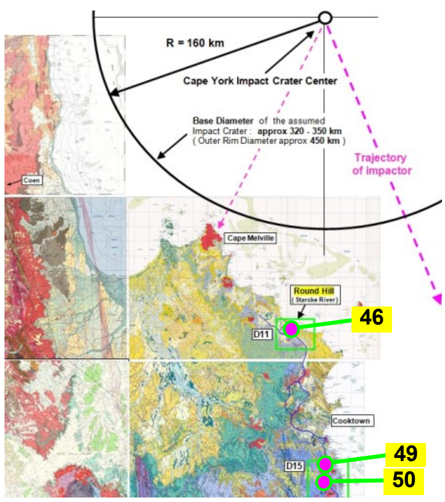
Gravity Anomaly Map of the Ø 320 km Cape York Crater



Ø 320 km Cape York Crater



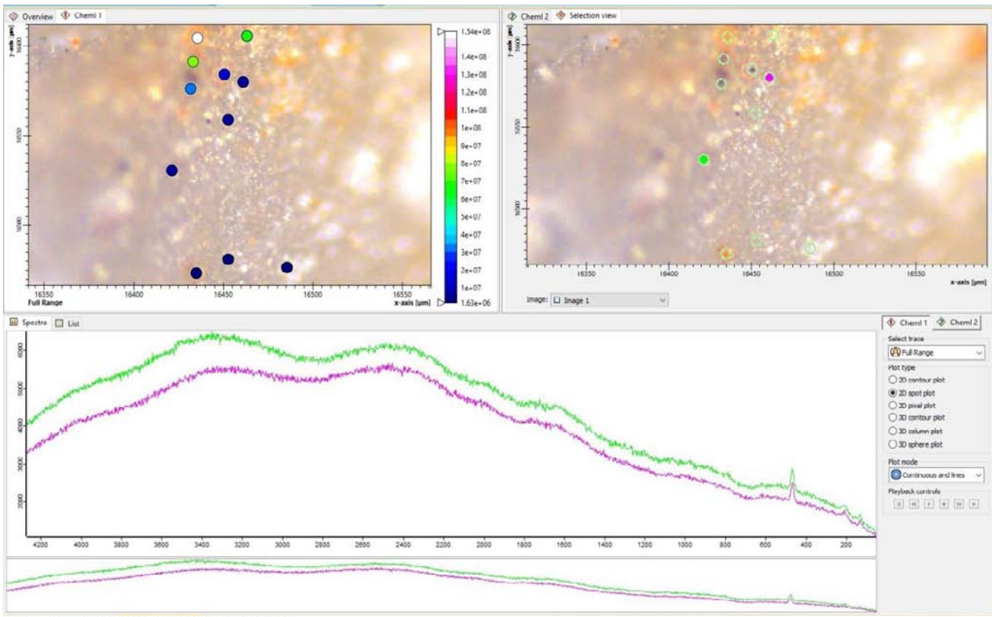
Manipulated Gravity Anomaly Map



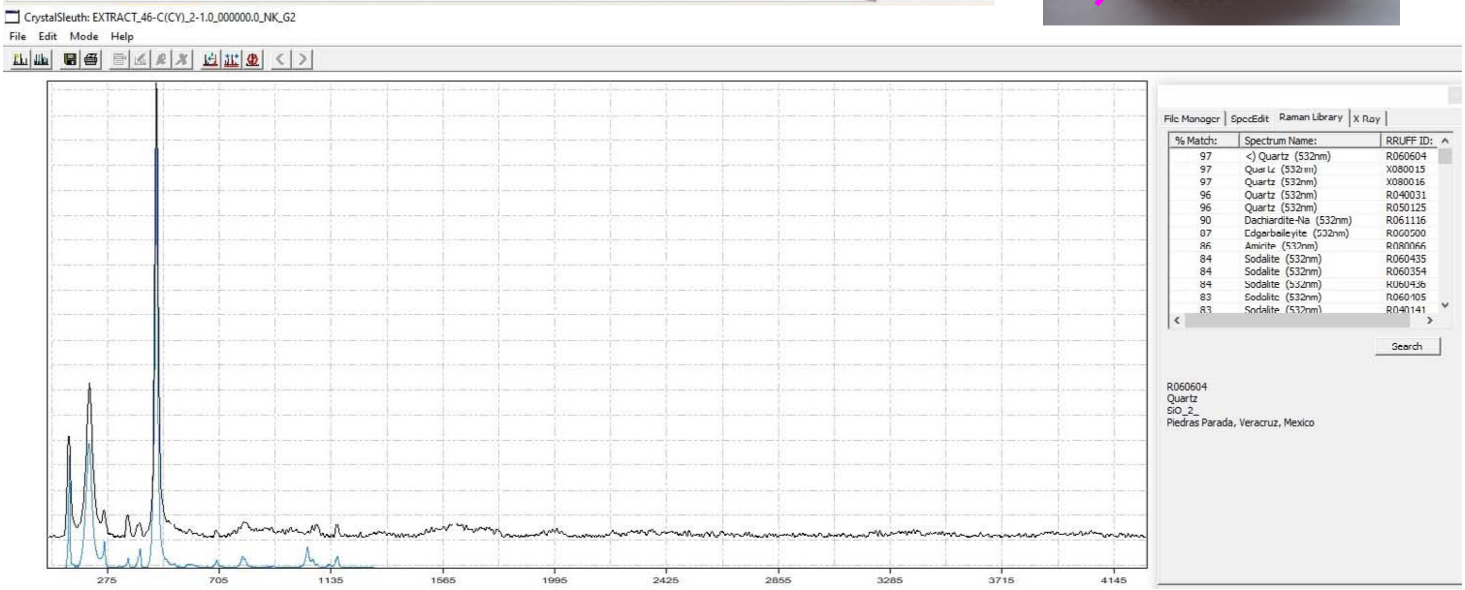
Geological Map - with sample site positions

Sample Site 46-C (2.Trip) : Stone 2_spectra 1 (white mineral)

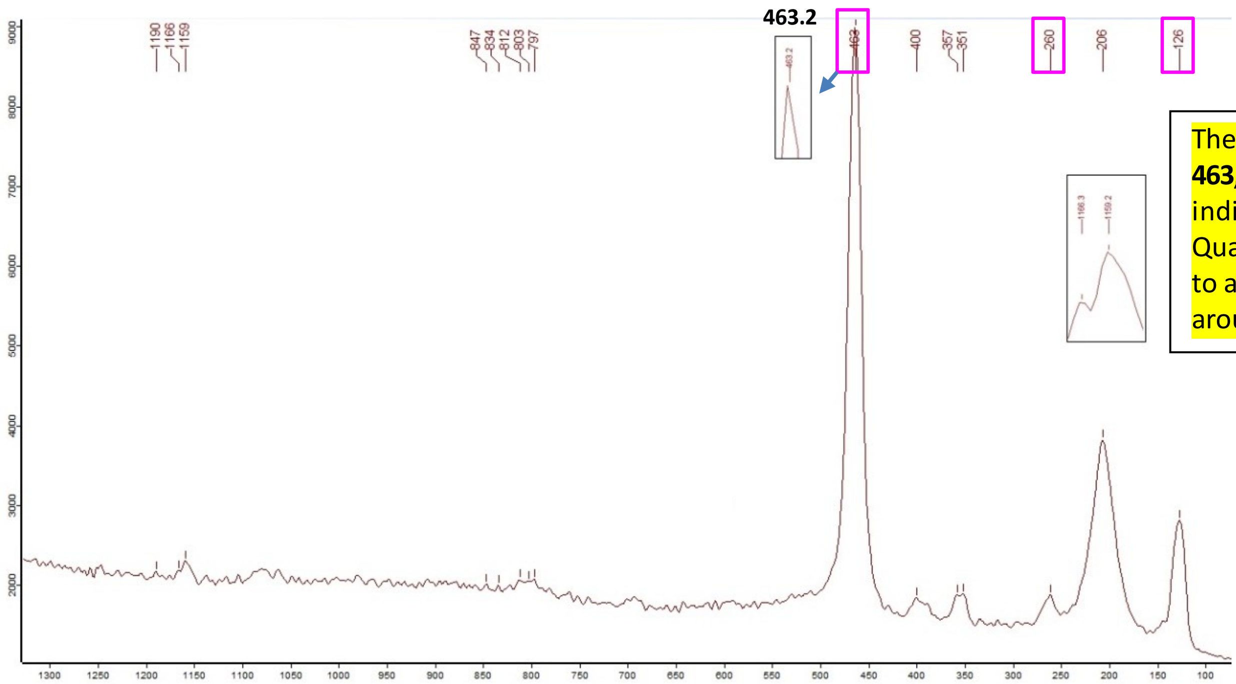
Search in the RRUFF Database indicates : Quartz



Sample :



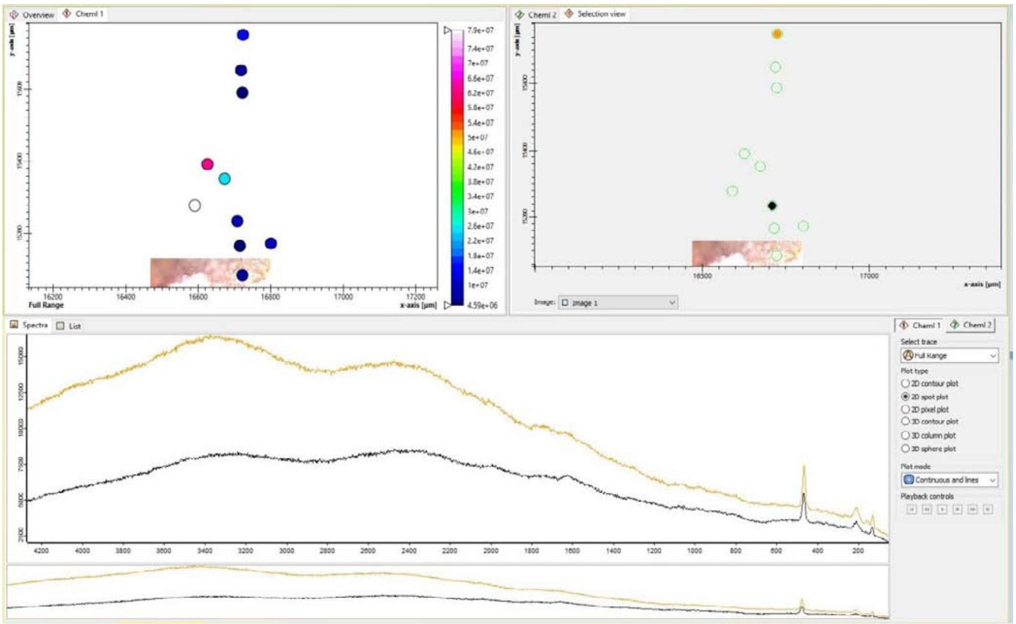
Indication for a shock event are the shifts of the marked Quartz spectral lines towards 463, 260 and 126



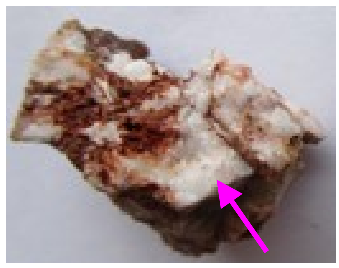
The spectral lines **463, 260** and **126** indicate that the Quartz was exposed to a shock pressure of around **22 GPa**

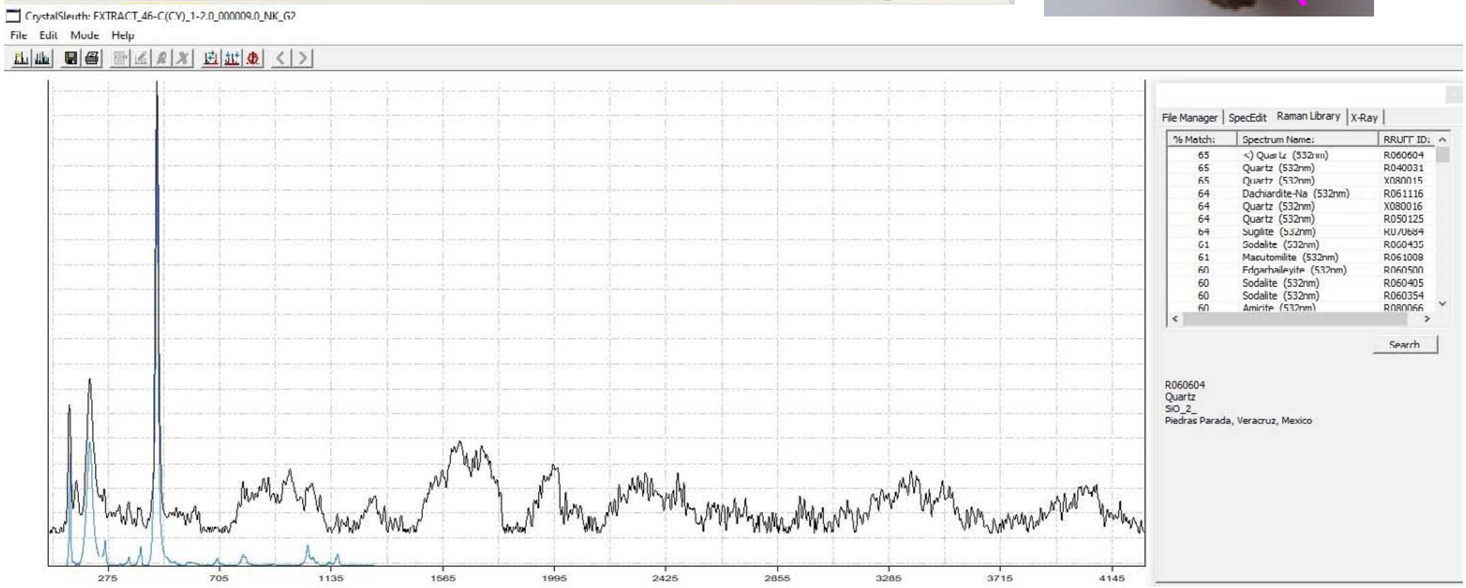
Sample Site 46-C (2.Trip) : Stone 1_spectra 3 (white mineral)

Search in the RRUFF Database indicates : Quartz

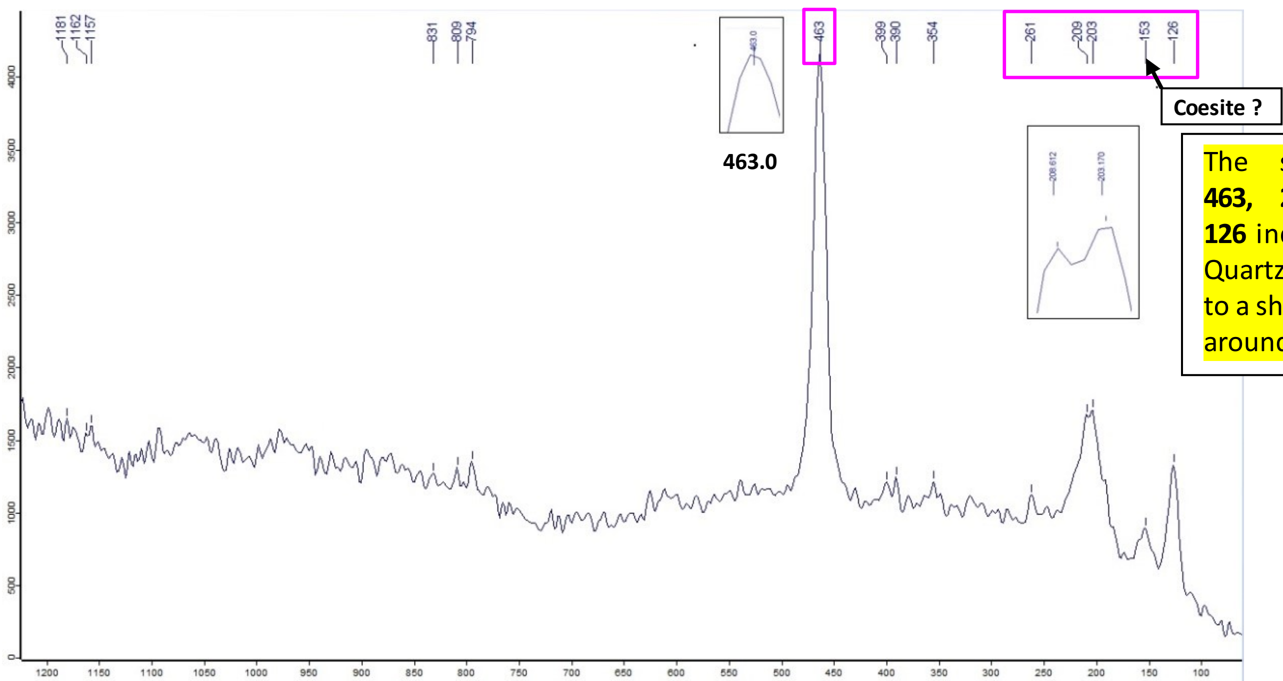


Sample :





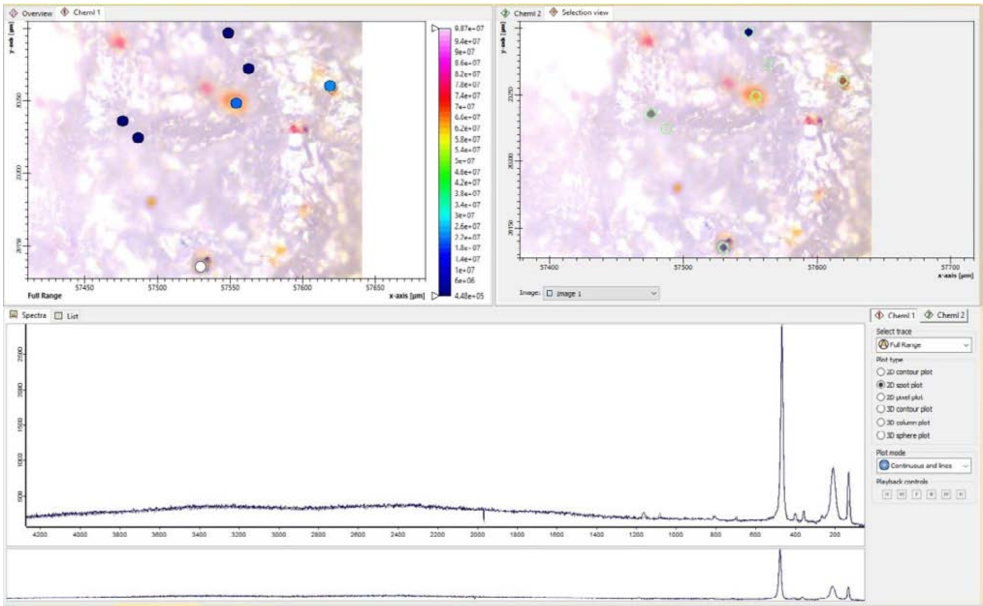
Indication for a shock event are the shifts of the marked Quartz spectral lines towards 463, 261, 203 and 126



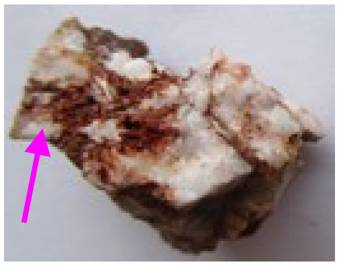
The spectral lines **463, 261, 203** and **126** indicate that the Quartz was exposed to a shock pressure of around **22 GPa**

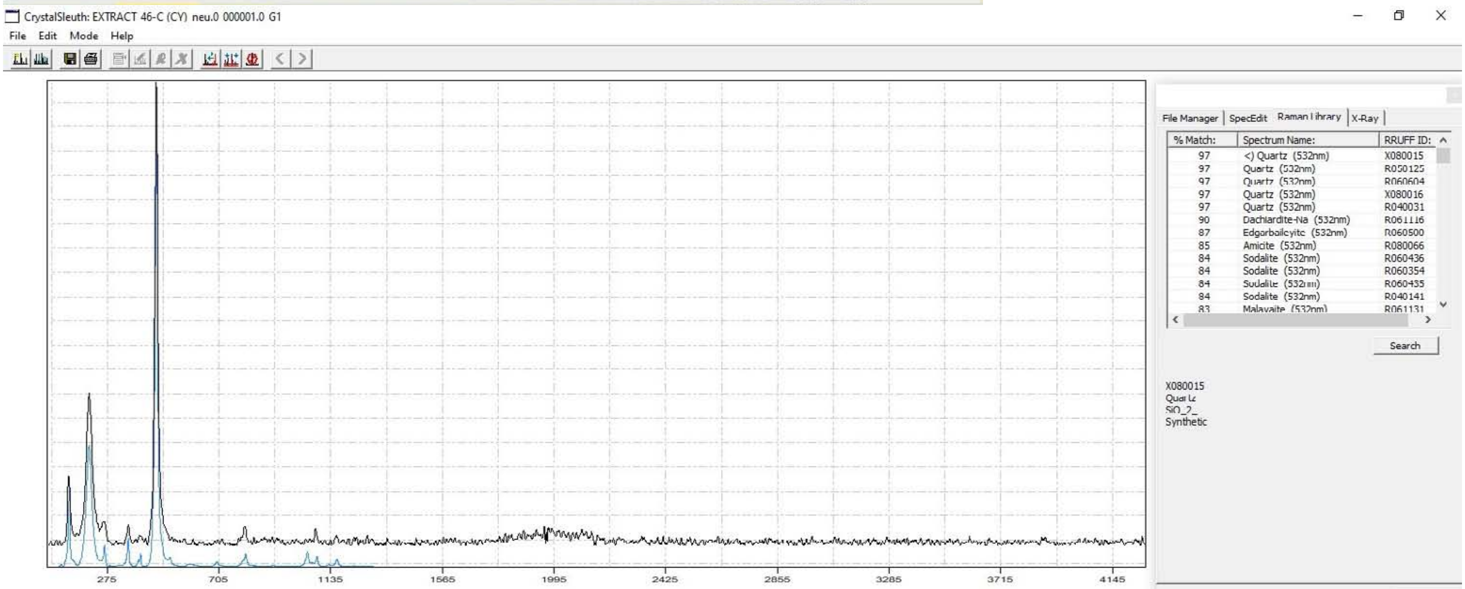
Sample Site 46-C (2.Trip) : Stone 1_spectra 1 (white mineral)

Search in the RRUFF Database indicates : Quartz

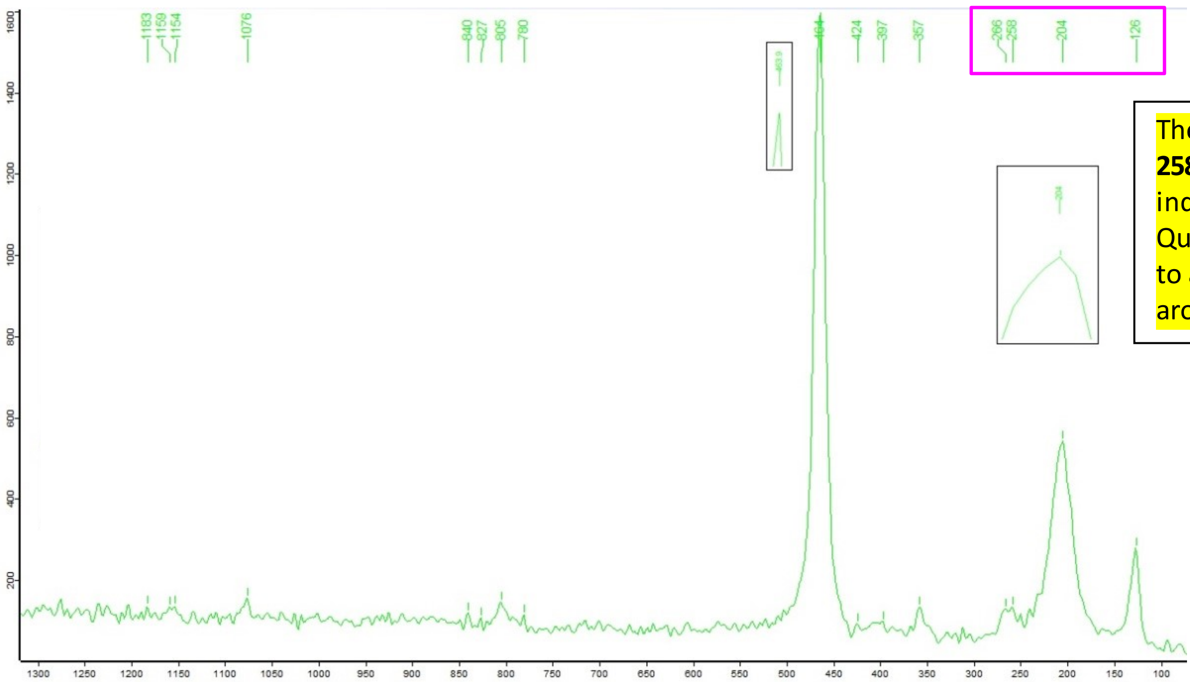


Sample :





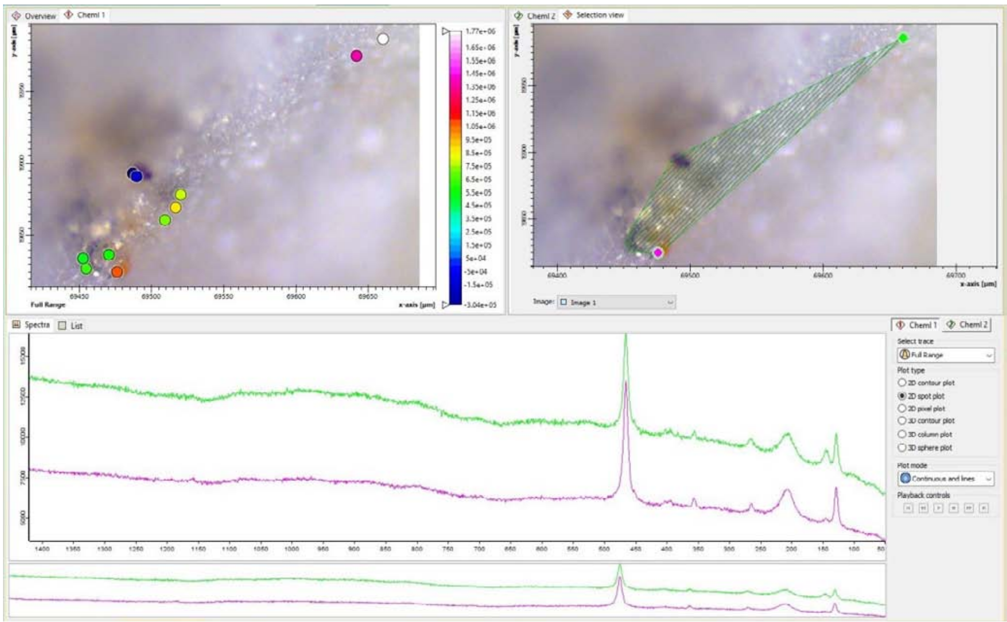
Indication for a shock event are the shifts of the marked Quartz spectral lines towards 258, 204 and 126



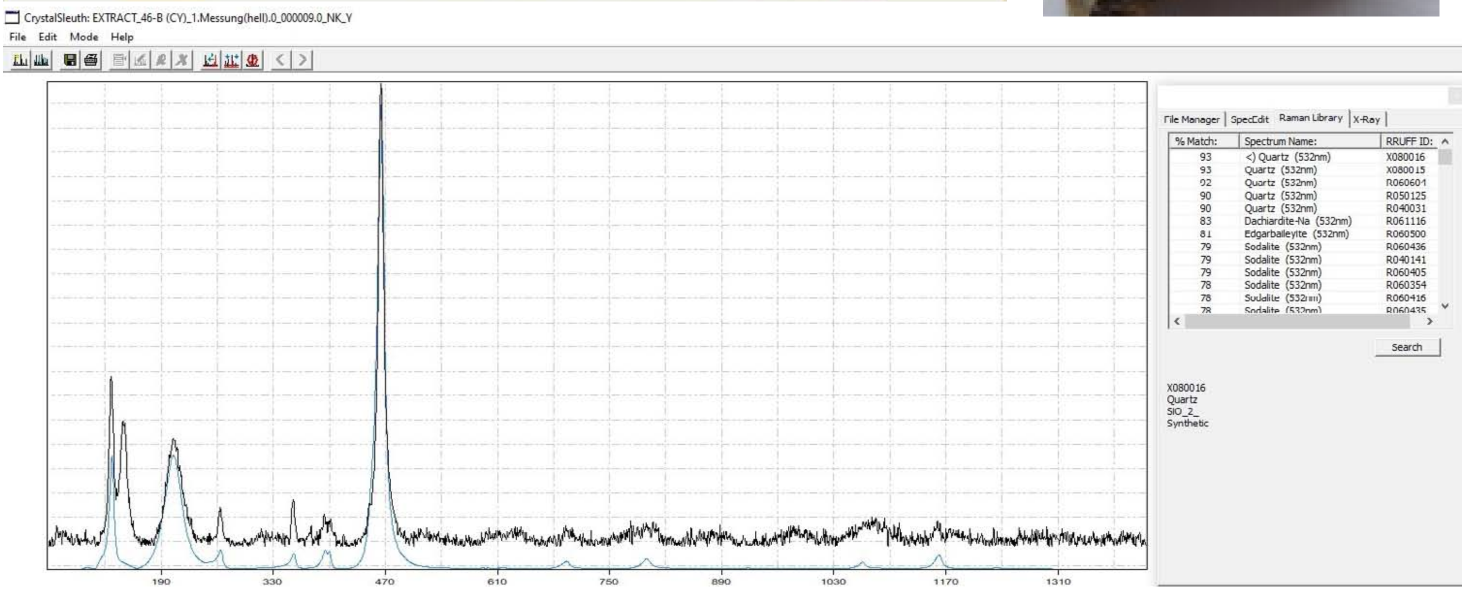
The spectral lines **258, 204** and **126** indicate that the Quartz was exposed to a shock pressure of around **22 GPa**

Sample Site 46-B (2.Trip) : Stone 1_spectra 1 (bright mineral)

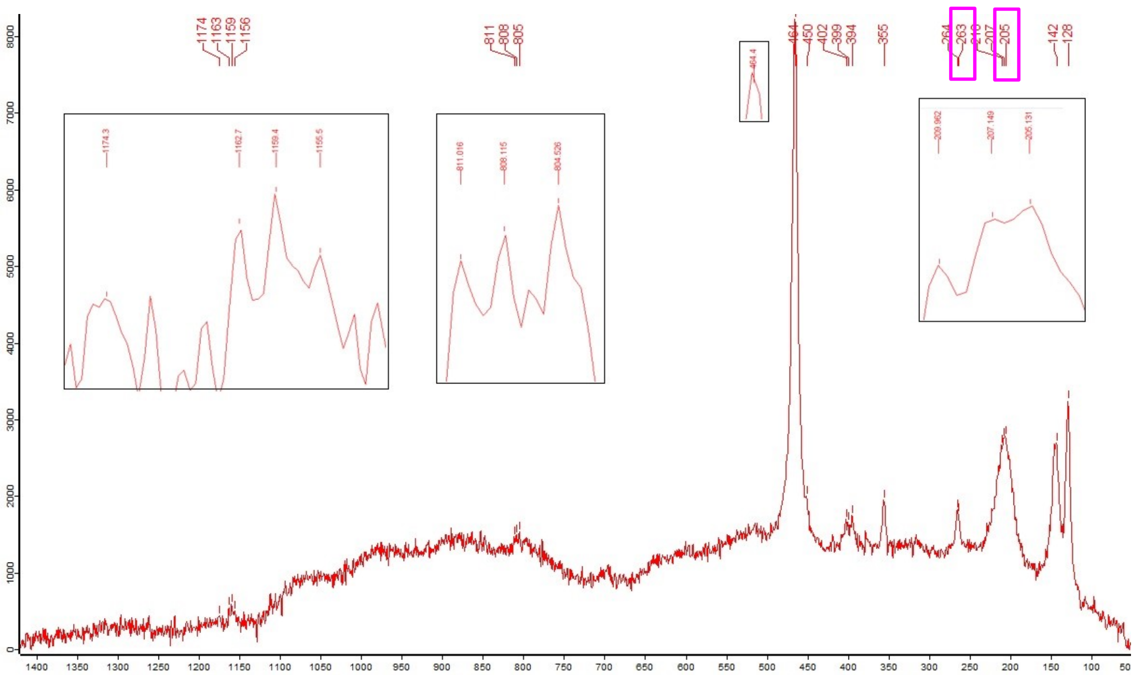
Search in the RRUFF Database indicates : Quartz



Sample :



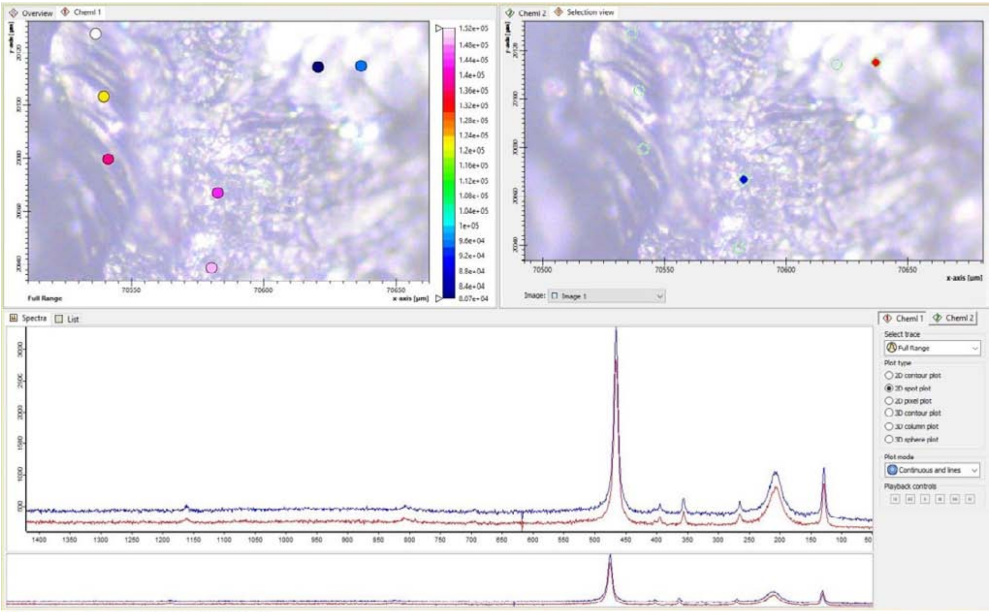
Indication for a shock event are the shifts of the marked Quartz spectral lines towards ~263 and 205



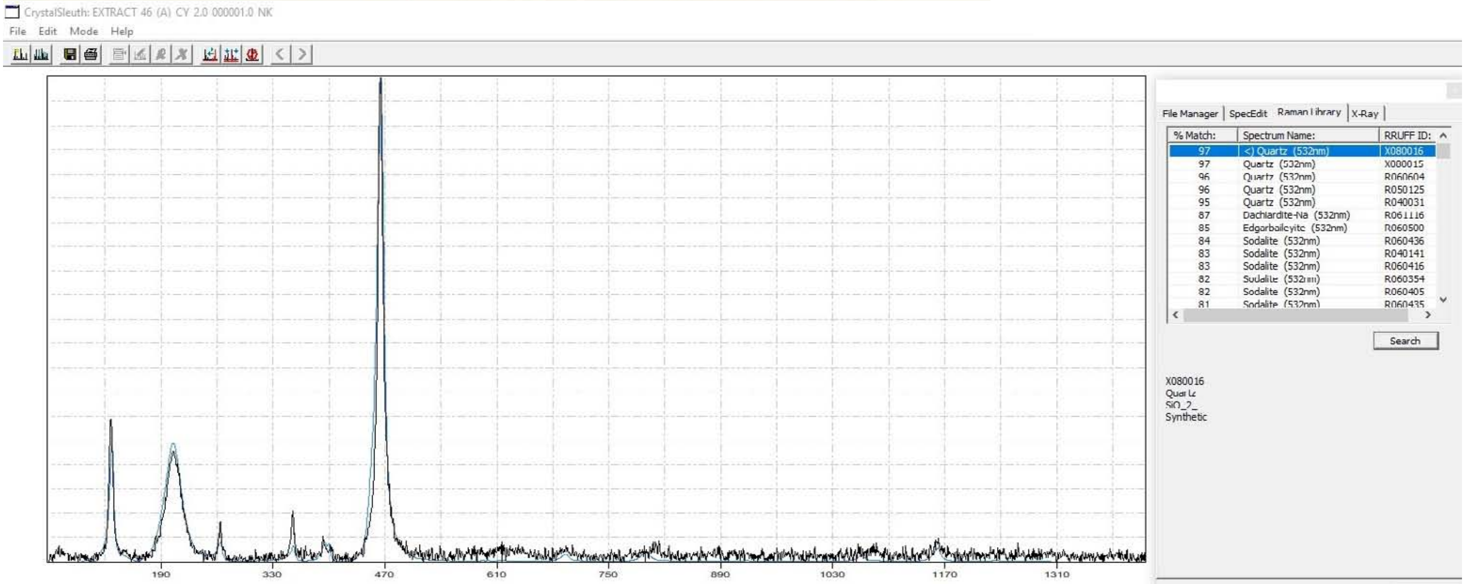
The spectral lines **263** and **205** indicate that the Quartz was exposed to a shock pressure of around **20 - 22 GPa**

Sample Site 46-A (2.Trip) : Stone 2_spectra 1

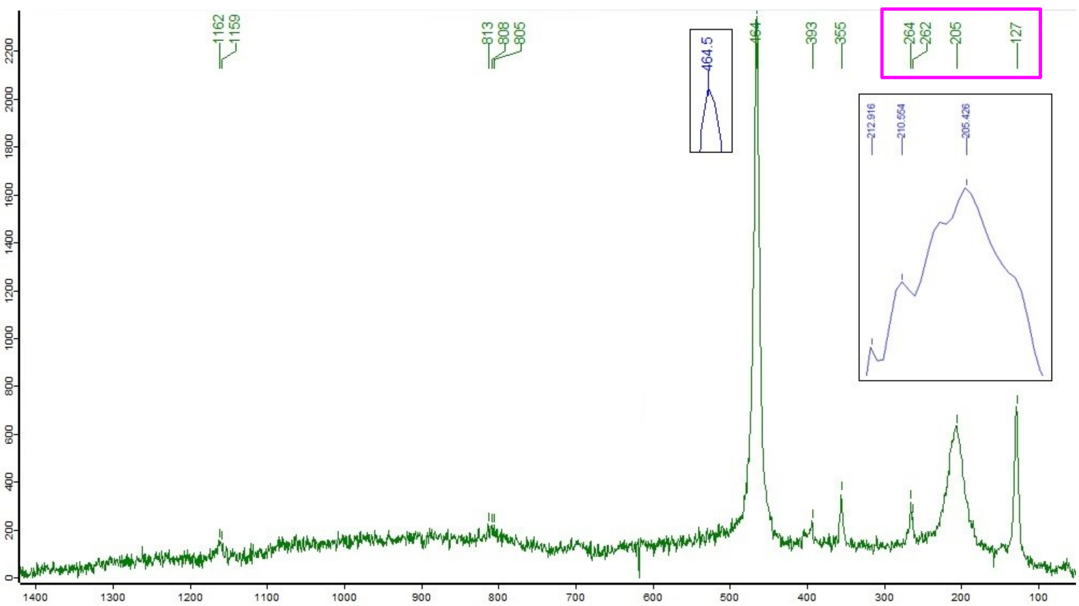
Search in the RRUFF Database indicates : Quartz



Sample : **Stone 2**



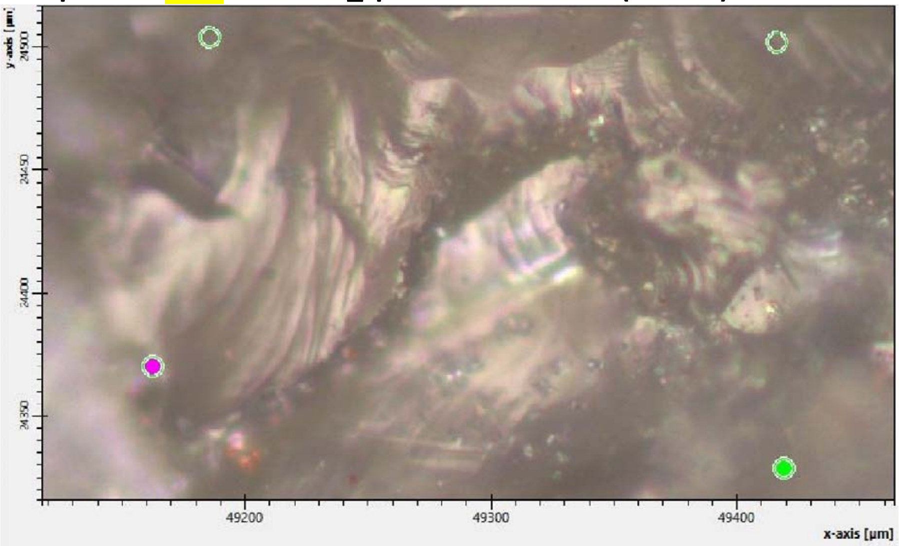
Indication for a shock event are the shifts of the marked Quartz spectral lines towards 262, 205 and 127



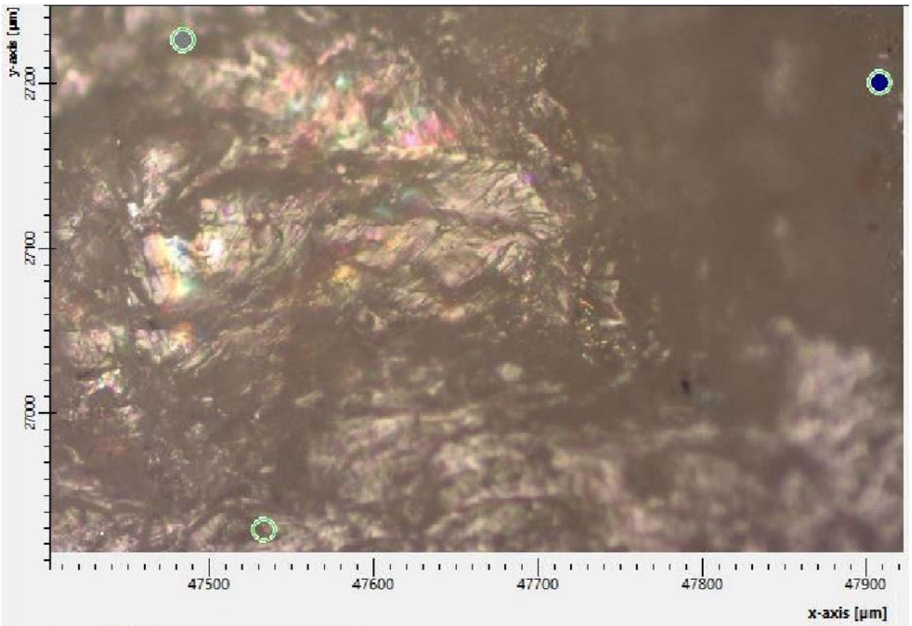
The spectral lines **262, 205** and **127** indicate that the Quartz was exposed to a shock pressure of around **22 GPa**

Microscopic Images : Samples from Site 46 – C / A → original state (no preparation for analysis)

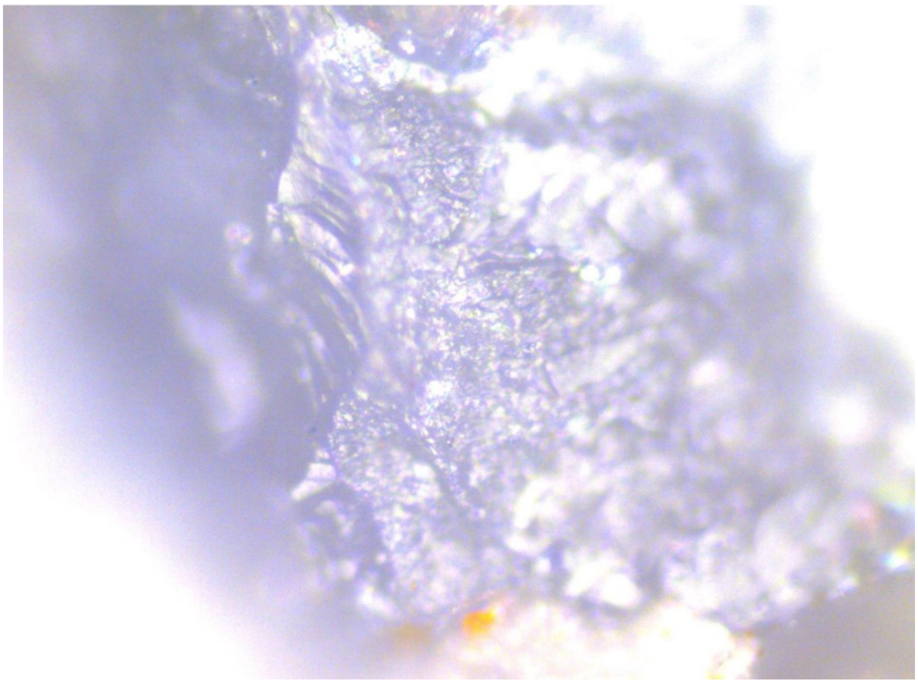
Sample Site 46-C Stone 2_spectra 1 : Quartz (white)



Sample Site 46-A Stone 2_spectra 1 Quartz (white)

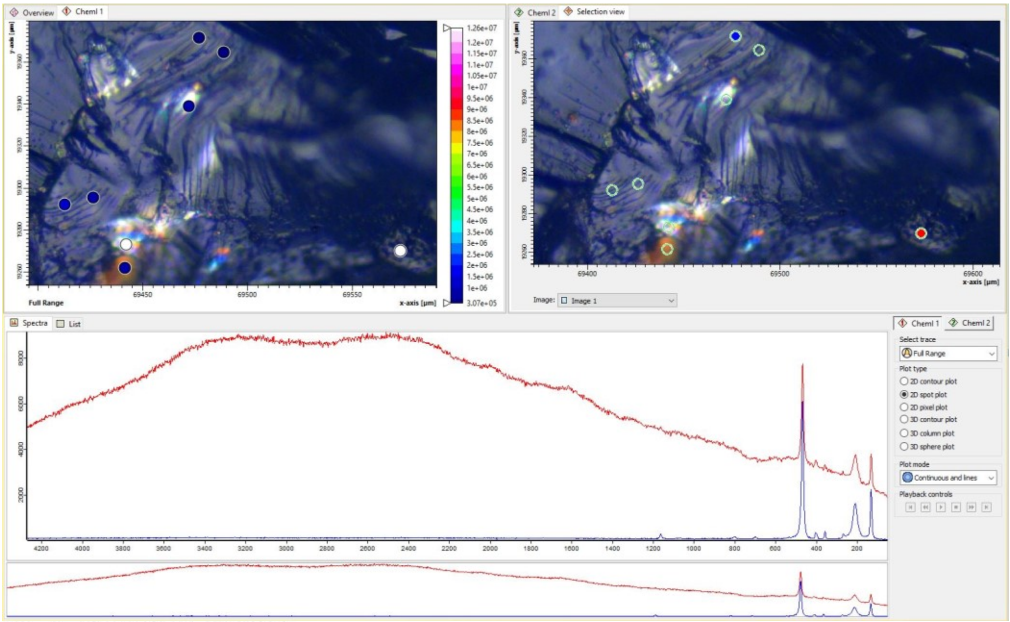


Sample Site 46-A Stone 2_spectra 1 Quartz (white)



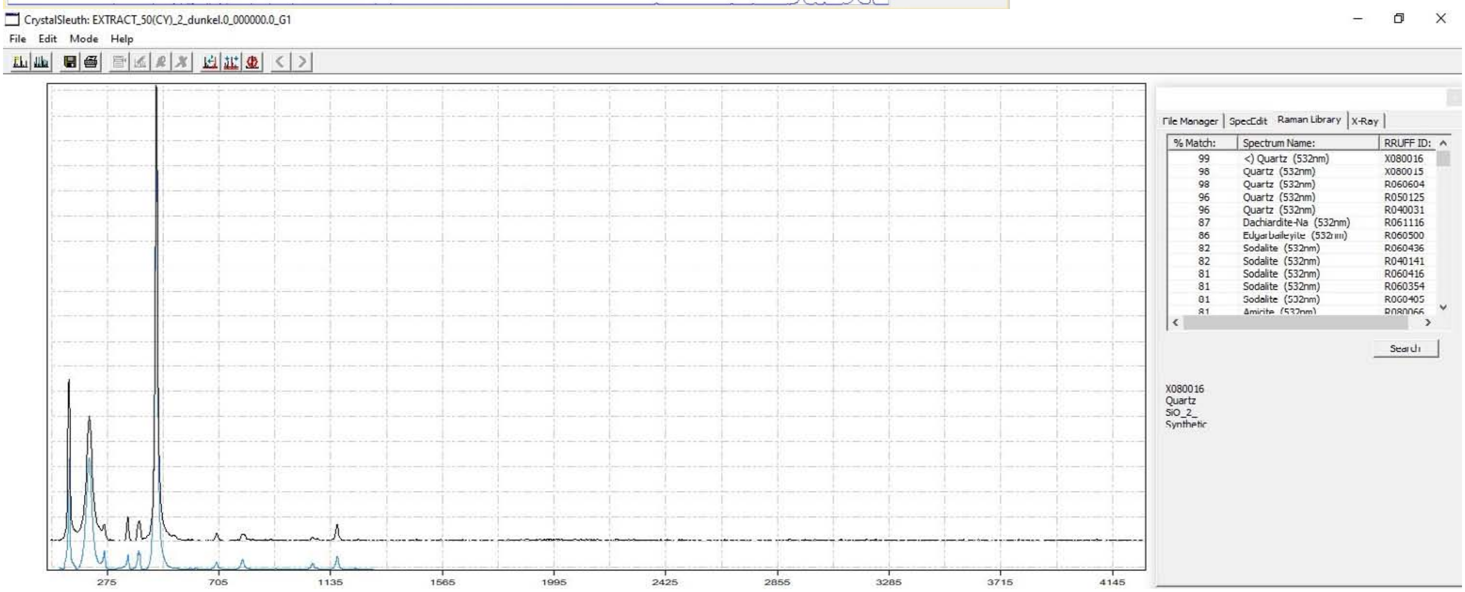
Sample Site 50 (2.Trip) : Stone 1_spectra 1 (dark mineral)

Search in the RRUFF Database indicates : Quartz

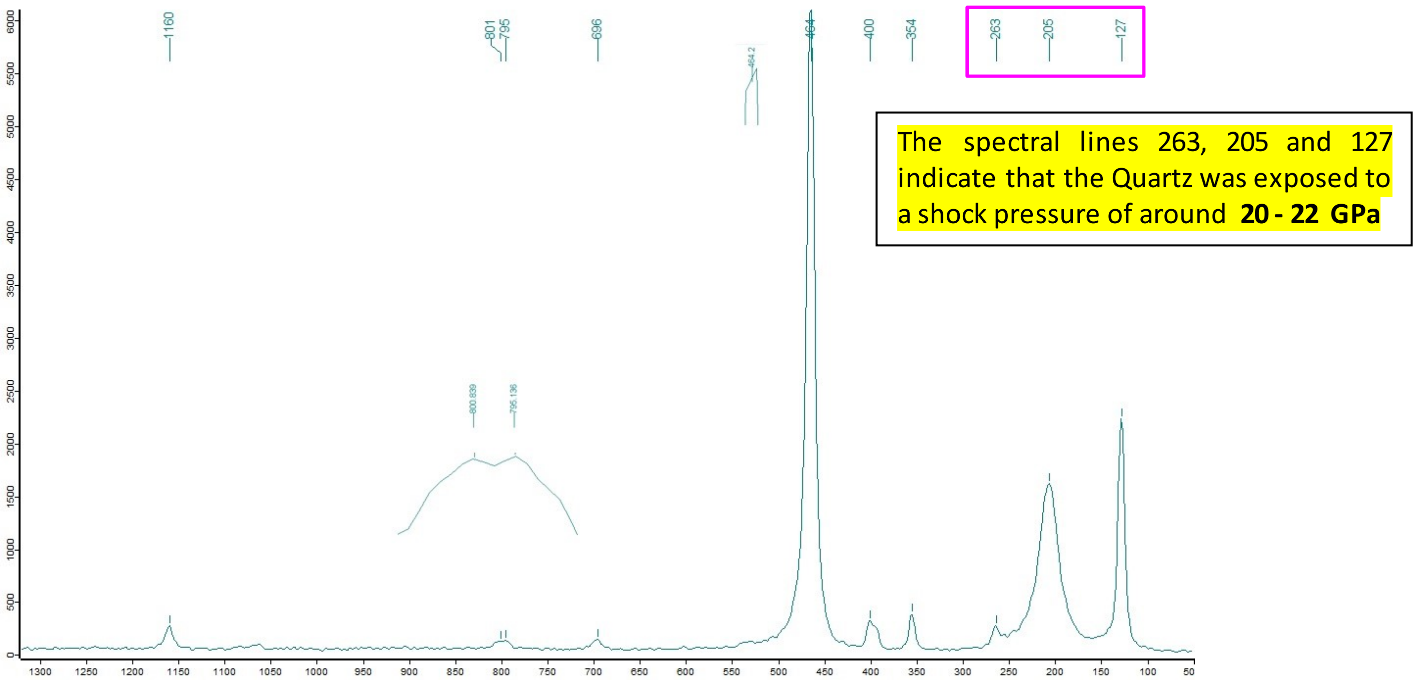


Note the fracture pattern on the microscopic image.

Sample :



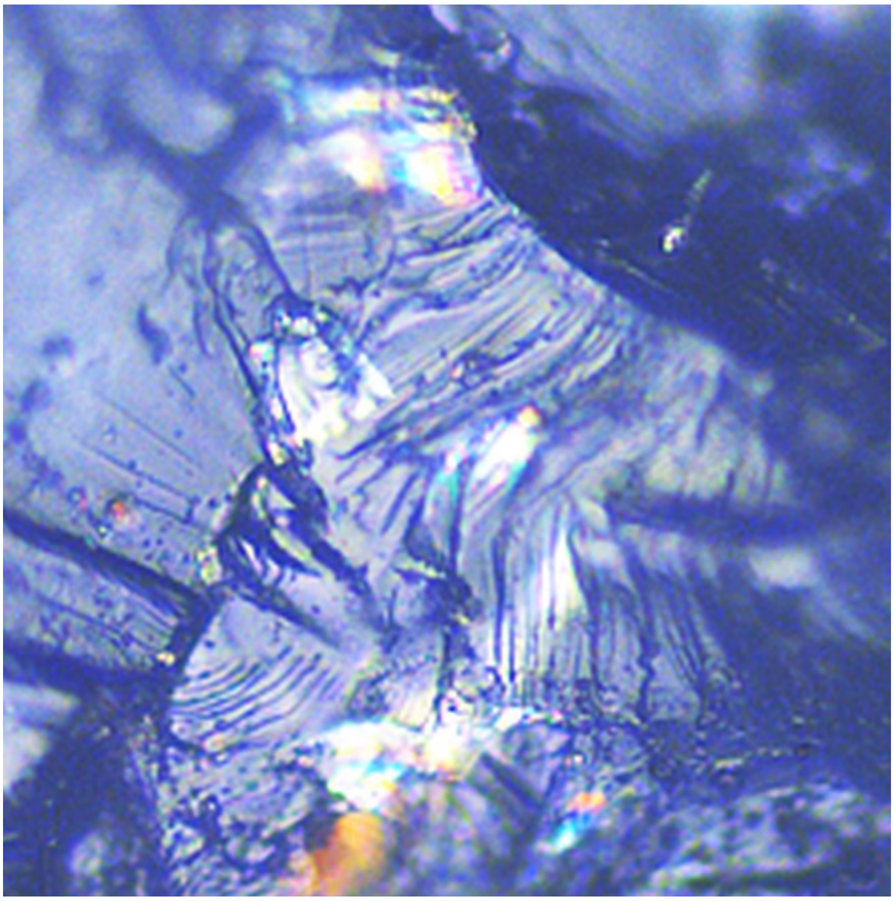
Indication for a shock event are the shifts of the marked Quartz spectral lines towards 263, 205 and 127



The spectral lines 263, 205 and 127 indicate that the Quartz was exposed to a shock pressure of around **20 - 22 GPa**

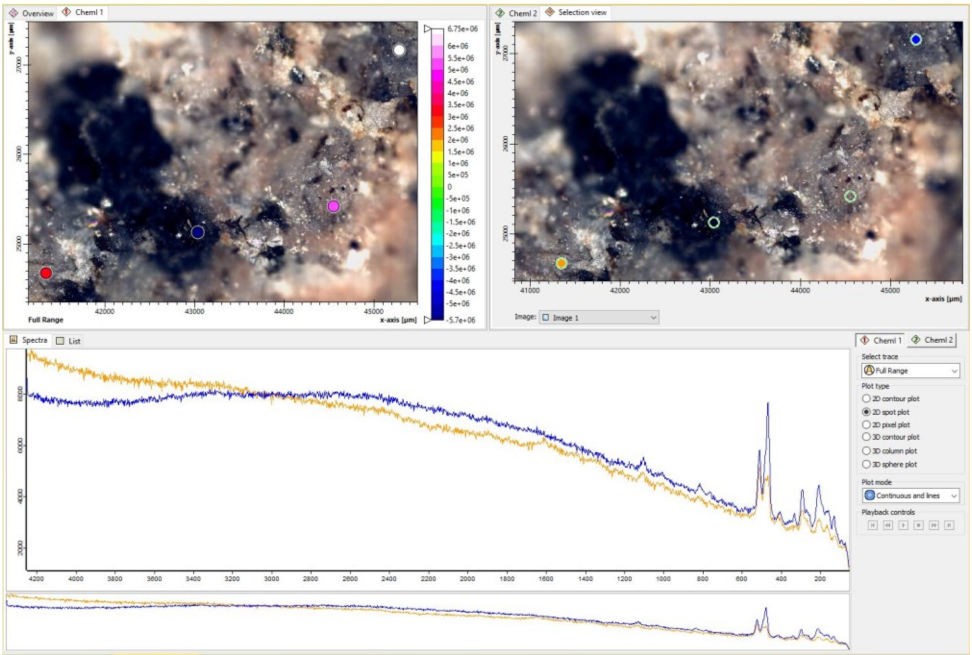
Microscopic Image : Sample from Site 50 → original state (no preparation on sample for analysis)

Sample Site 50 : Stone 1_spectra 1 : : Quartz (dark) - Image size ~ 120x120 µm



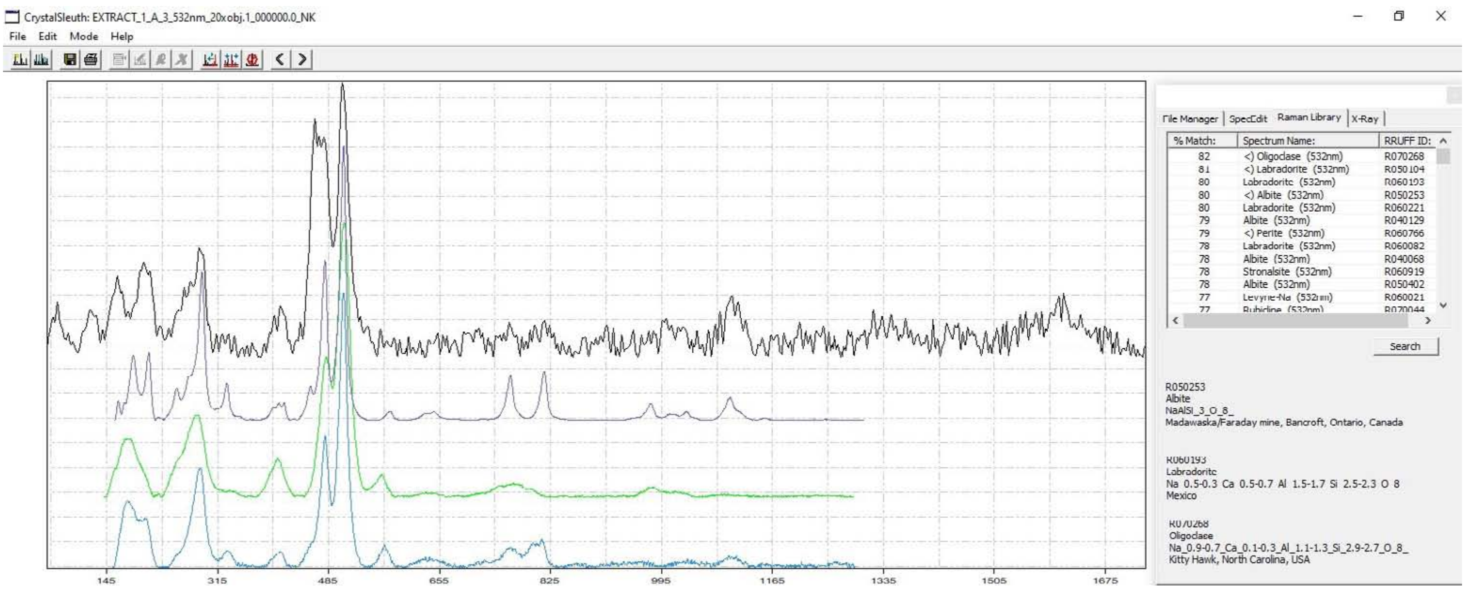
Sample Site 23 (1.Trip) = 49-C (2.Trip) → (same site !) : Stone 1_spectra 3 (grey mineral)

Search in the RRUFF Database indicates : Oligoclase , Labradorite , Albite, Quarz (→ see search results)

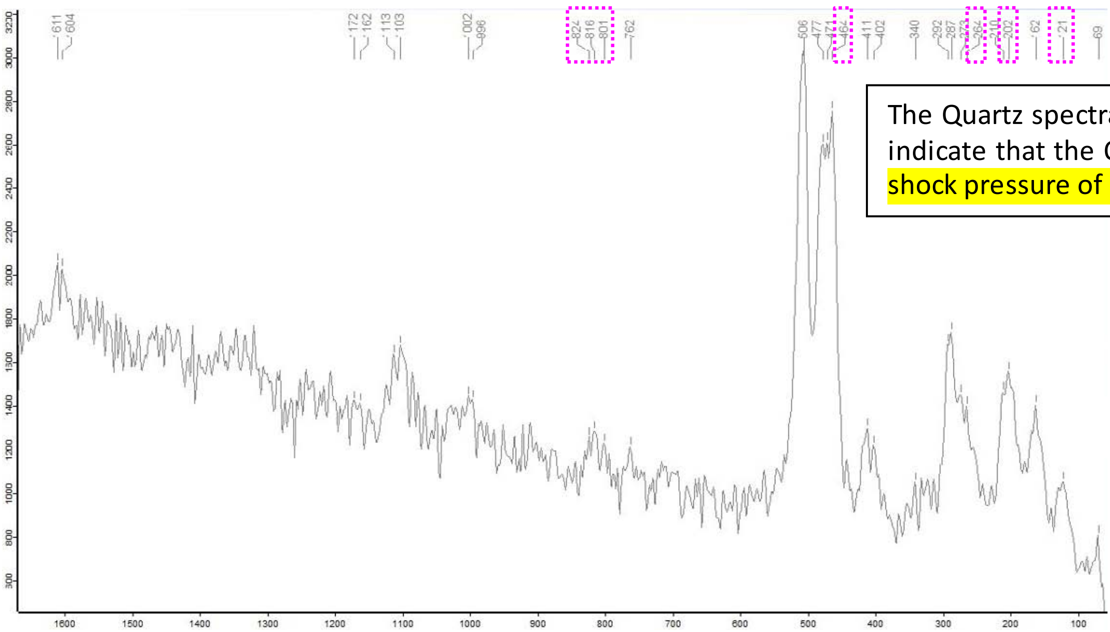


Note : the spectral-lines indicate that shocked Quartz also seems to present in the sample !

Sample :



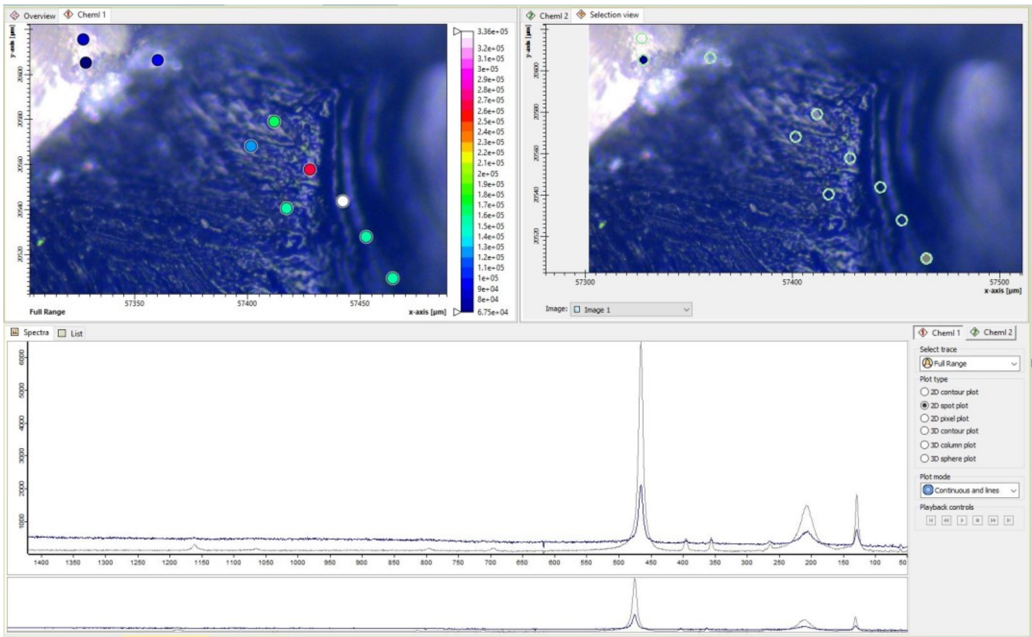
Indication for a shock event are the shifts of the marked Quartz spectral lines in the Spectrum towards 264, 202 & 121



The Quartz spectral-lines 264, 202 and 121 indicate that the Quartz was exposed to a shock pressure of around **20 - 22 GPa**.

Sample Site 49-C (2.Trip) : Stone 1_spectra 4 (glassy mineral)

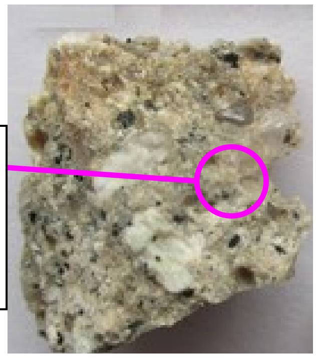
Search in the RRUFF Database indicates : Quartz

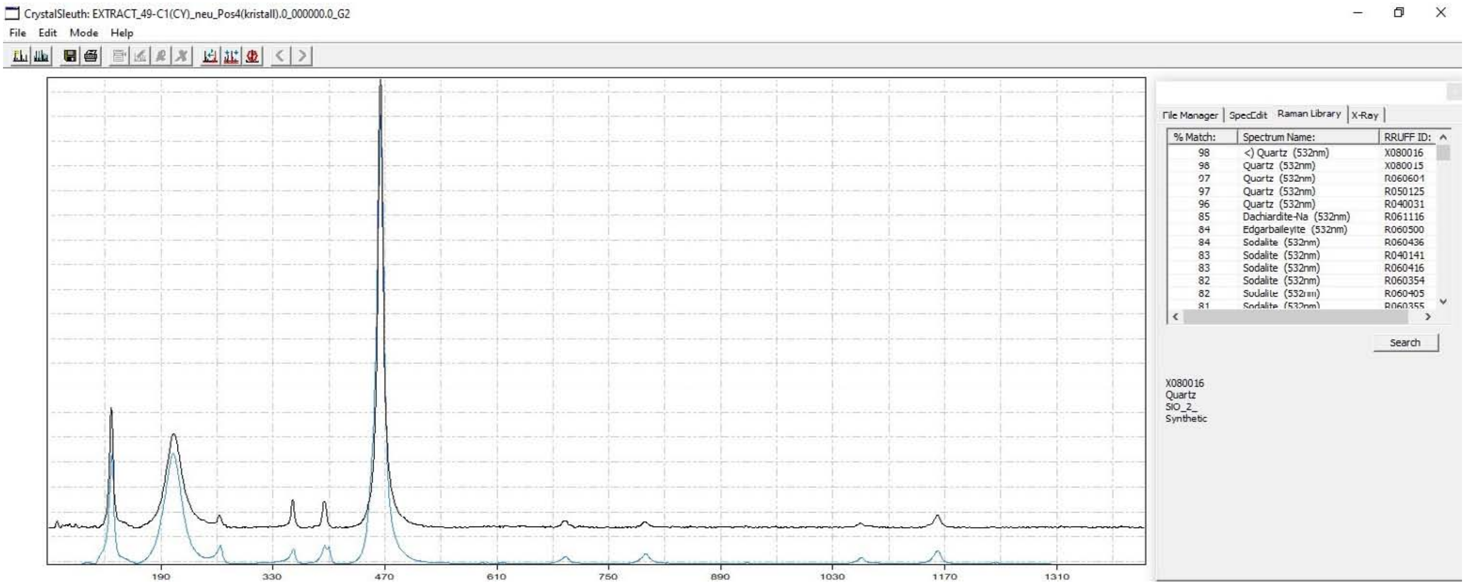


Note the fracture pattern on the microscopic image.

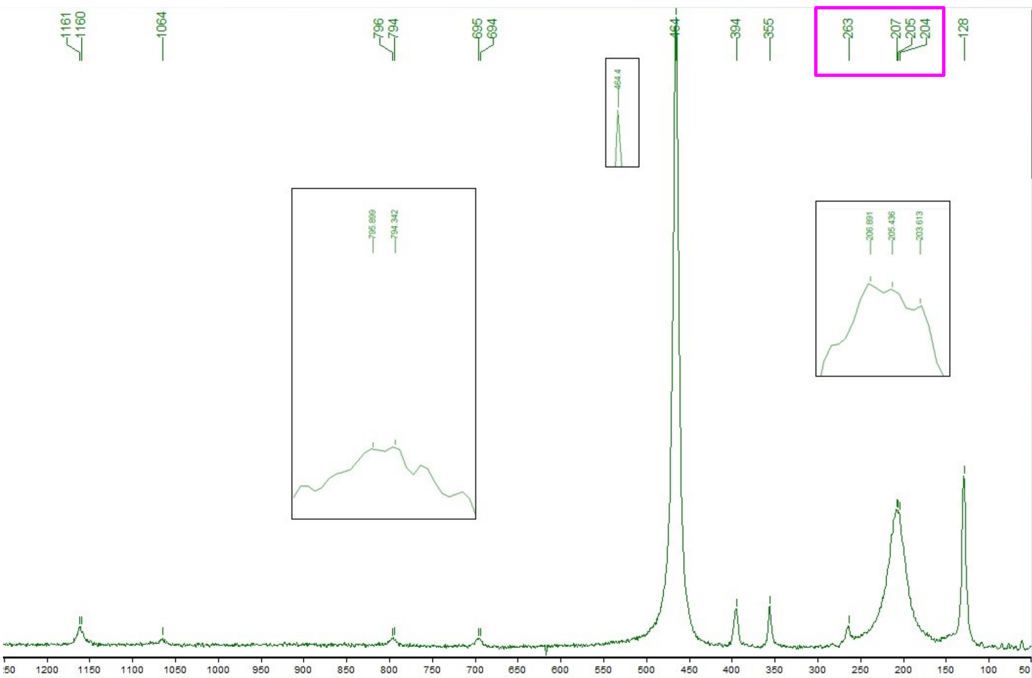
Sample :

On Backside (glassy mineral)





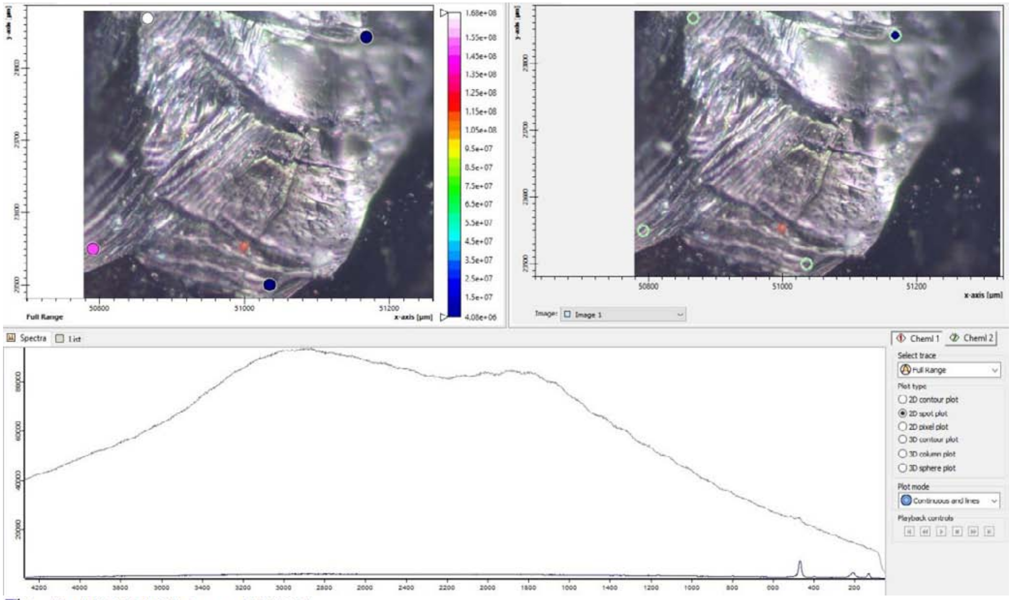
Indication for a shock event are the shifts of the marked Quartz spectral lines towards 263 and ≈ 205



The spectral lines 263 and 205 indicate that the Quartz was exposed to a shock pressure of around **20 - 22 GPa**

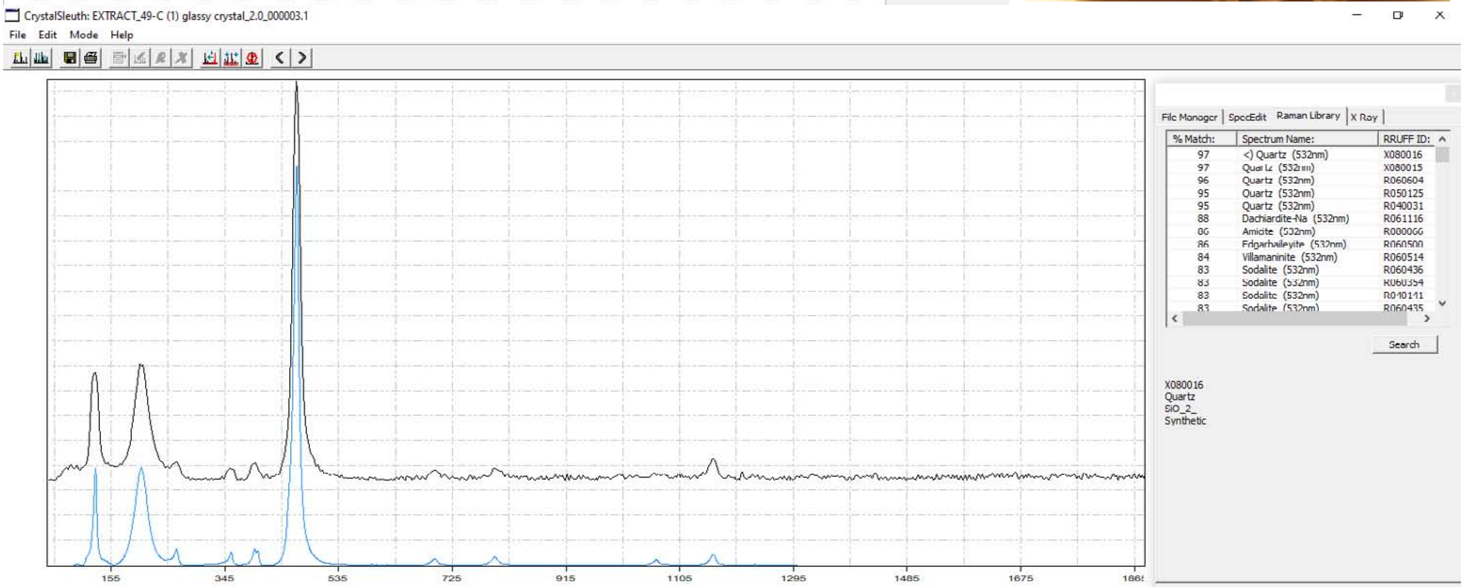
Sample-Site 23 (1.Trip) = 49-C (2.Trip) → (same site !) : Stone 2_spectra 3 (glassy mineral)

Search in the RRUFF Database indicates : Quartz

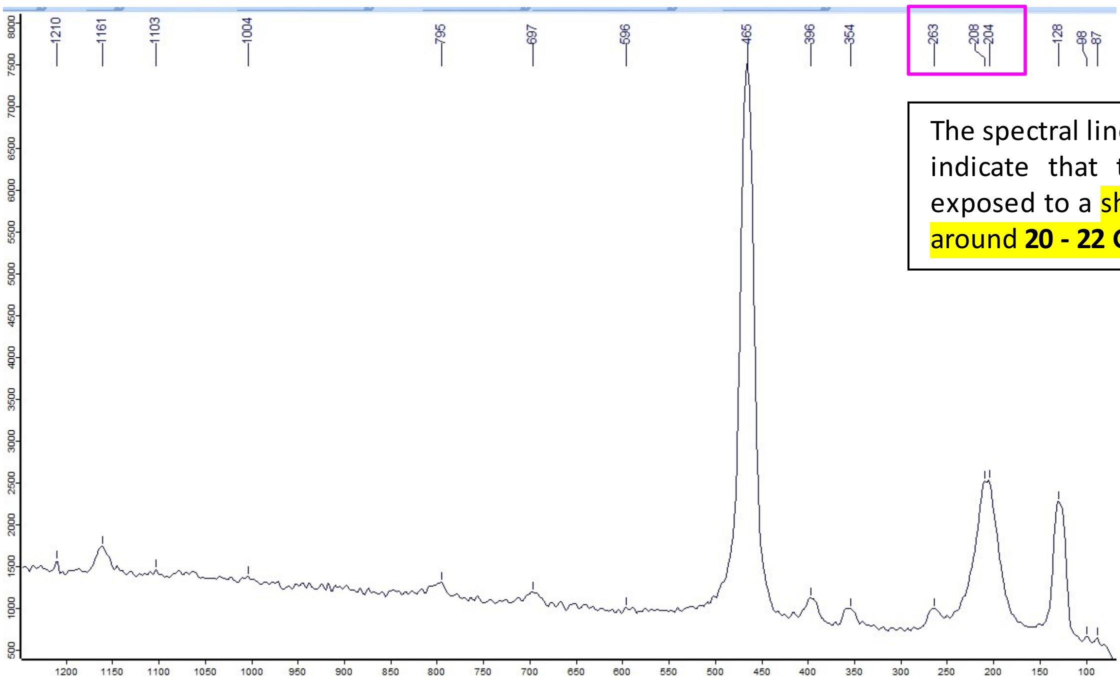


Note the fracture pattern on the microscopic image.

Sample :



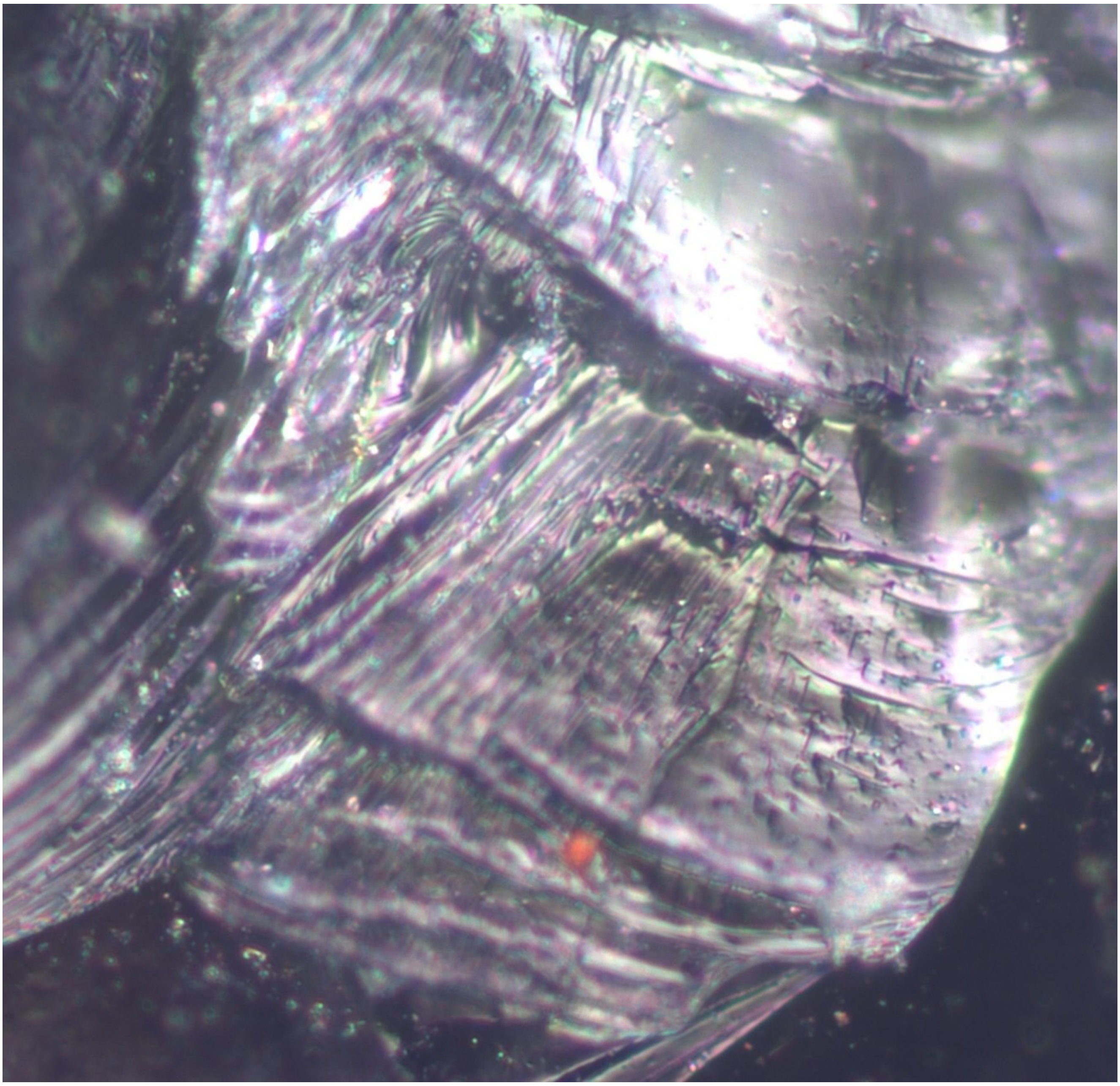
Indication for a shock event are the shifts of the marked Quartz spectral lines towards 263 and (204)



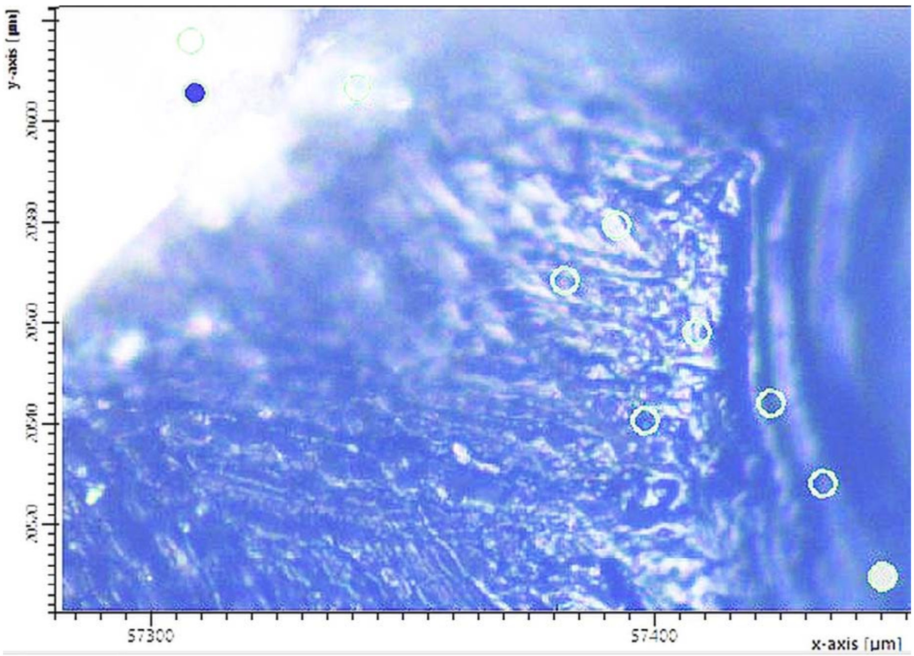
The spectral lines 263 and (204) indicate that the Quartz was exposed to a shock pressure of around **20 - 22 GPa**

Microscopic Images : Samples from Site 23 (1.Trip) = 49-C (2.Trip) → original state (no preparation)

Sample Site 23 / 49-C Stone 2_spectra 3 (glassy mineral) : Quartz - Image size ~350 x 350 µm

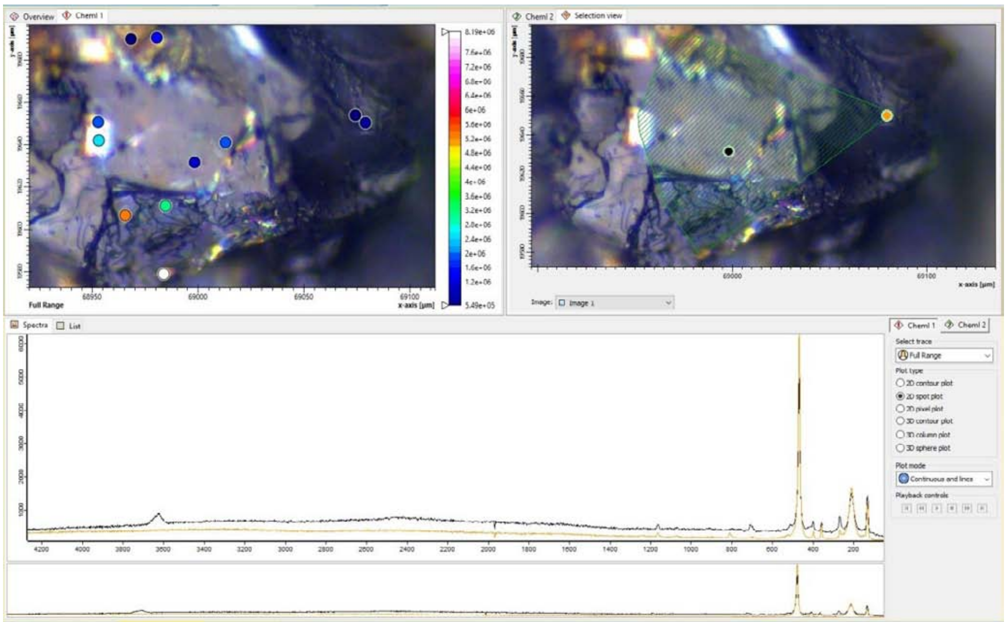


Sample Site 23 / 49-C Stone 1_spectra 4 (glassy mineral) : Quartz - Image size ~150 x 100 µm

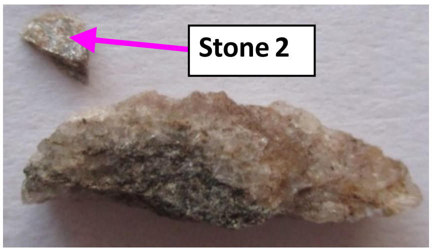


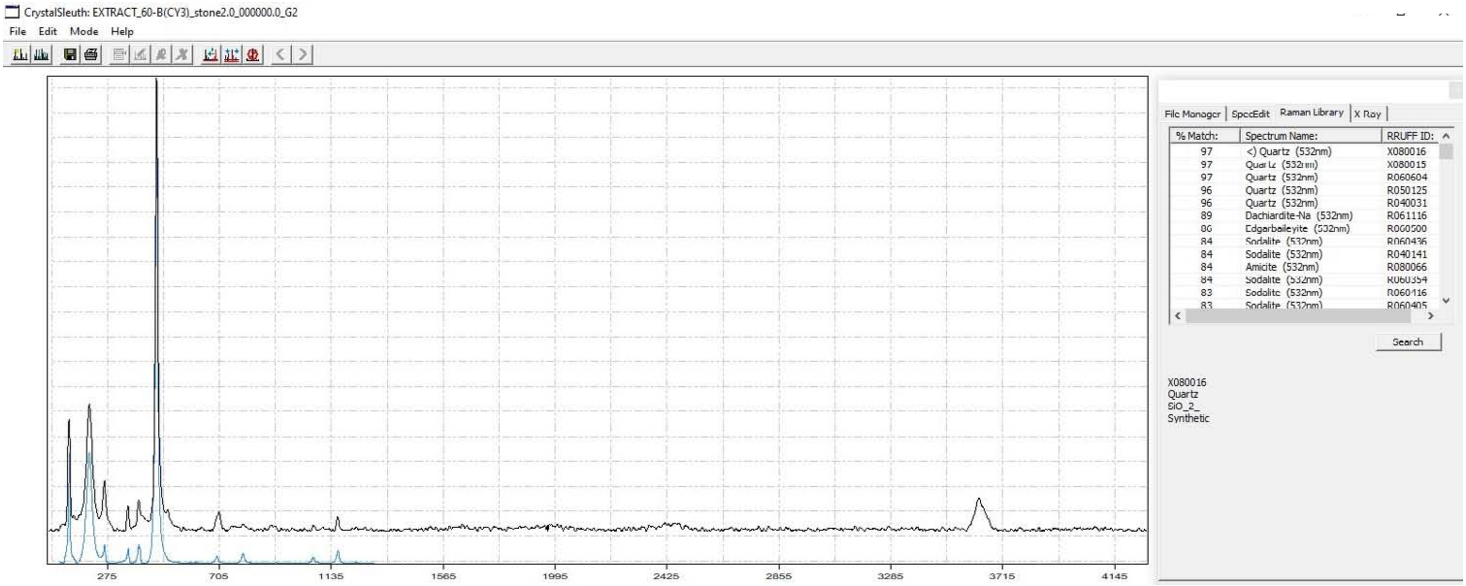
Sample Site 60-B (2.Trip) : Stone 2_spectra 1

Search in the RRUFF Database indicates : Quartz

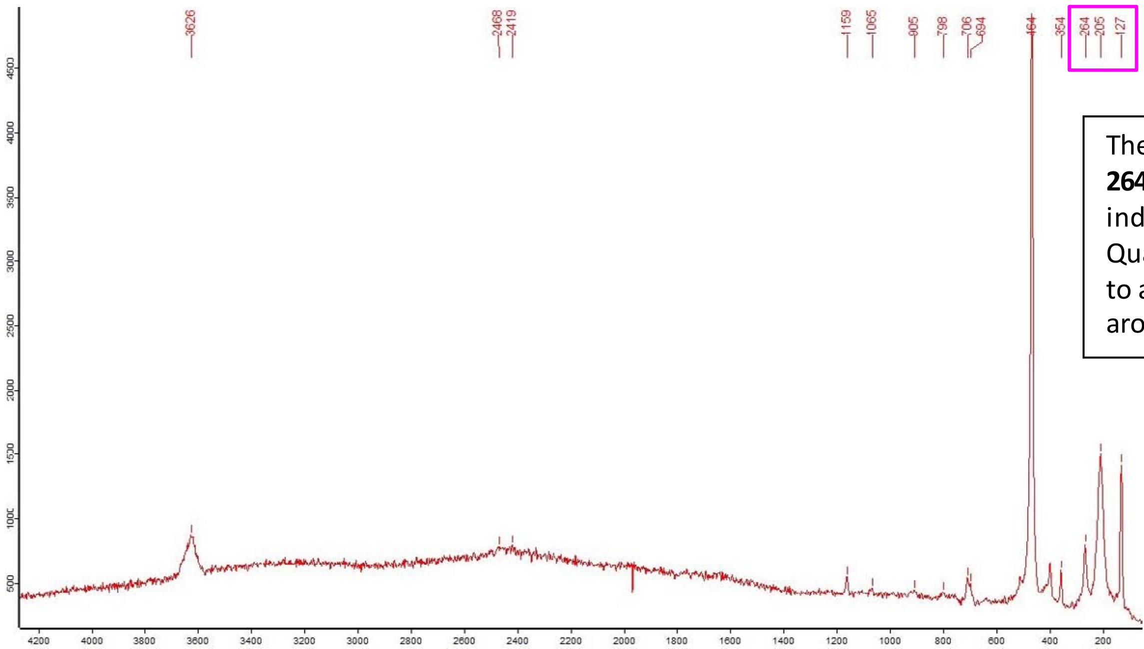


Sample :





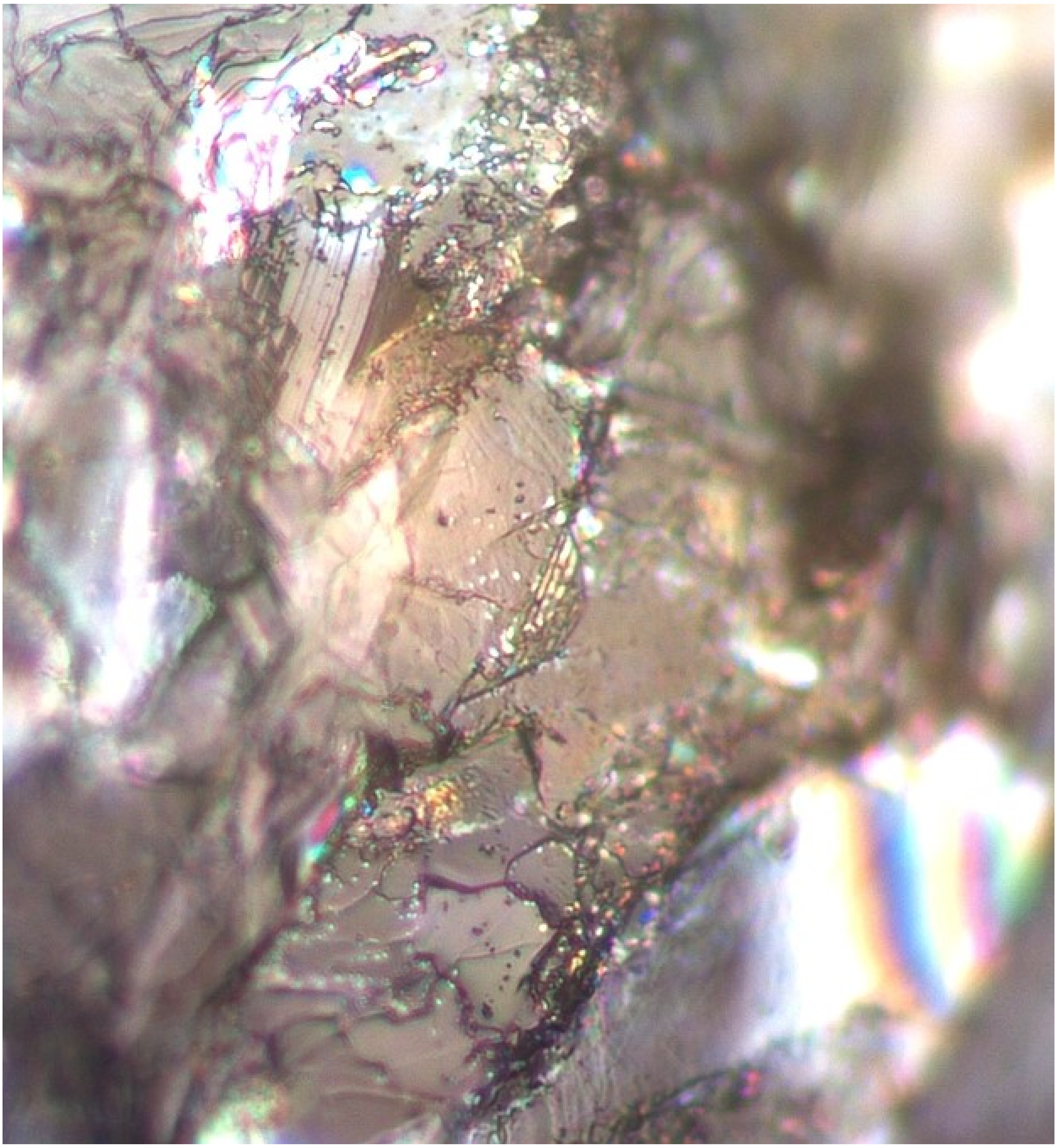
Indication for a shock event are the shifts of the marked Quartz spectral lines towards 264, 205 and 127



The spectral lines **264, 205** and **127** indicate that the Quartz was exposed to a shock pressure of around **20 - 22 GPa**

Microscopic Image : Sample from Site 60-B → original state (no preparation for analysis)

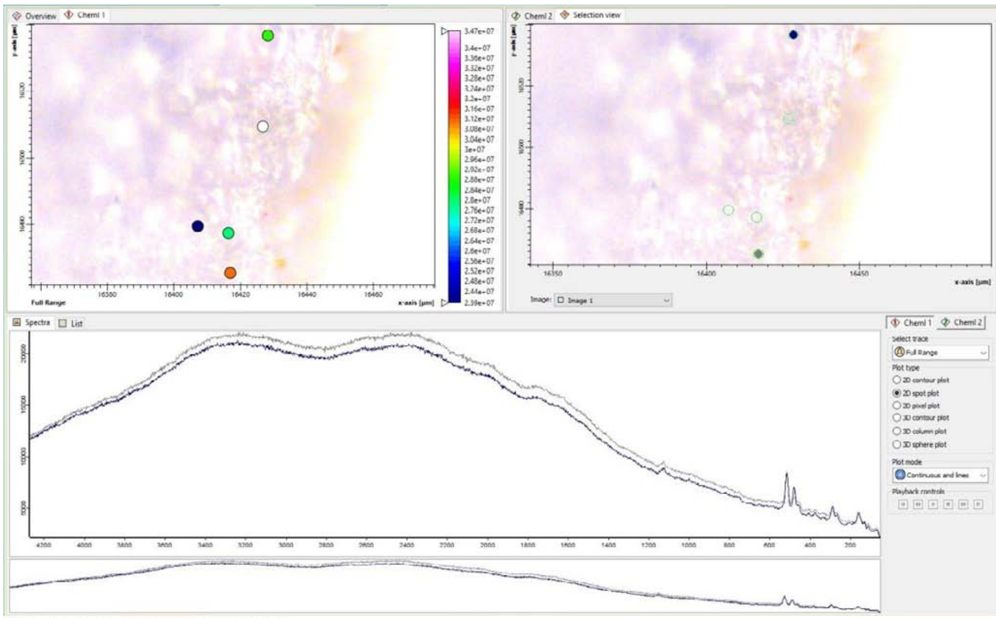
Sample Site 60-B Stone 2_spectra 1 : Quartz (white) - image size ~250 x 250 µm



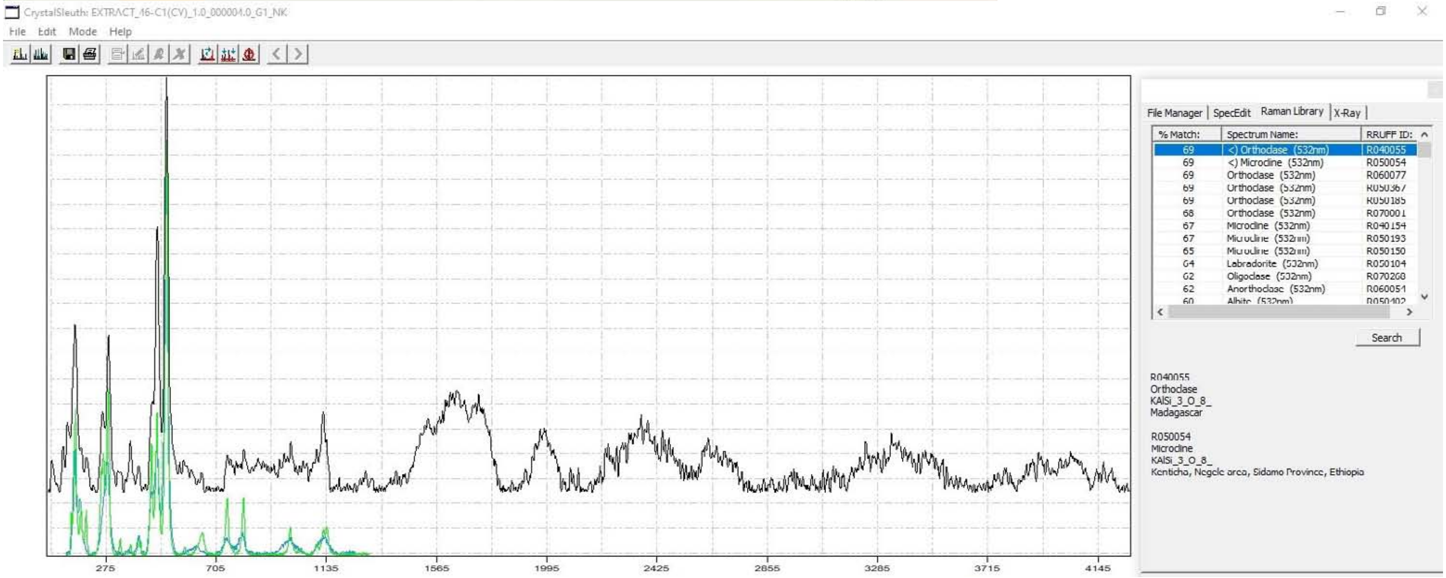
OTHER SPECTRA FROM THE SAMPLES No's. : 46 , 50 , 49 and 60 ON THE FOLLOWING PAGES :

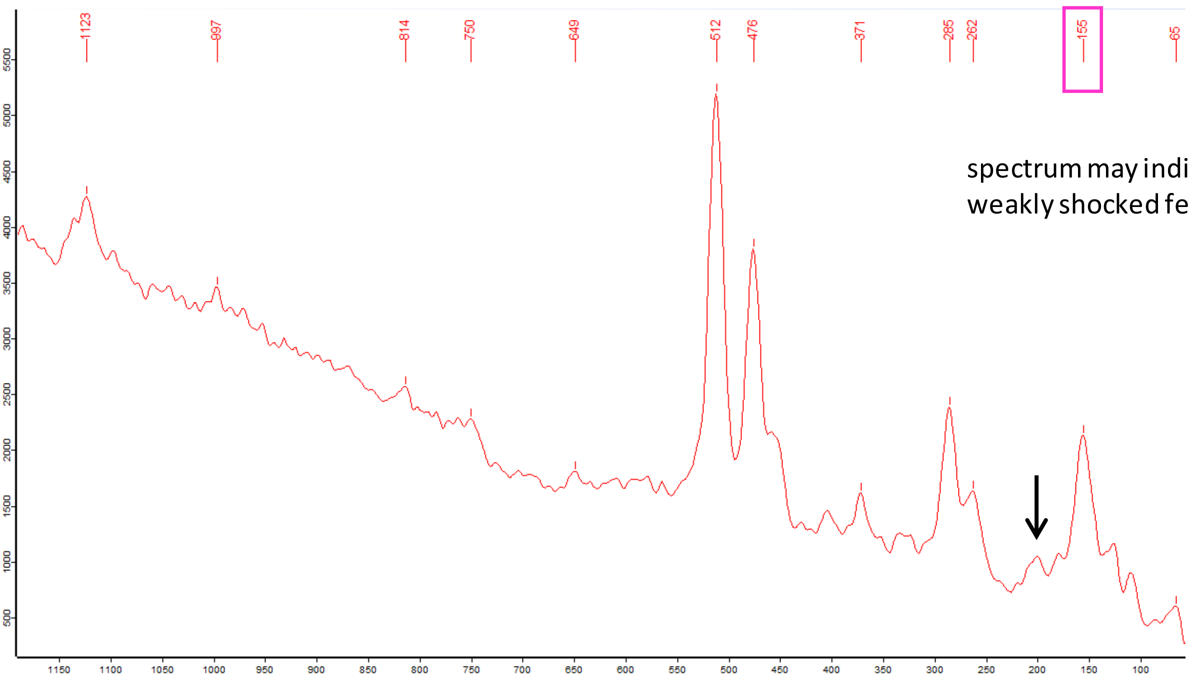
Sample Site 46-C (2.Trip) : Stone 1_spectra 2 (white mineral)

Search in the RRUFF Database indicates : Orthoclase , Microcline



Sample :

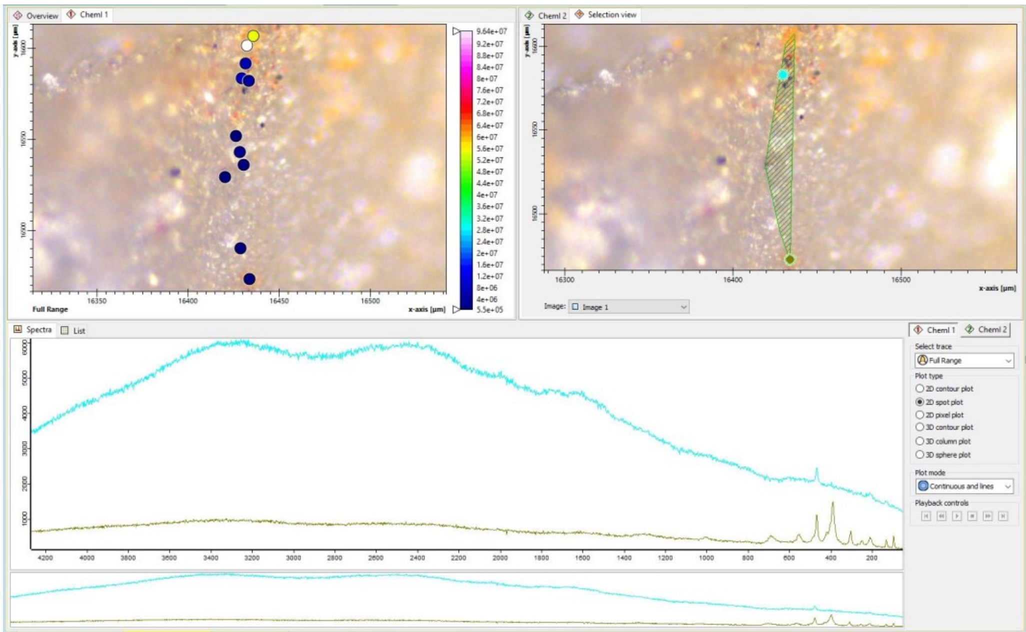




spectrum may indicate
weakly shocked feldspar

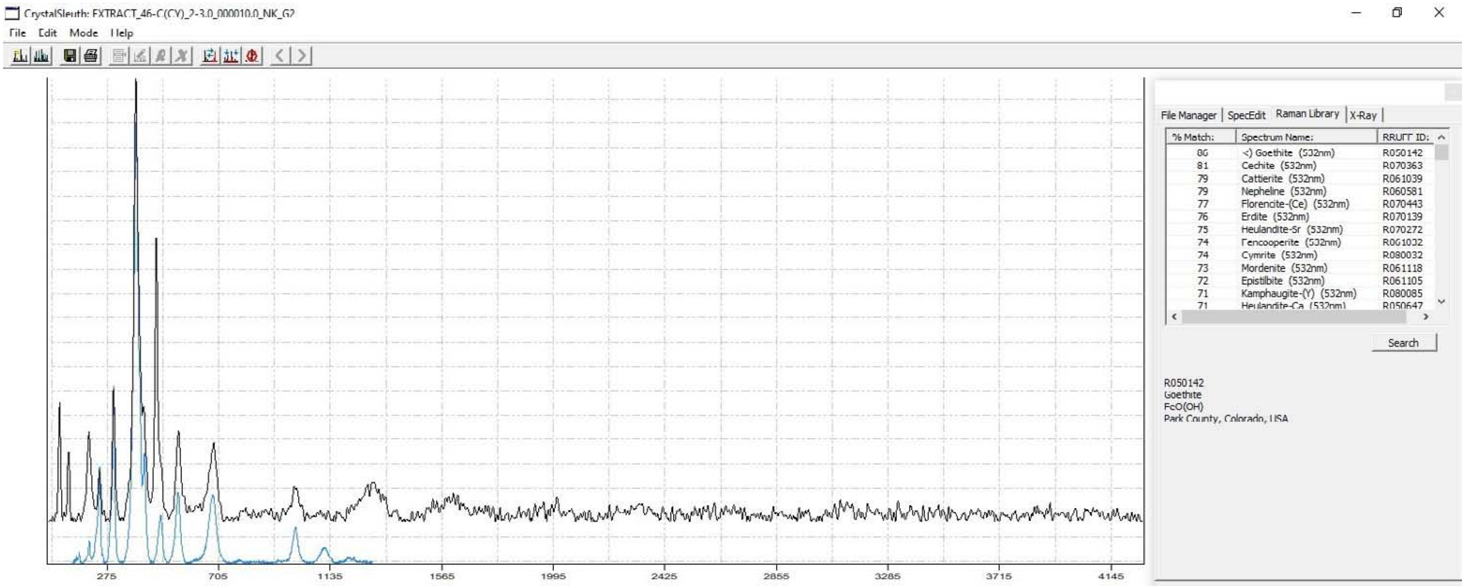
Sample Site 46-C (2.Trip) : Stone 2_spectra 2 (white-grey mineral)

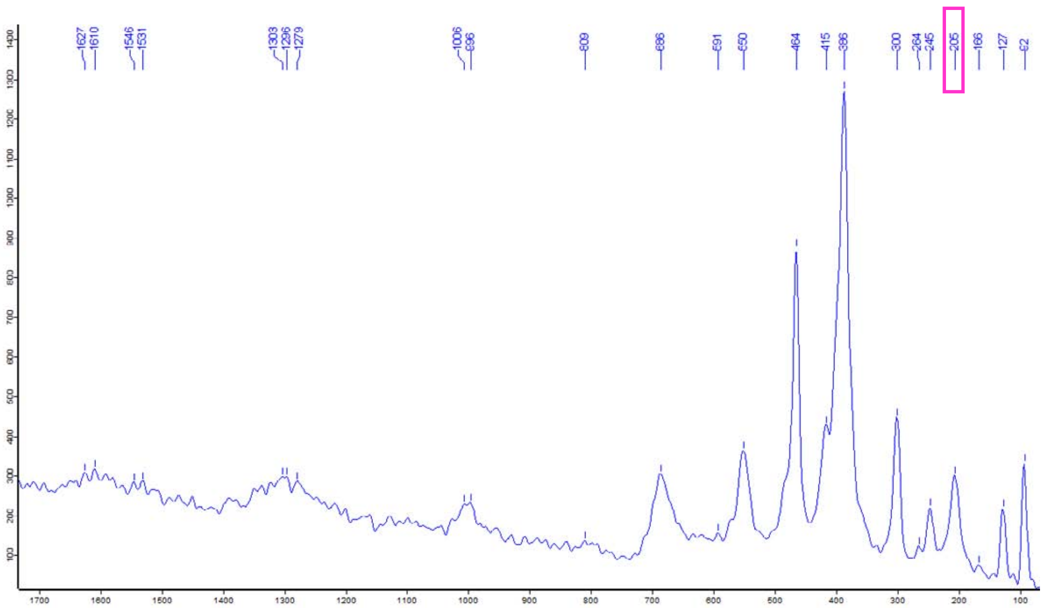
Search in the RRUFF Database indicates : Goethite , Quartz



Quartz-lines present in the sample

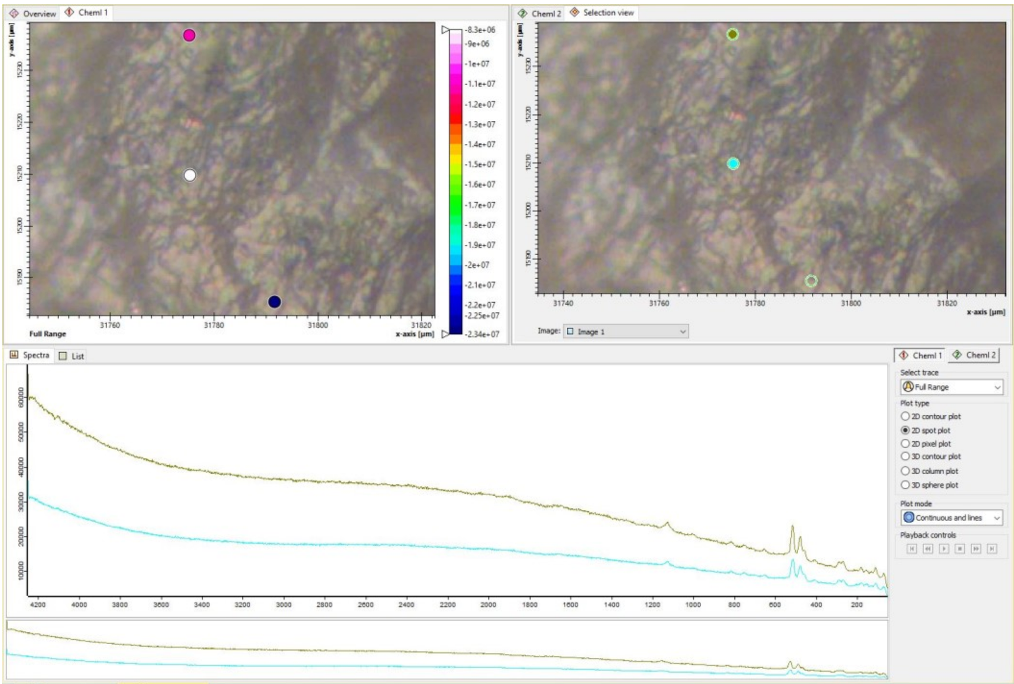
Sample :



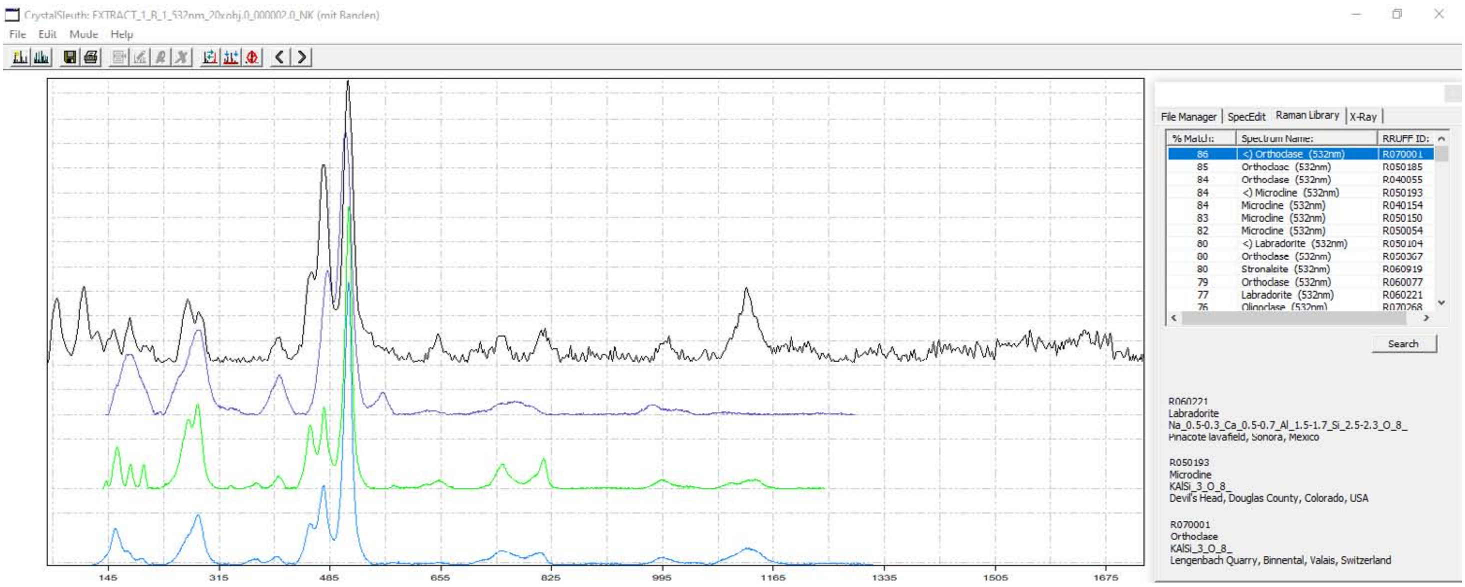


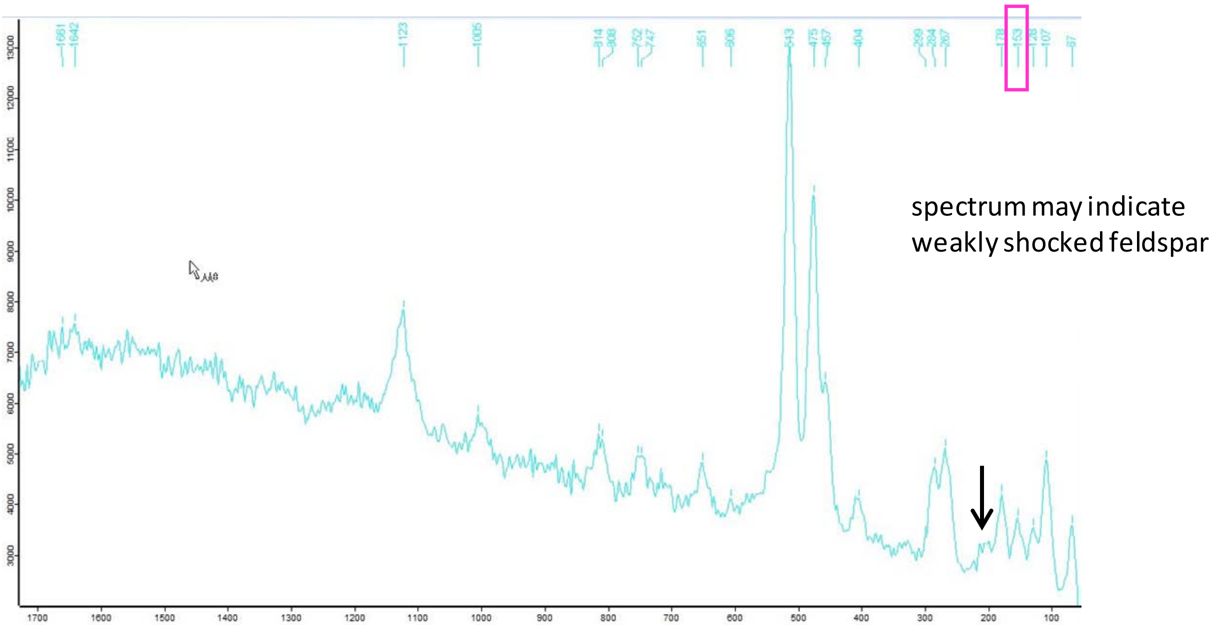
Sample Site 23 (1.Trip) = 49-C (2.Trip) → (same site !) : Stone 2_spectra 1 (white mineral)

Search in the RRUFF Database indicates : Orthoclase , Microcline , Labradorite (→ see search results)



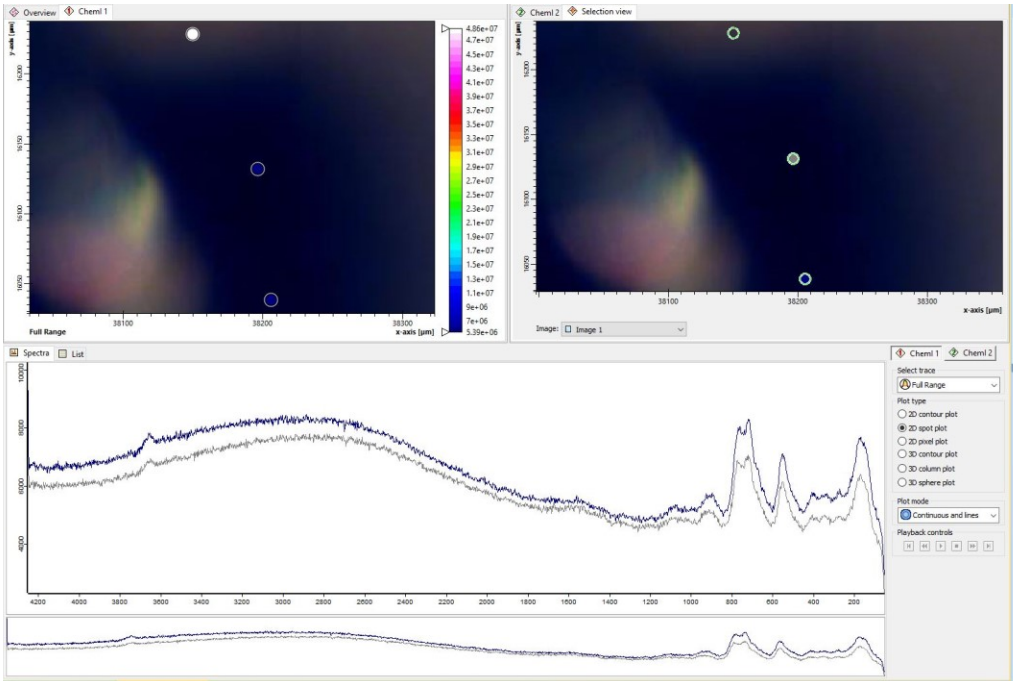
Sample :



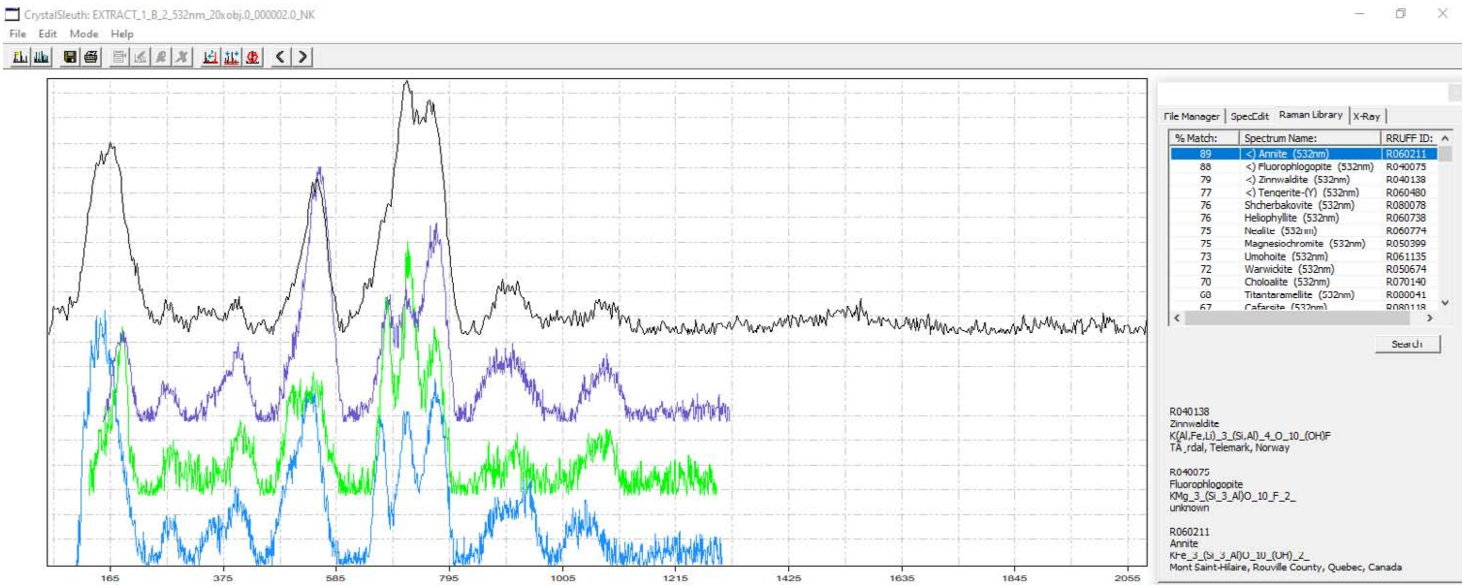


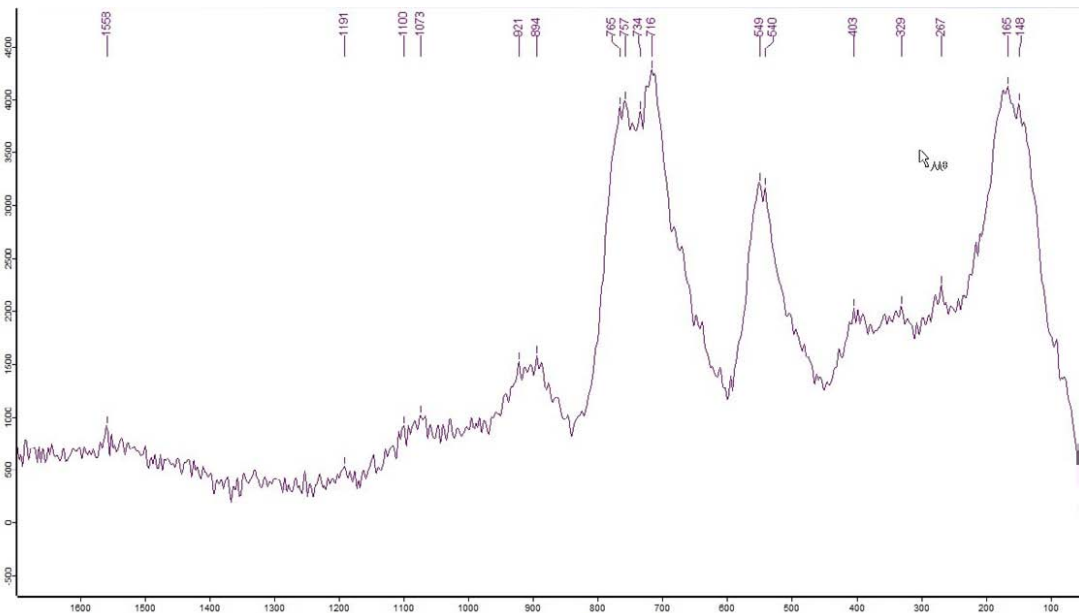
Sample Site 23 (1.Trip) = 49-C (2.Trip) : Stone 2_spectra 2 (dark mineral)

Search in the RRUFF Database indicates : Annite , Fluorophlogopite, Zinnwaldite   (→ see search results)



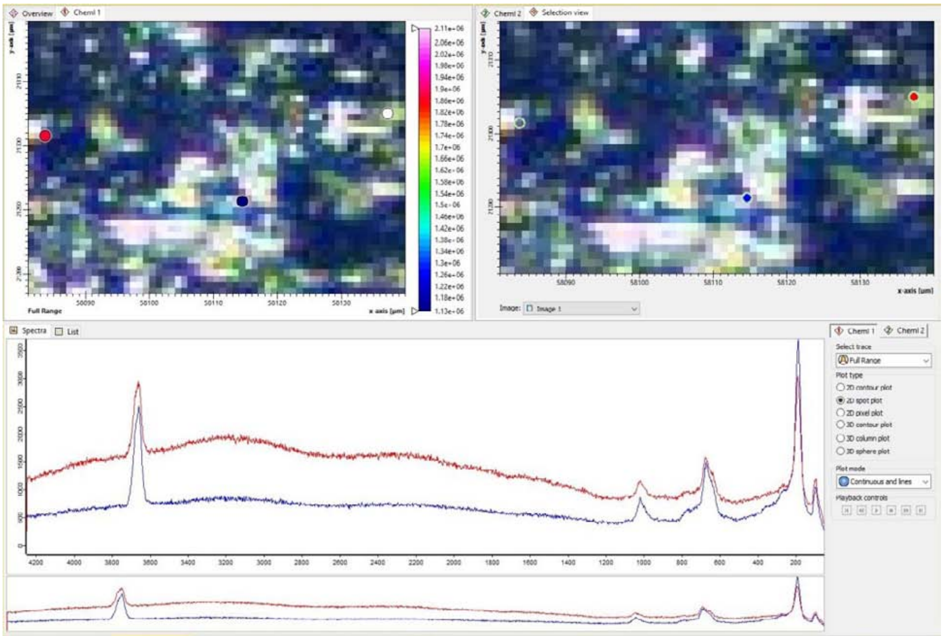
Sample :





Sample Site 23 (1.Trip) = 49-C (2.Trip) → (same site !) : Stone 1_spectra 1 (dark mineral)

Search in the RRUFF Database indicates : **Senarmonite , Jamesonite , Jagoite** and others (see search results)



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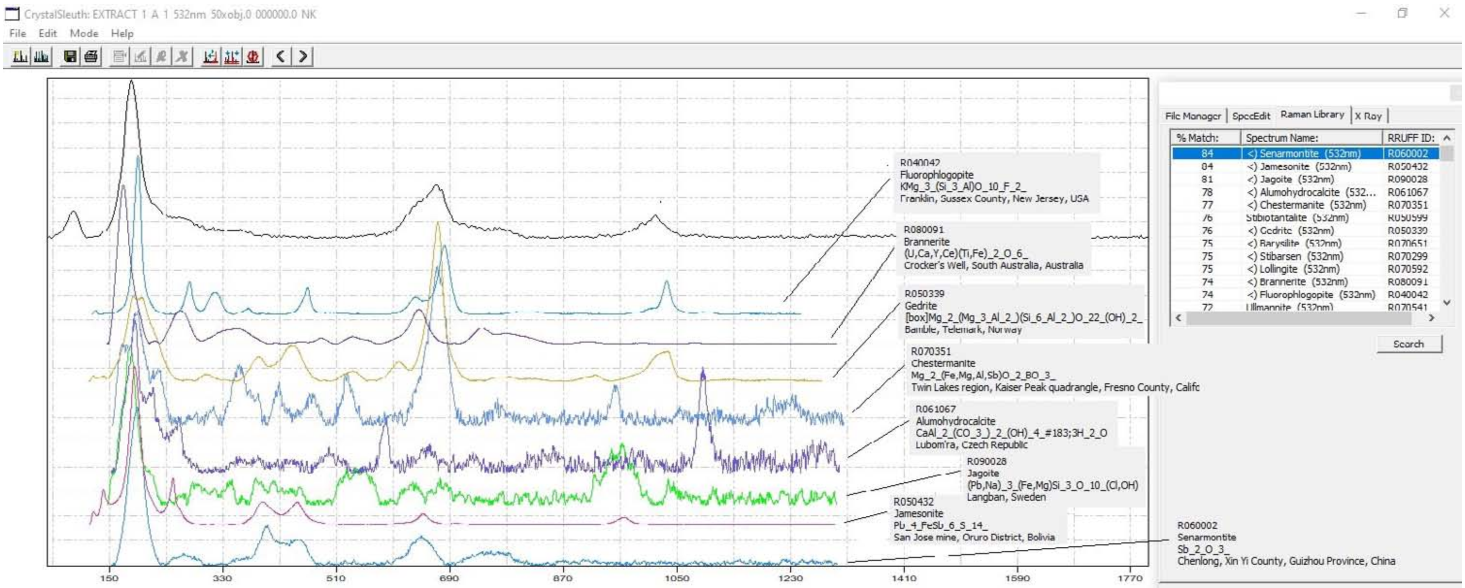
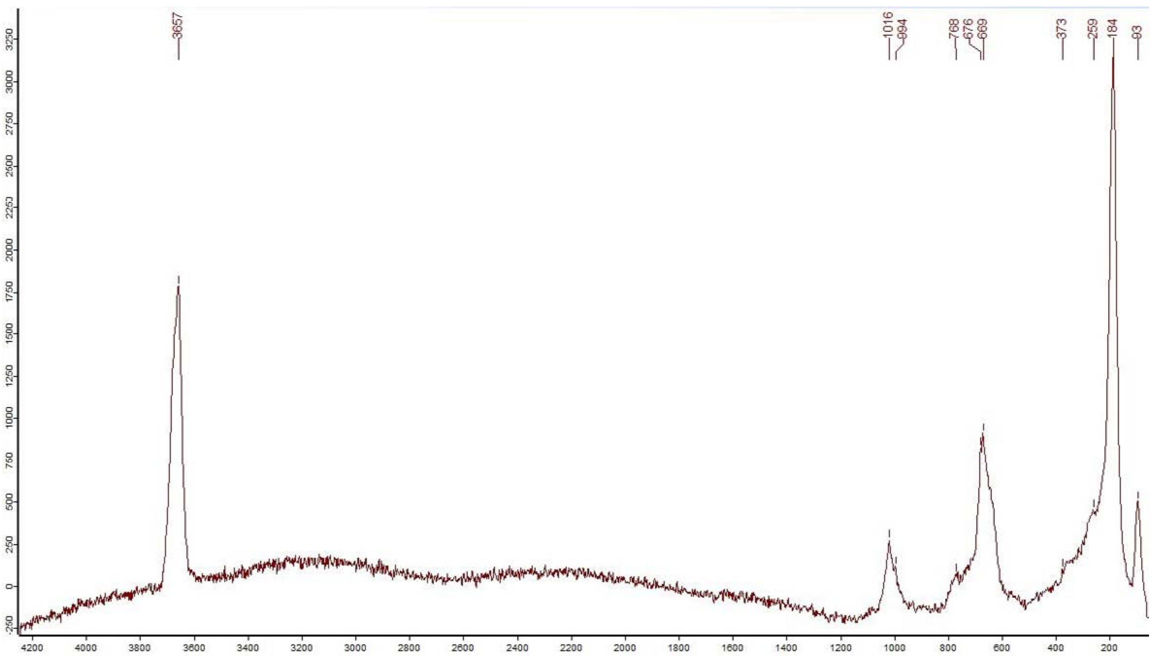
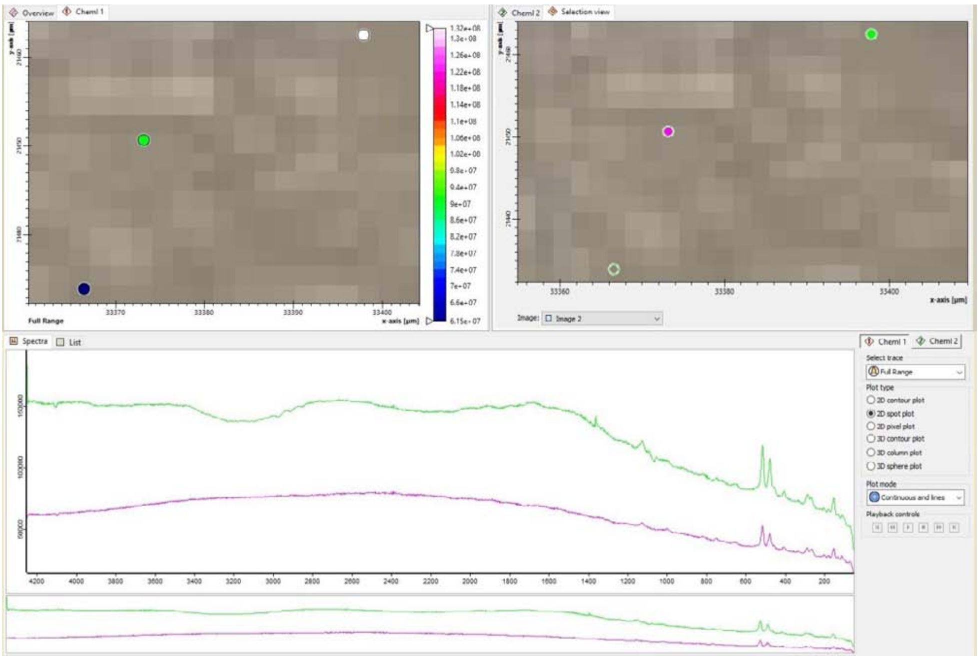




Sample Site 23 (1.Trip) = 49-C (2.Trip) → (same site !)   : Stone 1_spectra 2 (white mineral)

Search in the RRUFF Database indicates : Orthoclase , Microcline   (→ see search results)



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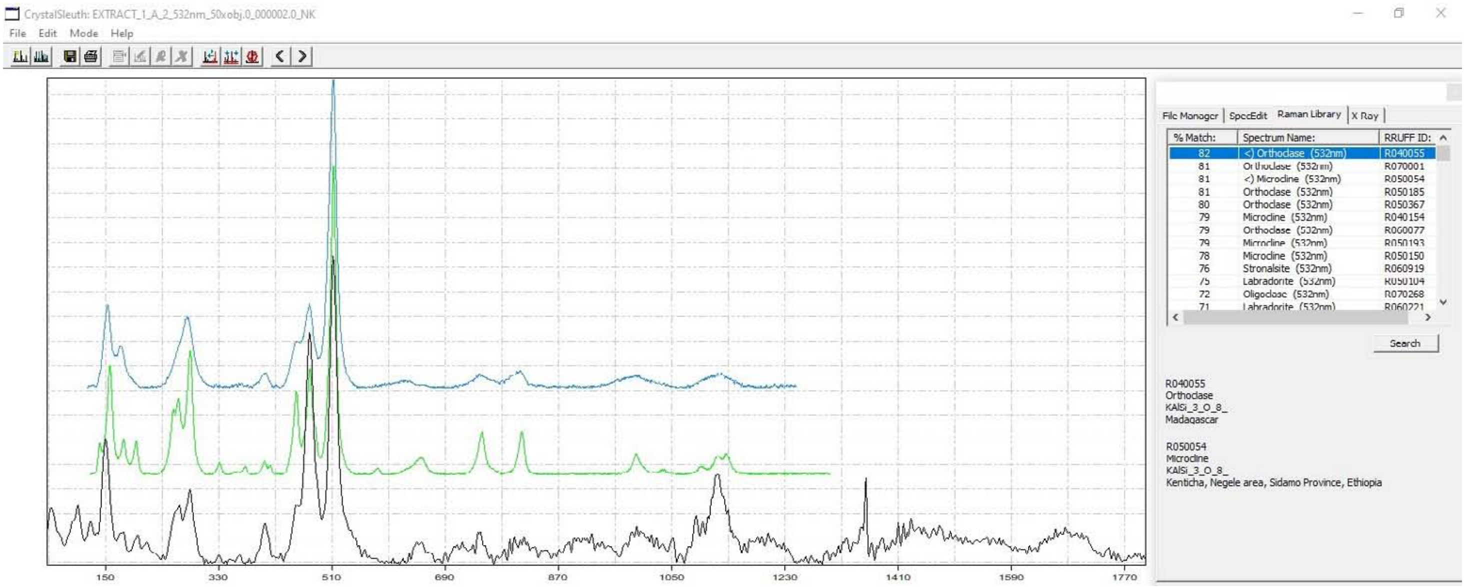
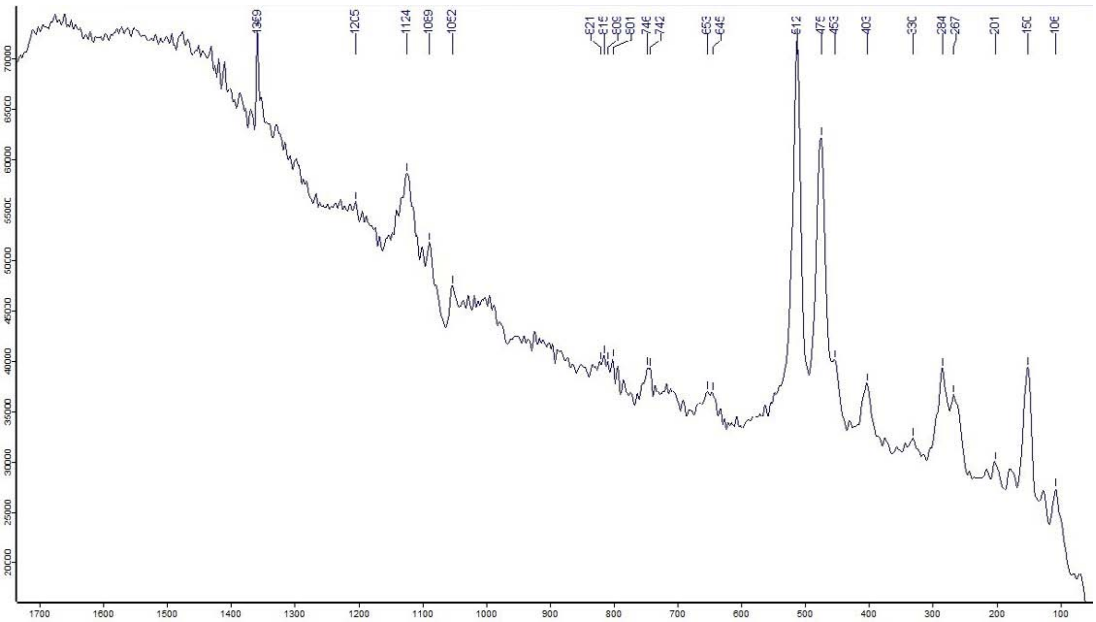
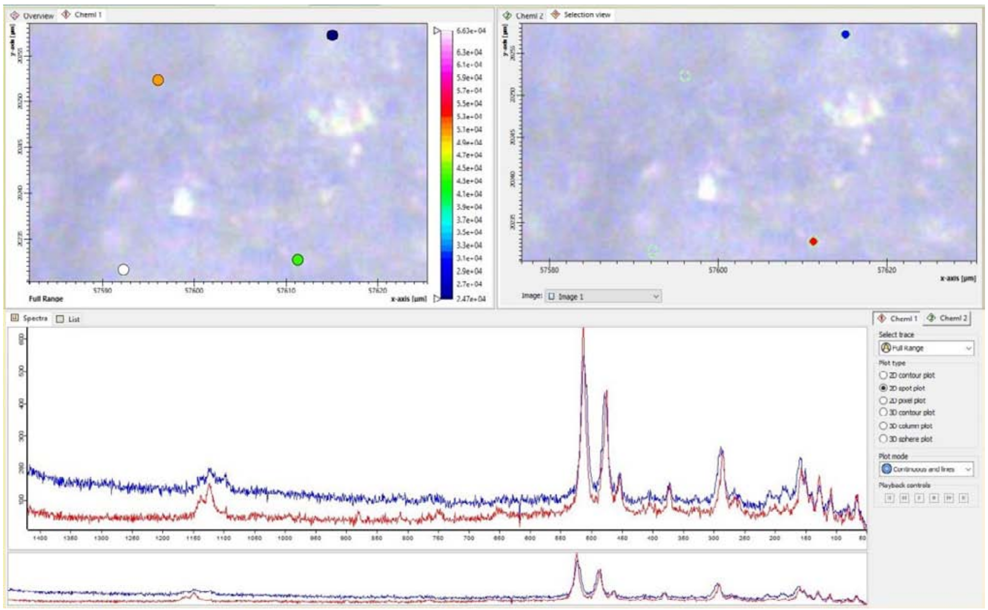


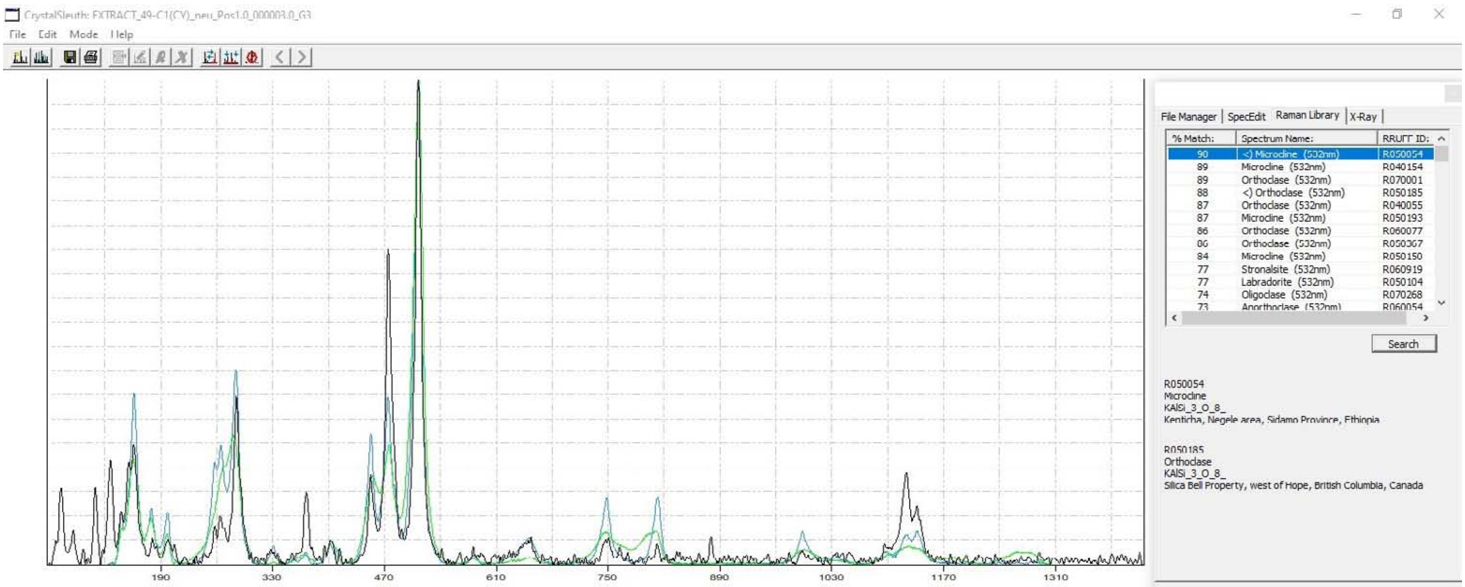


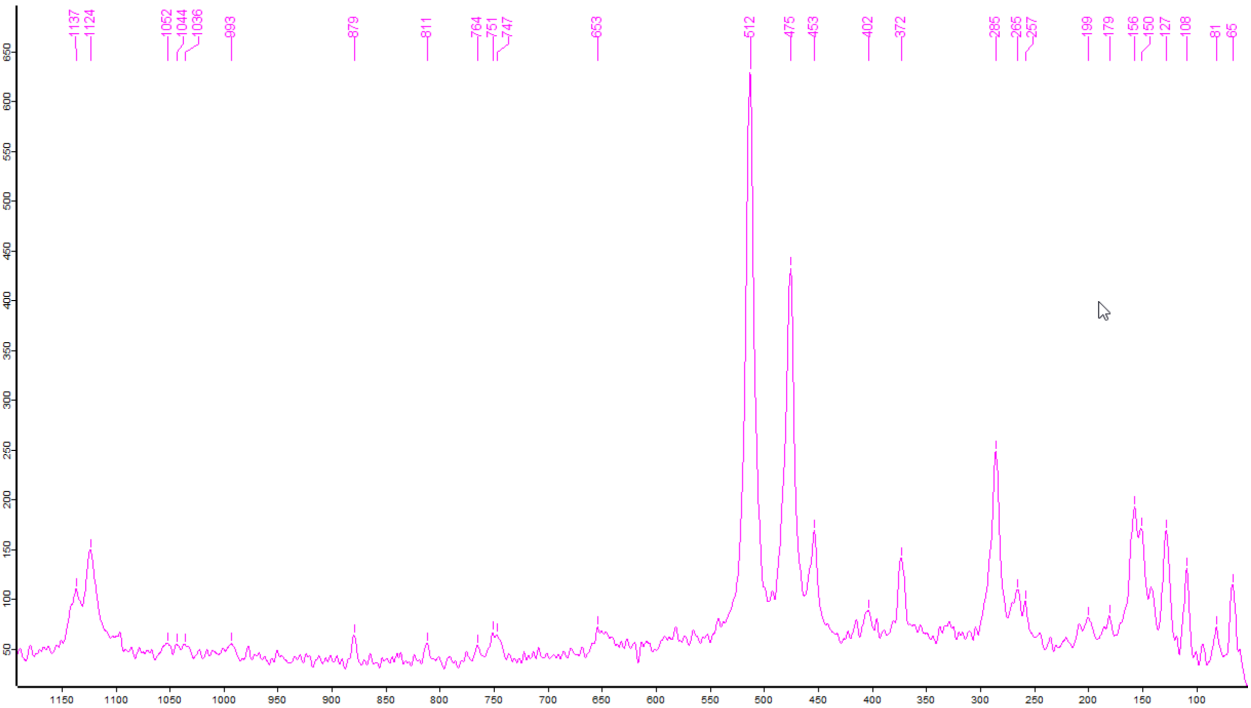
Sample Site 49-C (2.Trip) : Stone 1_spectra 1 (white mineral)

Search in the RRUFF Database indicates : Microcline , Orthoclase



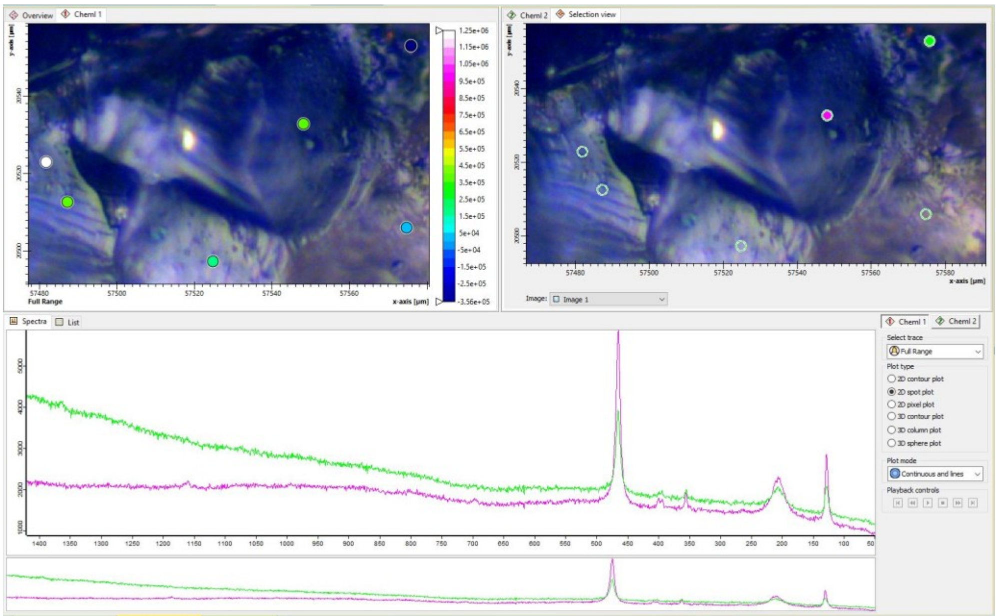
Sample :





Sample Site 49-C (2.Trip) : Stone 1_spectra 2 (dark mineral)

Search in the RRUFF Database indicates : Quartz



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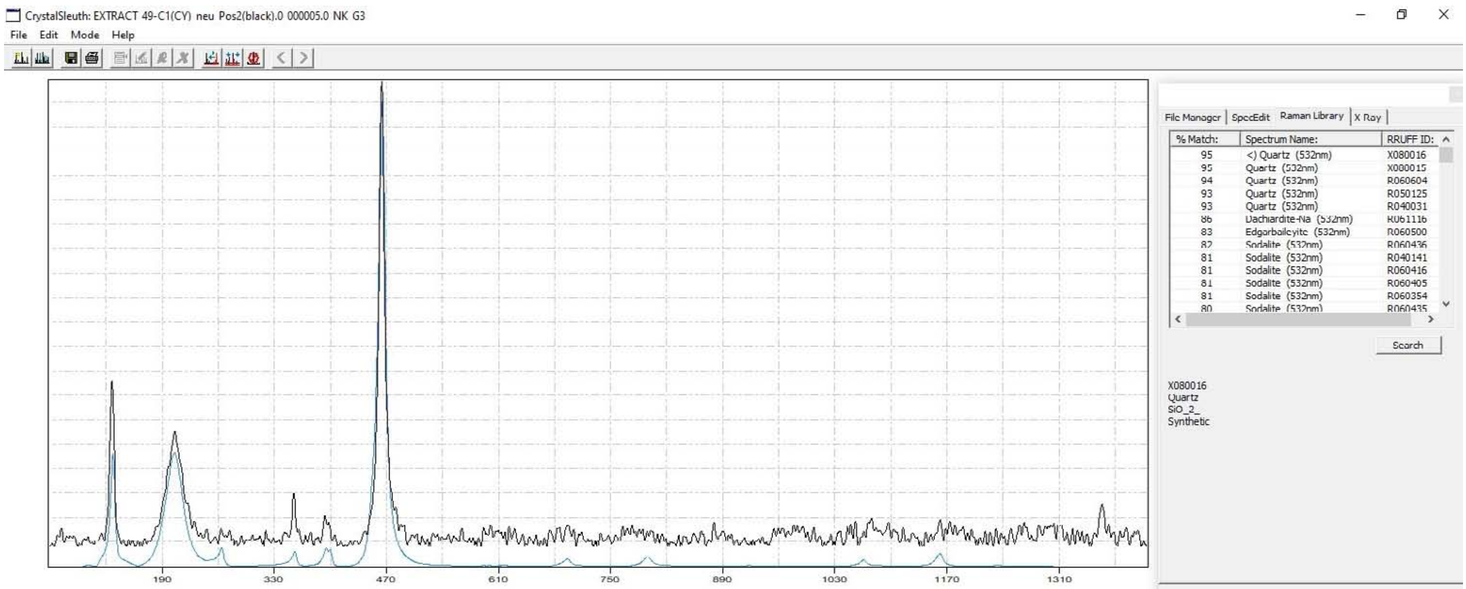
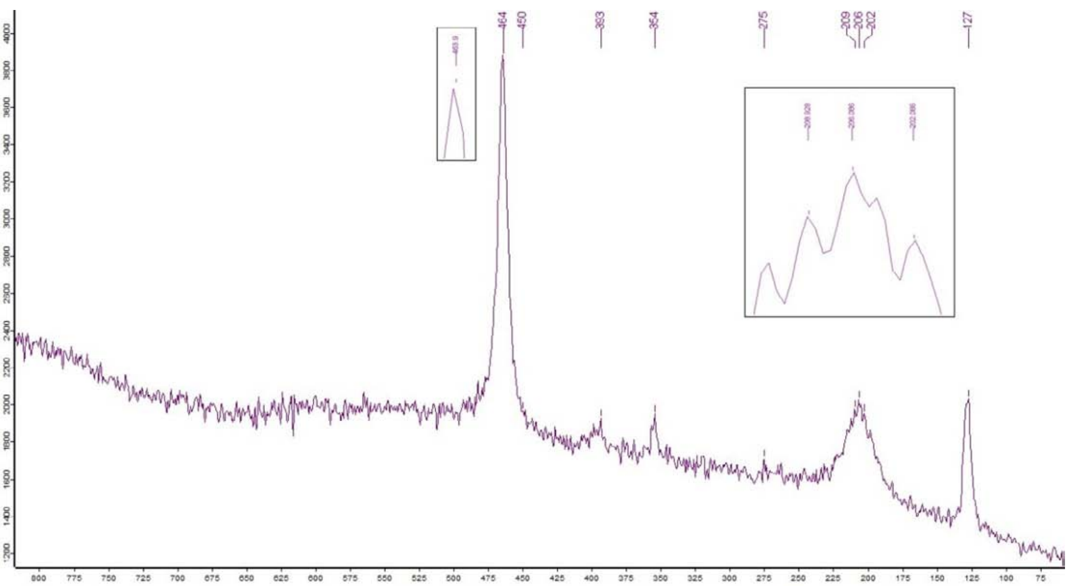
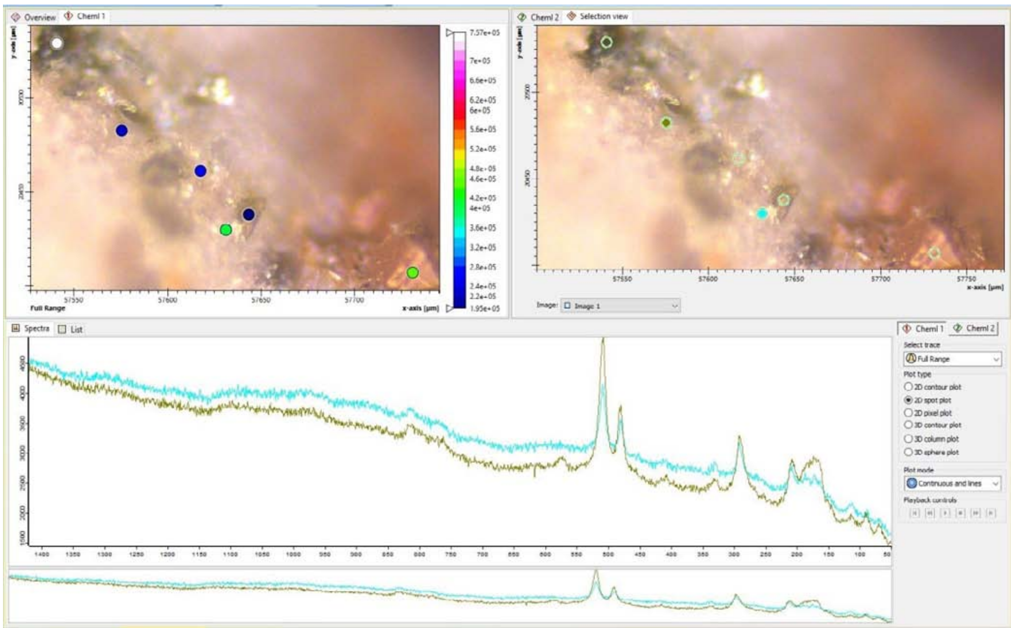


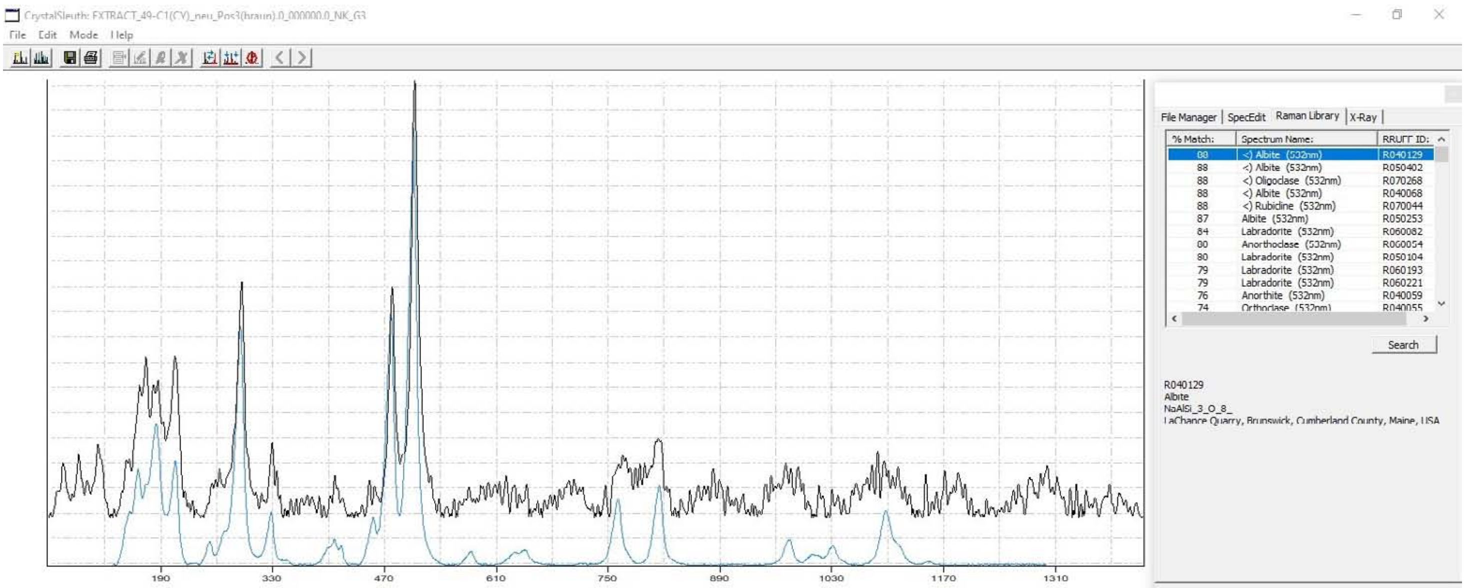


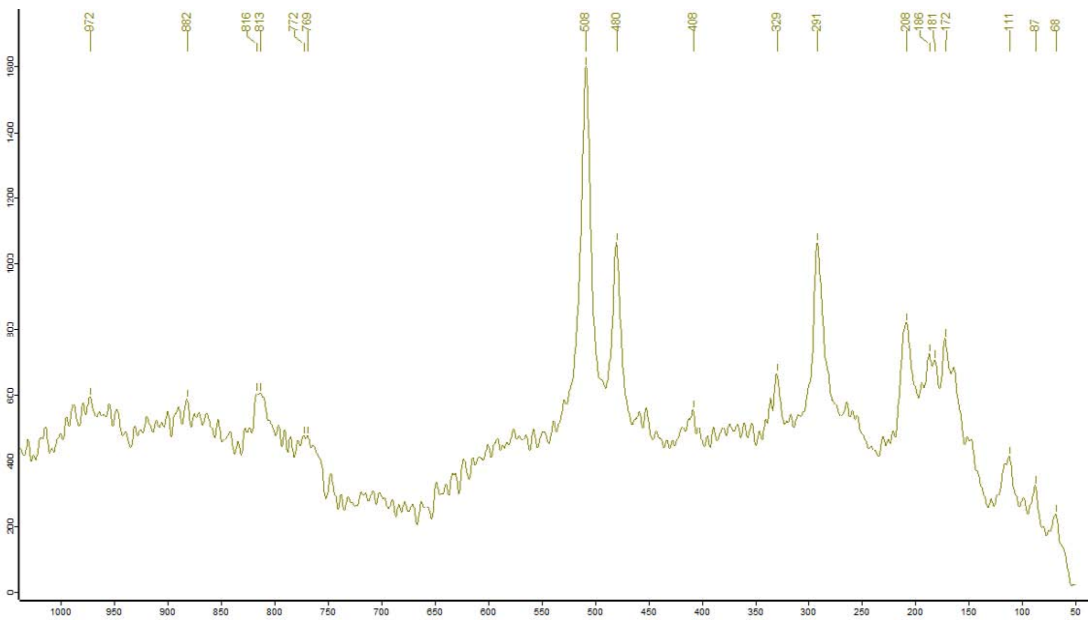
Sample Site 49-C (2.Trip) : Stone 1_spectra 3 (brown mineral)

Search in the RRUFF Database indicates : Albite



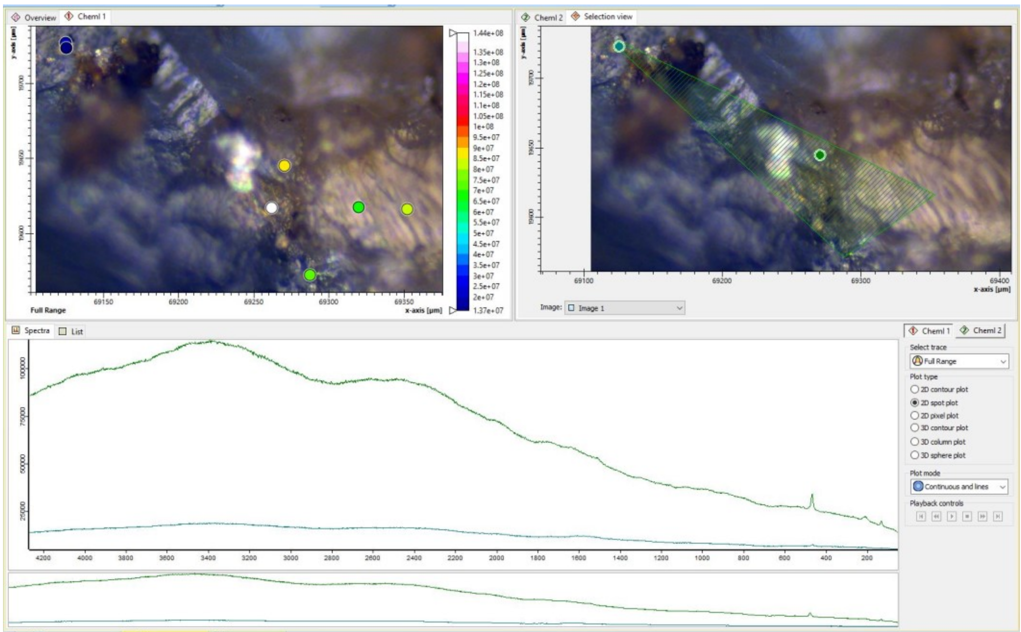
Sample :



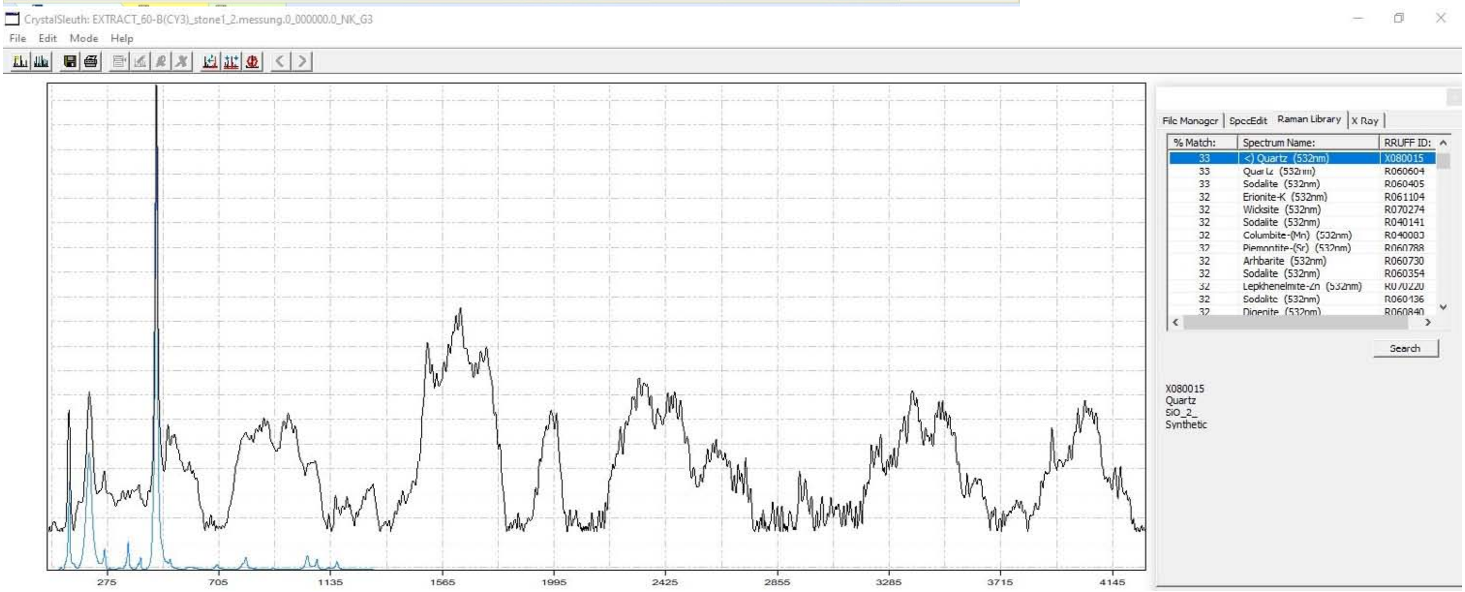


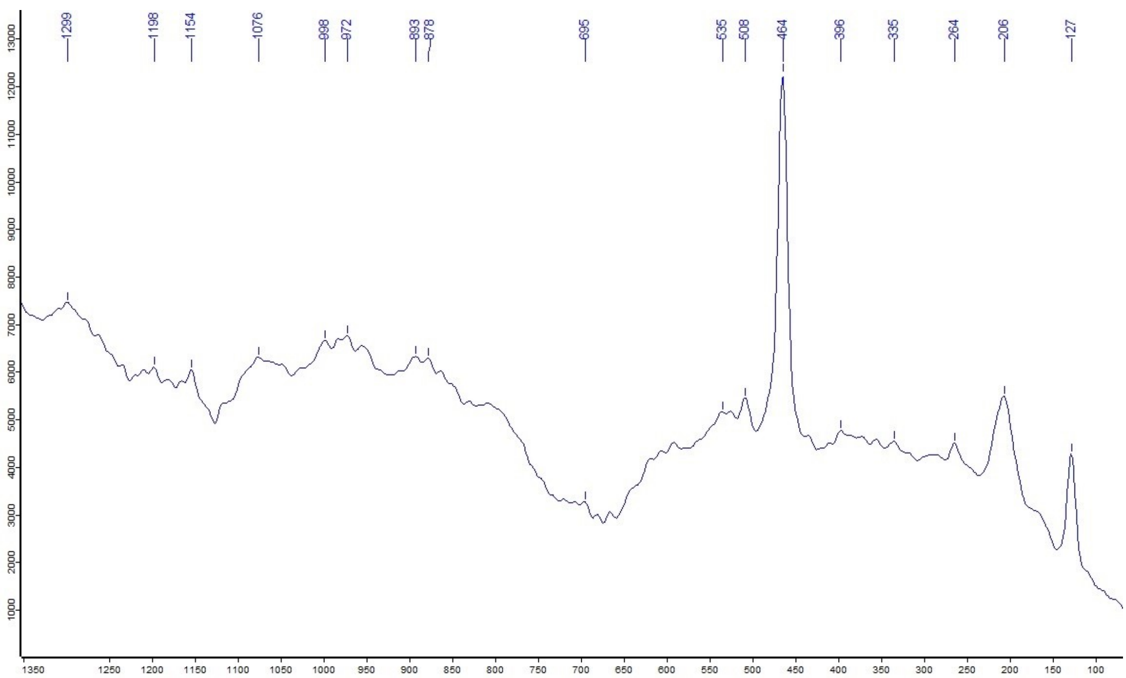
Sample Site 60-B (2.Trip) : Stone 1_spectra 2

Search in the RRUFF Database indicates : Quartz



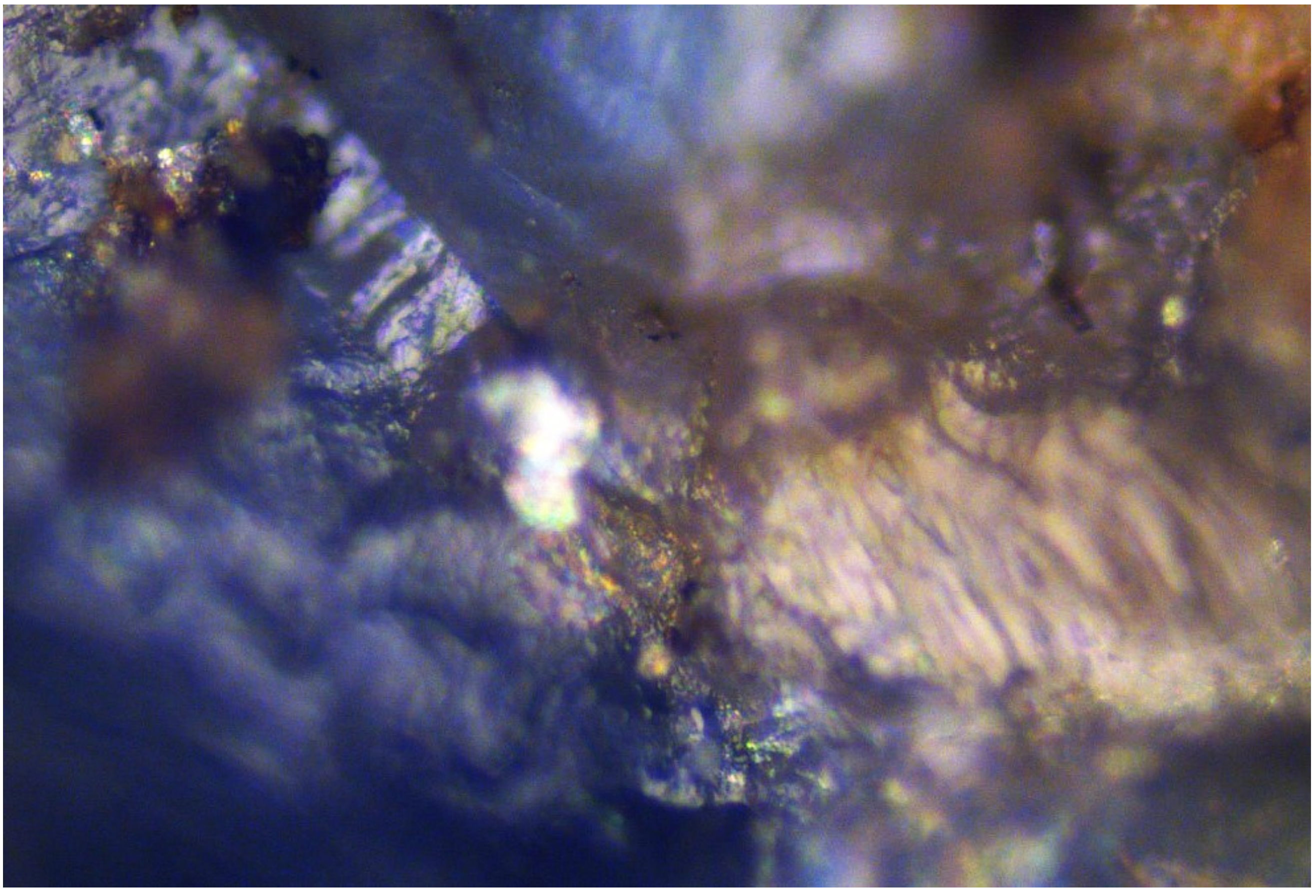
Sample :





Microscopic Image : Sample from Site 60-B → original state (no preparation for analysis)

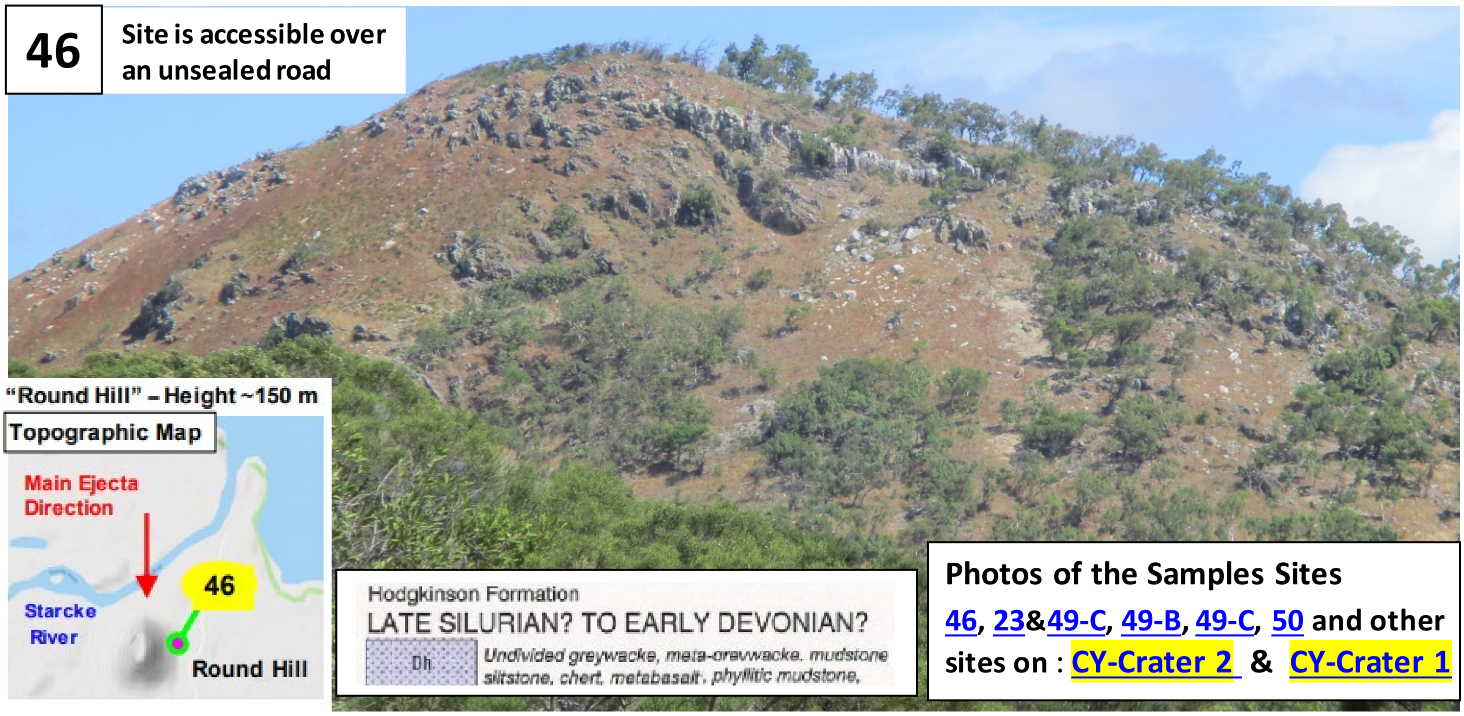
Sample Site 60-B Stone 1_spectra 2 : Quartz (white) - image size ~250 x 200 µm



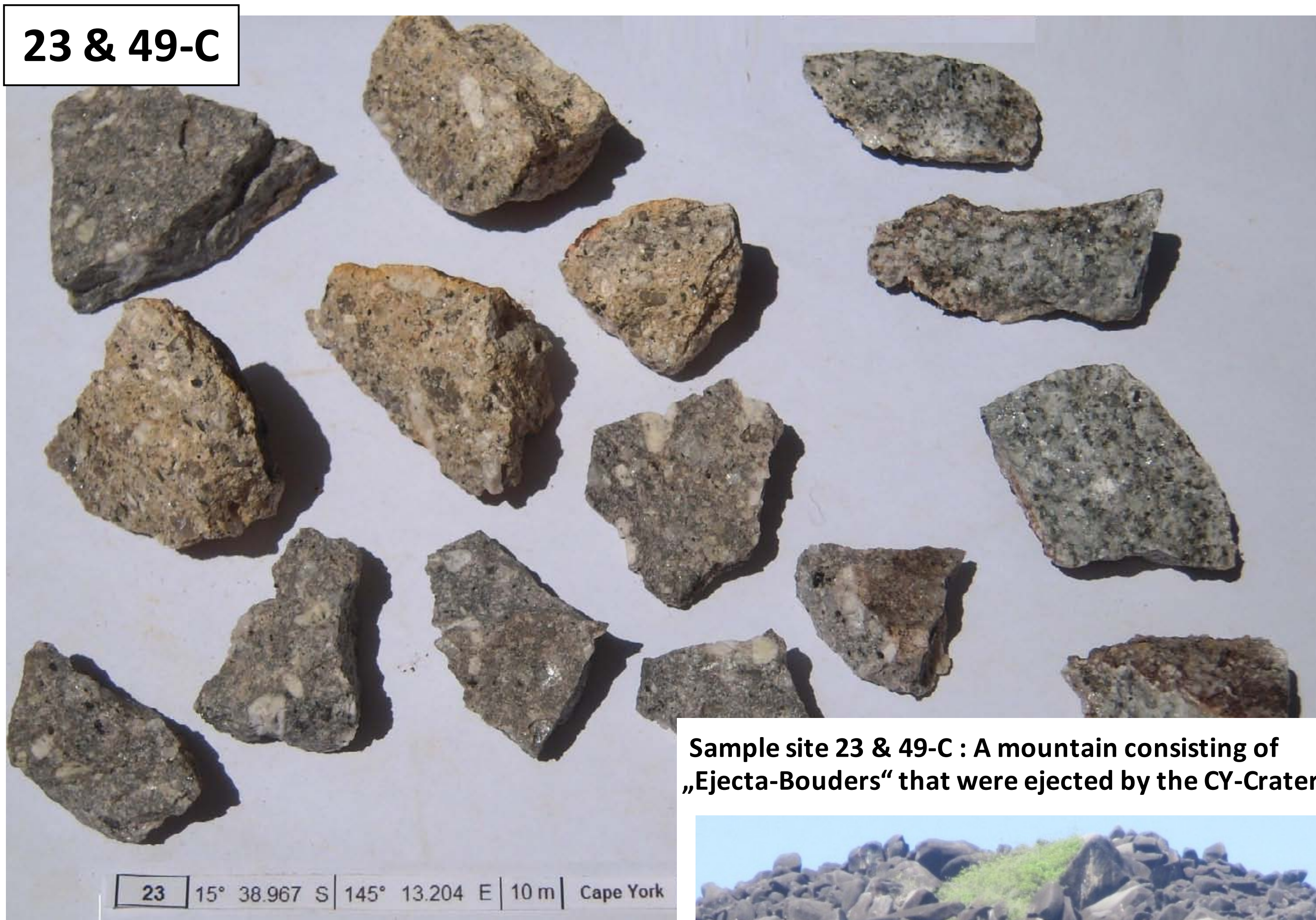
Appendix 1 : Photos of the rock samples from sample sites : 46, 23 & 49-C, 50, 60-B

Please note : Photos of the Samples Sites 46, 23 & 49-C, 50, 60-B and other sample sites are available on my website → weblink : Sample Sites : CY-Crater 2 & CY-Crater 1

Sample Site 46 is the closest sample site in relation to the Cape York Crater : Round Hill is a hill consisting of Silurian-/Devonian-age rock material which is > 400 million years old and was effected by impact shock waves of the Cape York Crater (CYC) impact event Therefore it should contain proof of the described Impact Event.



23 & 49-C



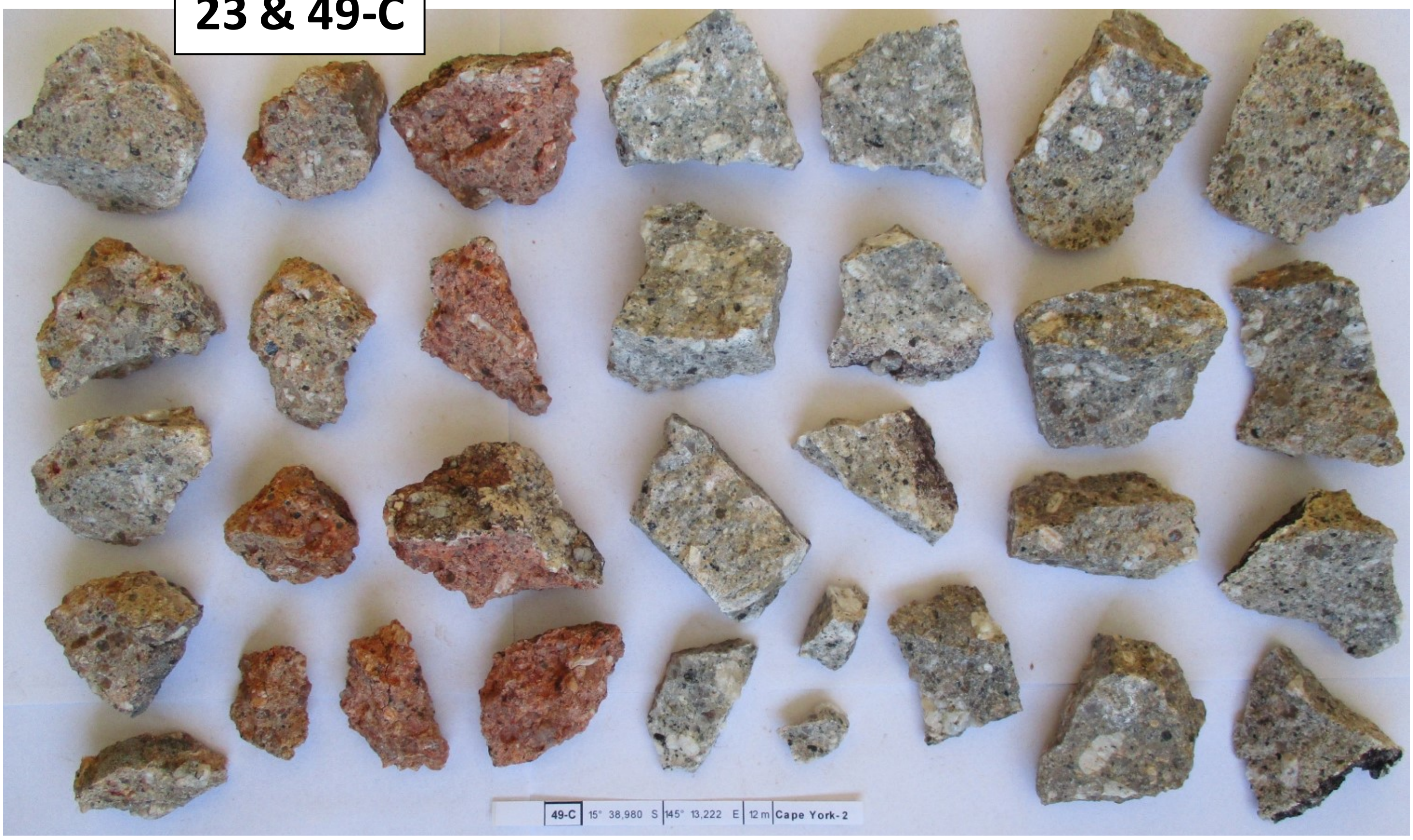
Sample site 23 & 49-C : A mountain consisting of „Ejecta-Bouders“ that were ejected by the CY-Crater

Trevethan Granodiorite (259 ± 1 Ma)

Note the age of the boulders ! It is very close to the Permian-Triassic Boundary

Pgyv	*Mainly white to grey, medium-grained, porphyritic, (orthopyroxene-) (clinopyroxene-) (hornblende-) biotite adamellite and granodiorite, with scattered mafic and gneissic enclaves* Yates Supersuite

23 & 49-C




50
50 | 15° 44,427 S | 145° 14,033 E | 10 m | Cape York-2


60-B
60-B | 17° 21,640 S | 146° 1,975 E | 12 m | Cape York-2

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

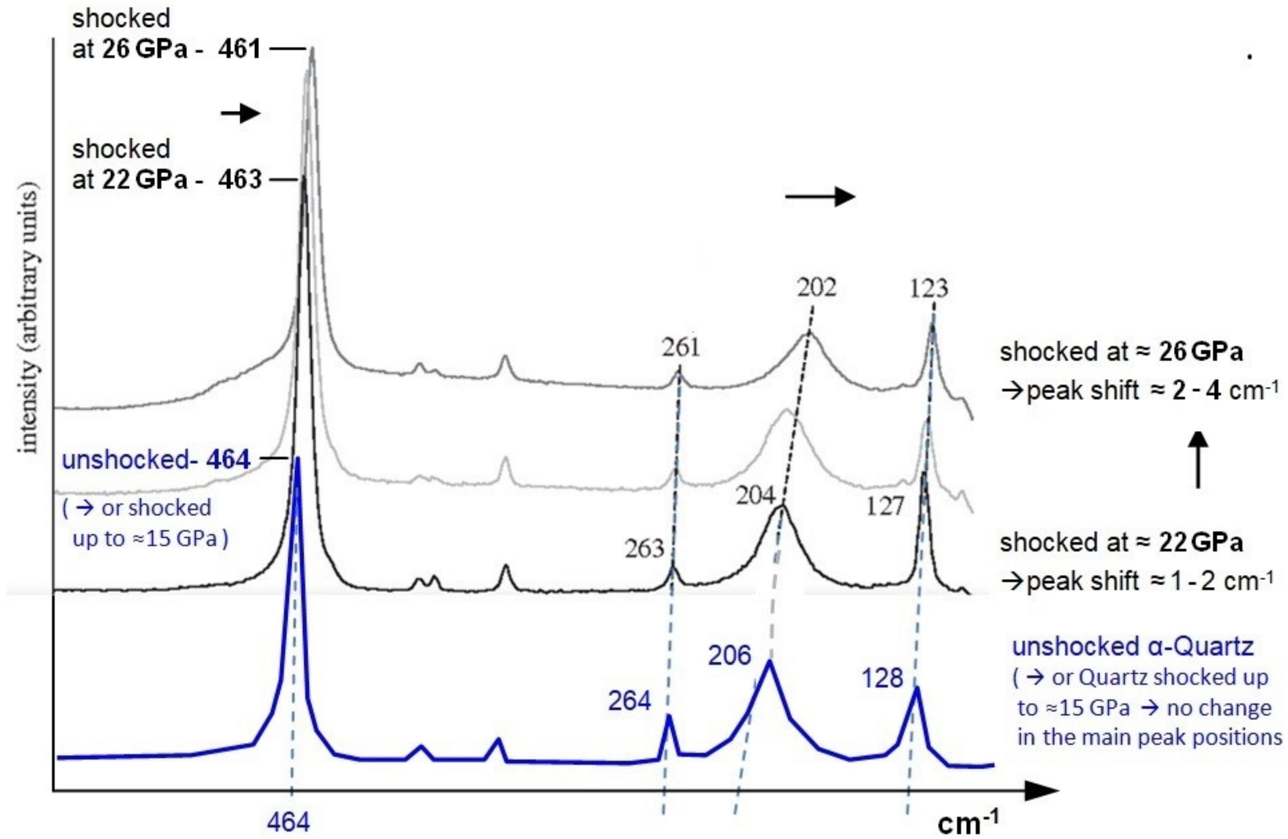
In order to verify a sample site as an impact site or impact structure, shock-metamorphic effects must be discovered in the rocks of the sample site. This can be done by different methods.

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

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

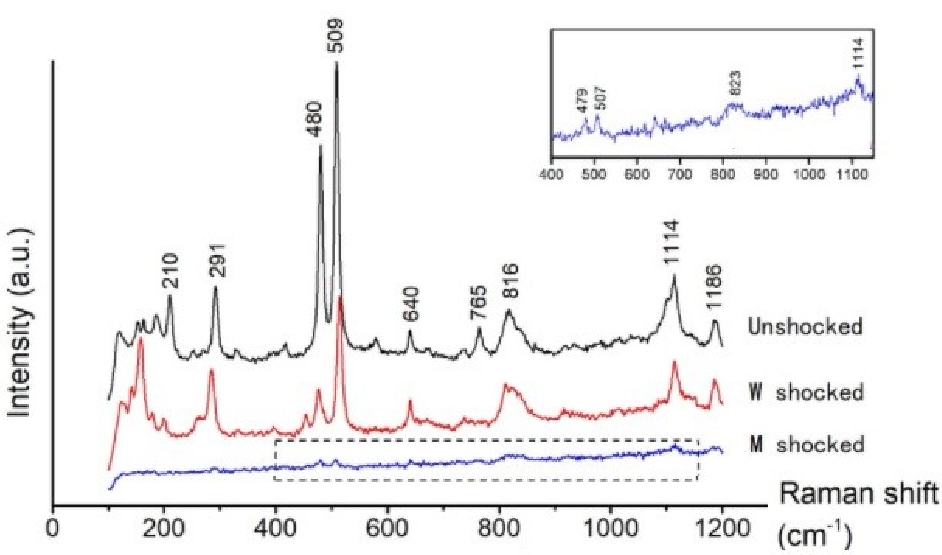
Mc Millan et al. (1992) and others have shown that the main RAMAN-peaks of Quartz shift towards lower frequencies if the Quartz was exposed the a shock-pressure > 15 GPa. → see diagram below

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



Quartz shocked with **22 GPa** and **26 GPA** shows shifts of the main RAMAN-peaks of 1 - 4 cm^{-1} to lower frequencies

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



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

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

References :

The 320 km Cape York Impact Crater and the Cape York Crater Chain in North-East Australia - by Harry K. Hahn
https://vixra.org/abs/2101.0136 alternative : https://archive.org/details/the-320-km-cape-york-impact-crater-in-ne-australia

Photos of all Sample Sites & Rock Samples are available on : CY-Crater 2 & CY-Crater 1 (or: CY-Crater 2 & CY-Crater 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

Shock metamorphism of planetary silicate rocks and sediments: Proposal for an updated classification system
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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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Shock-induced irreversible transition from α-quartz to CaCl2-like silica - Journal of Applied Physics: Vol 96, No 8
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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, …
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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
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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
https://www.hou.usra.edu/meetings/lmi2019/pdf/5086.pdf

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