Impact-area of an Ejecta-Ray from the Port Hedland Crater, located near Southern-Cross (Western Australia)

- **Raman Spectra of selected Rock Samples - ** by Harry K. Hahn, 30.12.2021 **-**

Summary :

The visited area is located near the small town Southern-Cross in Western Australia. The Gravity Anomaly Map indicates that **Ejecta-material from the assumed Ø 400 x 350 km Port Hedland Crater (Impact) in all probability impacted here and formed these linear structures.** The Port Hedland Crater is located north of the town Port Hedland on the sea-floor of the Indian Ocean. The Port Hedland Crater, which is unknown yet, in all probability is a large secondary crater caused by the Permian-Triassic Impact Event. Another possible source of the linear ejecta rays could be the Victoria Lake Impact (see map on next page)

For a detailed description of the Permian-Triassic Impact (PTI) Hypothesis please read **Part 1** (**P1**) of my hypothesis. And for more information to the Ø 400 x 350 km Port Hedland Crater (PHC) please read pages 14-16, 20-21 and 24-27 of **Part 3** (**P3**) and page 33 of **Part 2** (**P2**) of my hypothesis.

The geological map identifies the nearly linear structures as structures (low mountain ranges) which consist of different rock types than the surrounding plains of the Yilgarn Craton. These linear structures seem to penetrate the Yilgarn Craton down to a depth of around 6 km (see geologic cross-section A-B)

I have collected some rock-samples from these nearly linear structures in the Southern-Cross area and have analysed these samples, mostly quartz, with Micro-Raman-Spectroscopy, to find out if they were exposed to a shock pressure which may indicate an Impact Event. And indeed that seems to be the case !

The Raman-spectra of quartz from the Sample Sites 1, 9, 16 and 18 provide first evidence for an impact event as the probable cause of the linear ray-structure in the Southern-Cross area.

The clear shifts of the main Raman peaks, of the analysed quartz samples, to the lower frequencies 463, 261, 204 and 126 cm^{-1} (Site 1), to 463, 261 and 205 cm^{-1} (Site 9 & 16) and to 463, 261, 204 and 125 cm^{-1} (Site 18) provide first proof for an Impact Event as the cause of the linear ray-structure !
(→see explanation in **Appendix 1** at page **25** : Overview : The Raman bands (peaks) of shocked Quartz)

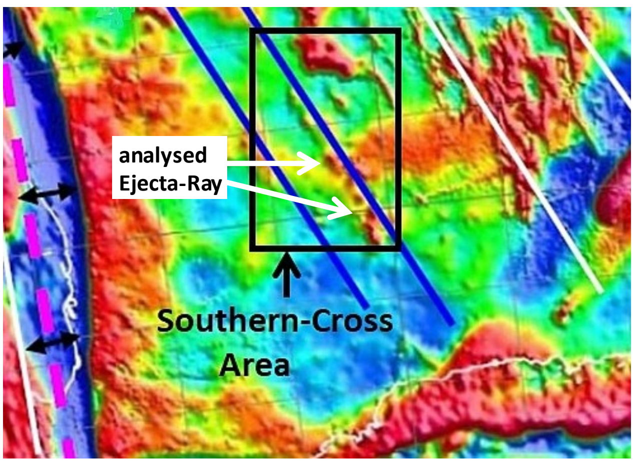
Microscopic images of some analysed quartz grains **seem to provide further proof for a shock event.** PDFs (planar deformation features) seem to be present in some samples (→ images on **pages 4 to 11**)

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

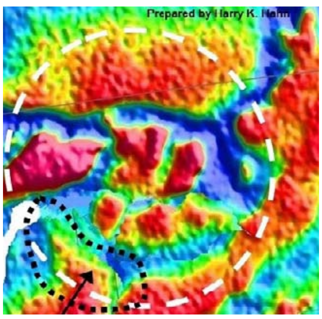
→ Images of the analysed rock samples and photos of the sample sites are in the Appendix at **page 18**.
→ More images of all sample sites are available on www.permiantriassic.de or www.permiantriassic.at
→ **References : see page 26** / and pages 14-16, 20-21 and 24-27 of **Part 3** (**P3**) of my hypothesis.

Note : A shock pressure of 20 GPa exceeds every pressure caused by normal terrestrial metamorphism. The indicated shock pressures of ≈20-22 GPa therefore in general point to an impact shock event.

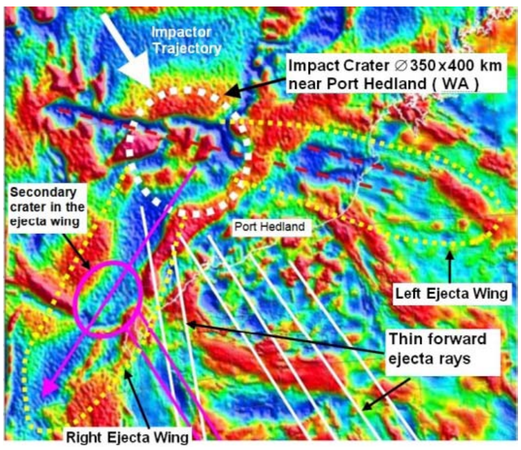
Gravity Anomaly Map of Southern-Cross area

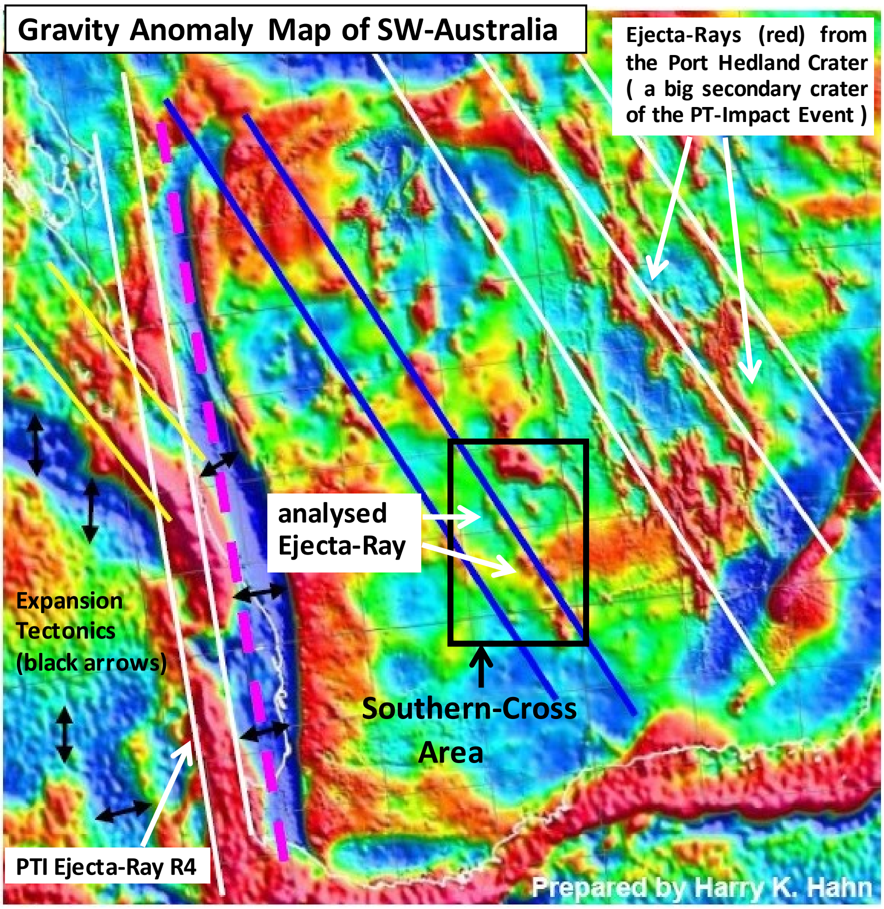


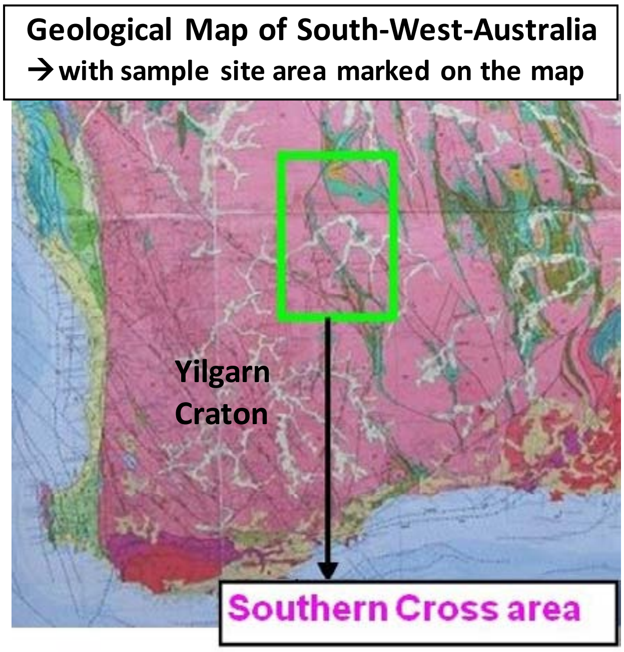
Ø 400 x 350 km Port Hedland Crater



Port Hedland Crater (= Bengal Bay Crater) + surrounding area (Gravity Anomaly Map)

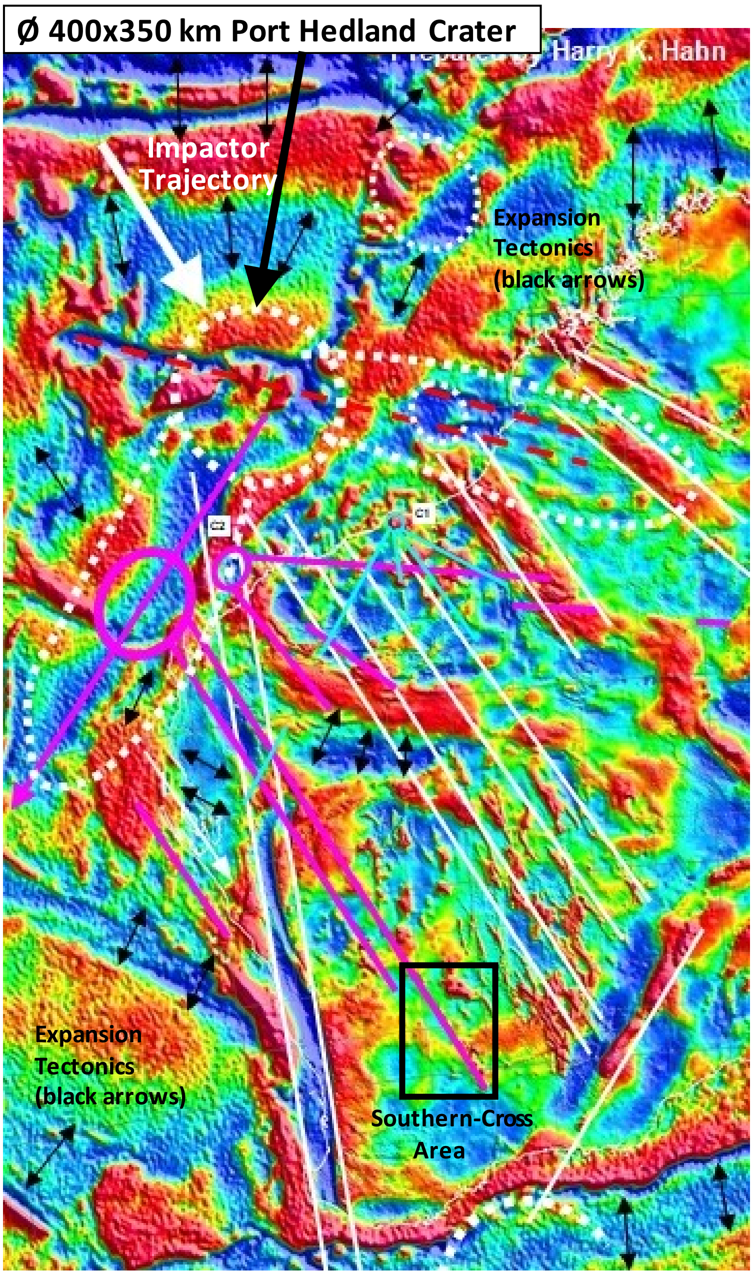


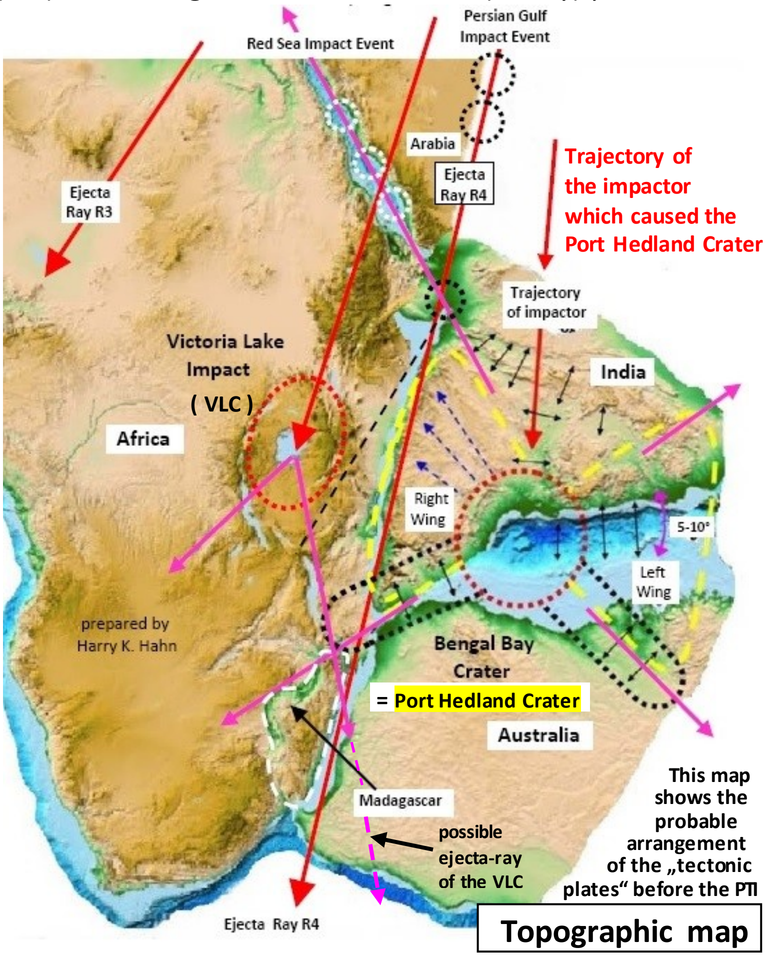




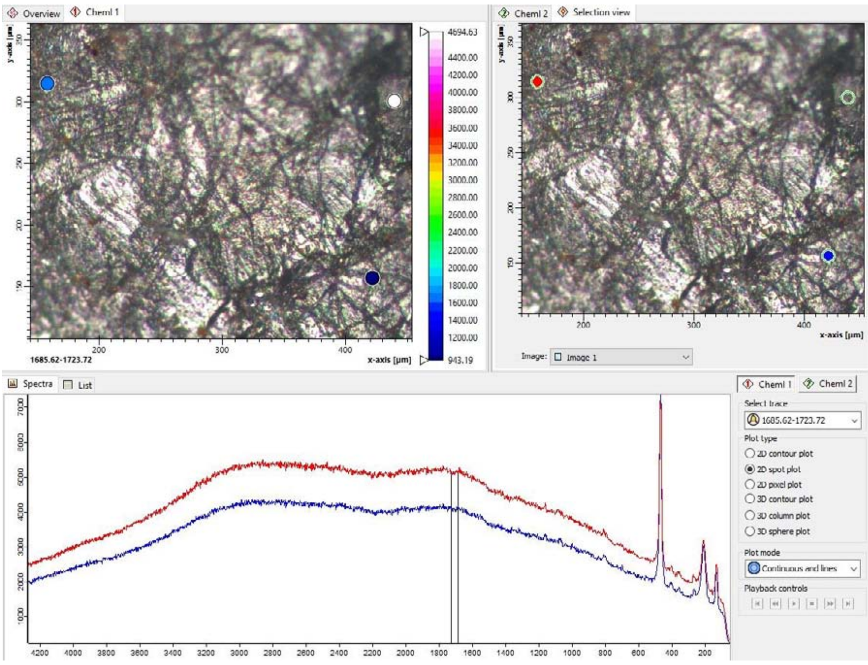
The Ejecta-Ray area near the town Southern-Cross is marked in green on the Geological Map above

The thin ejecta-ray-structures visible on the gravity anomaly map of Western Australia as linear red (positive) anomalies, were caused either by the **Ø400x350km** Port Hedland Crater (=Bengal Bay Crater) or by the Victoria Lake Impact Crater. According to my Permian-Trassic Impact (PTI) hypothesis the Port Hedland Crater (PHC) is a big secondary-crater caused by the **PT-Impact Event**, which is also responsible for the formation of the Bengal Bay (= Bengal Bay Crater) The topographic map below shows the original situation at the time of the PT-Impact Event. The gravity anomaly map indicates a number of linear eject-ray-structures (red) on the Yilgarn Craton which are (nearly) parallel

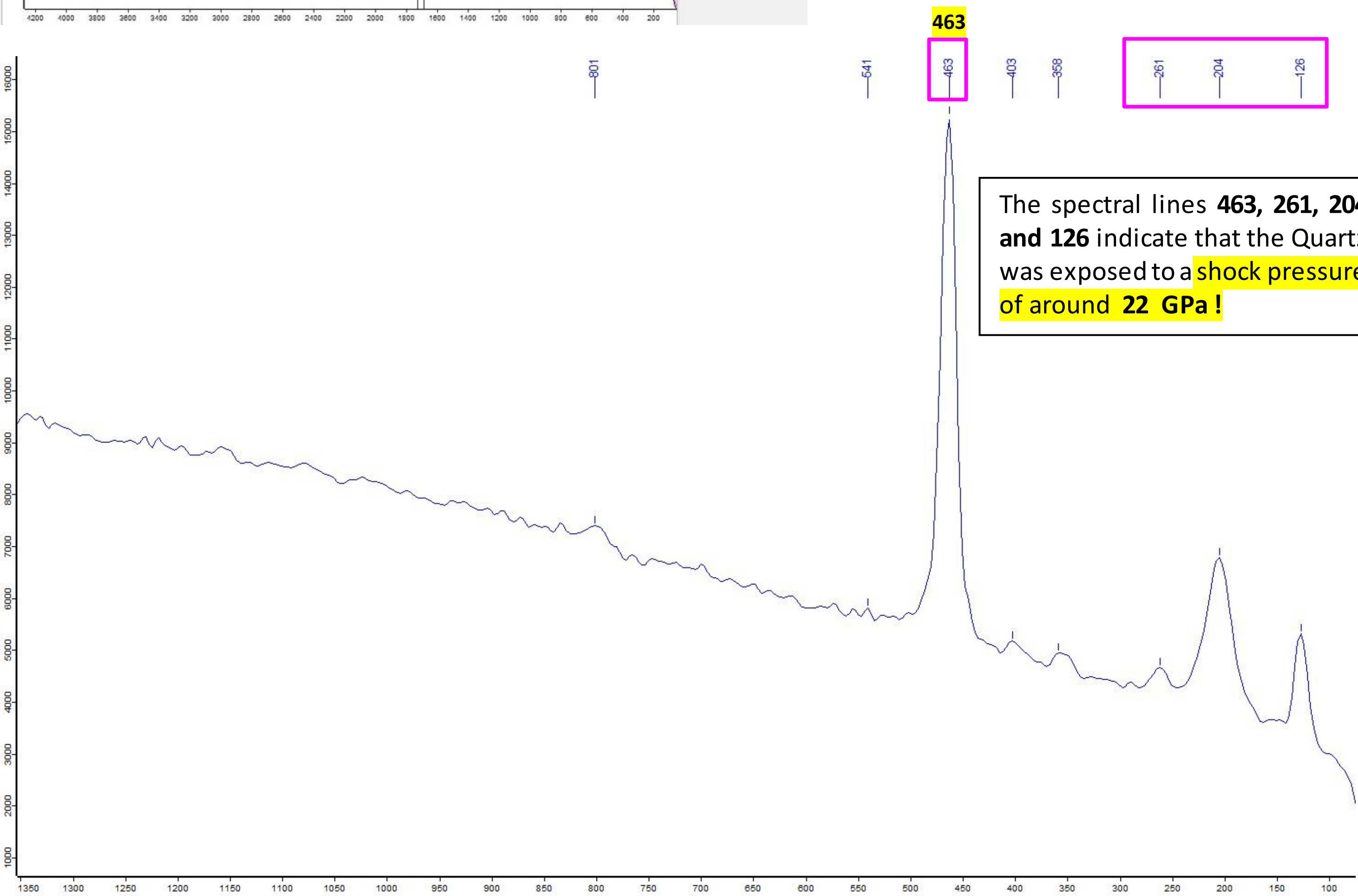




Sample Site 1 : Stone 1_spectra 1 indicates : Quartz

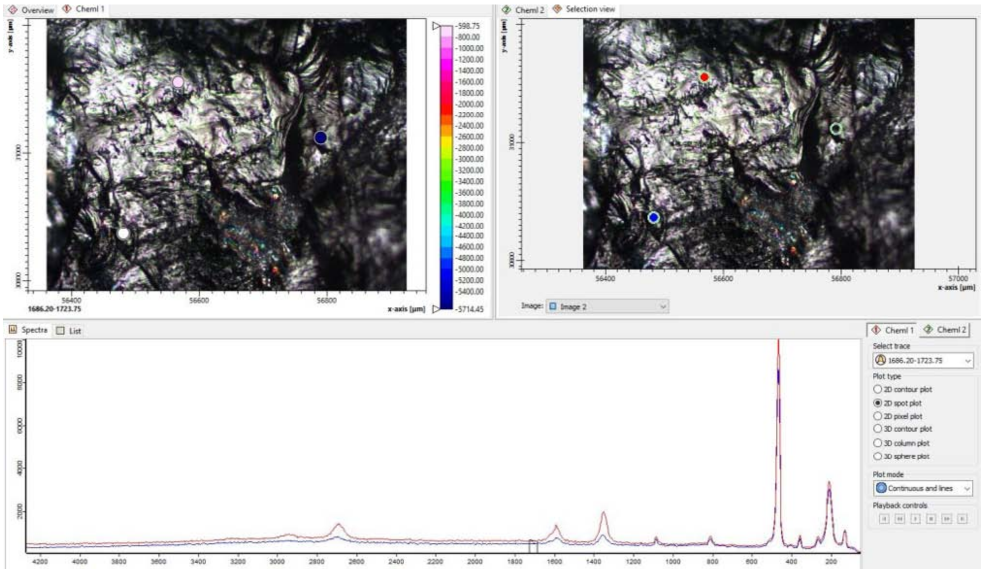


Sample :

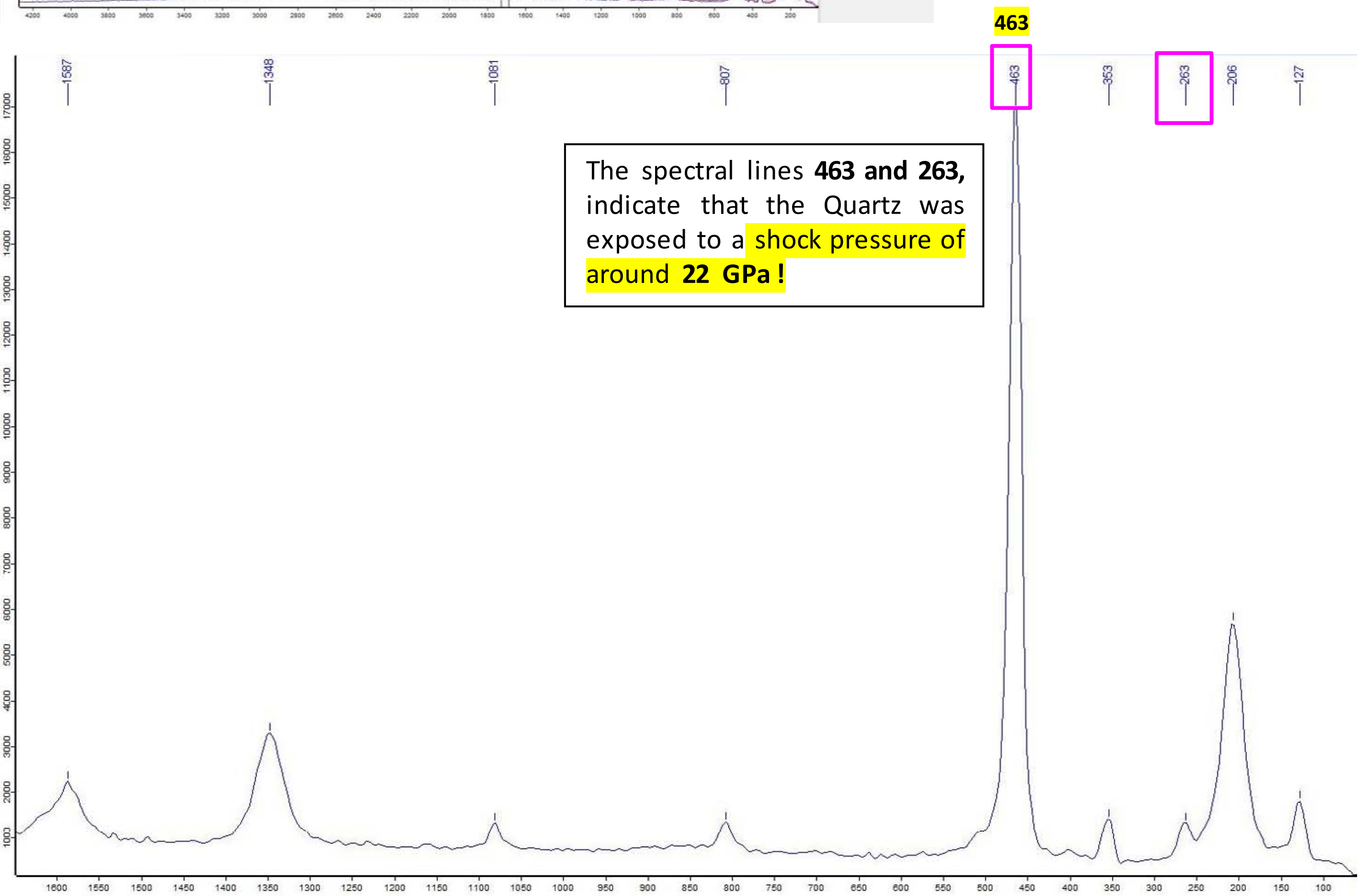


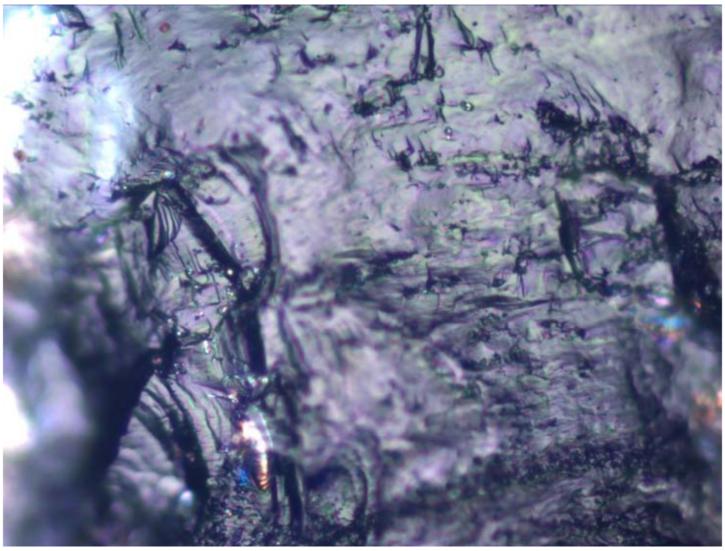
The spectral lines **463, 261, 204 and 126** indicate that the Quartz was exposed to a shock pressure of around **22 GPa !**

Sample Site 1 : Stone 2_spectra 1 indicates : Quartz



Sample :



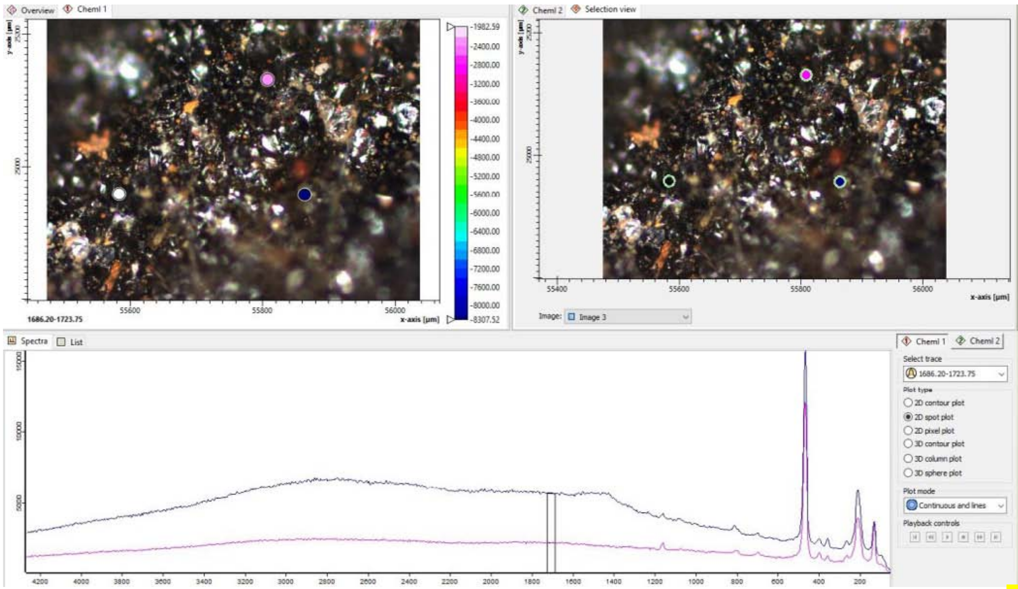


Sample Site 1: Stone 2 : Quartz

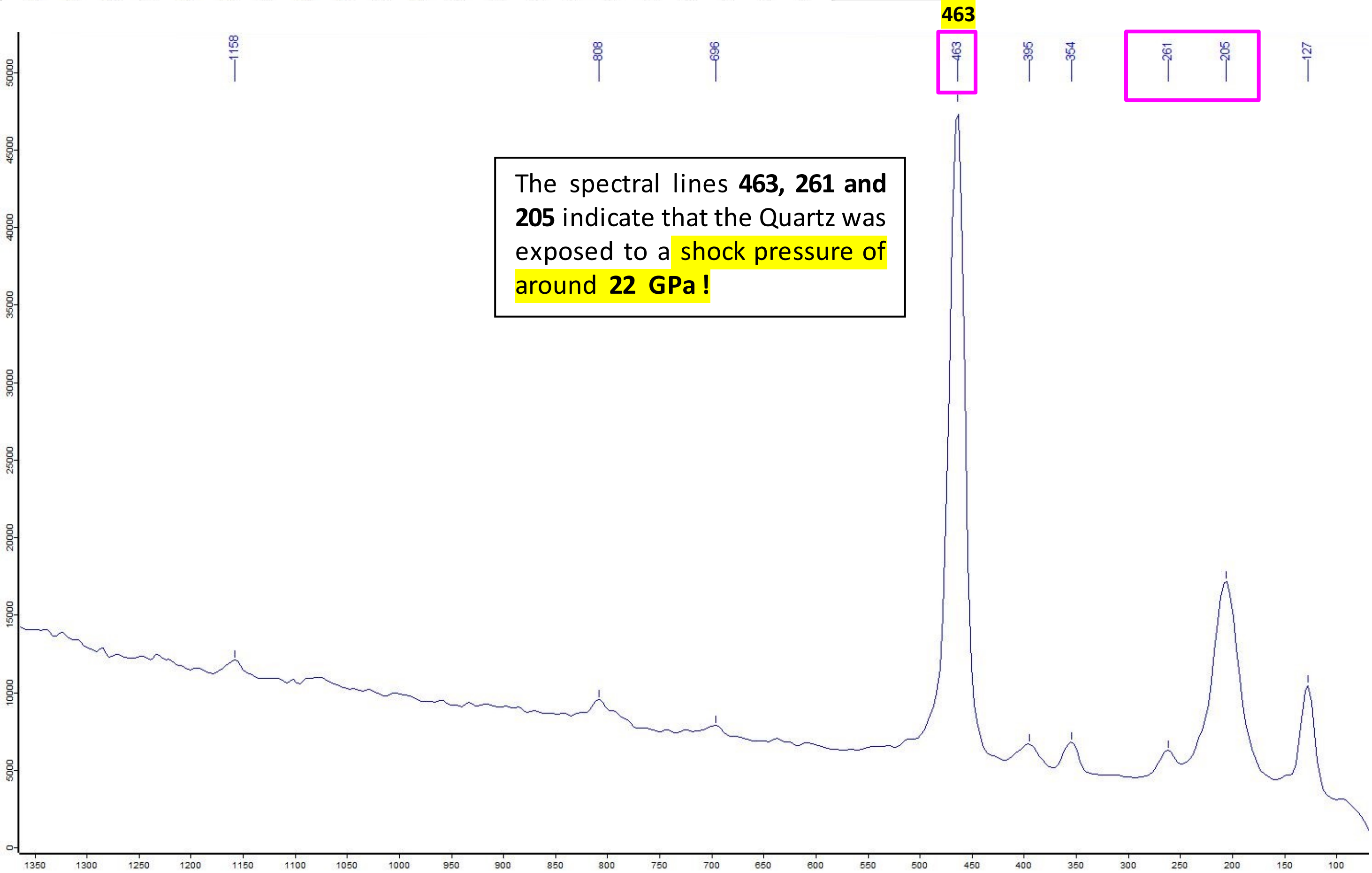
Detail of Microscopic Image

Image size : ~ 250 x 200 µm

Sample Site 9 : Stone 1_spectra 1 indicates : Quartz

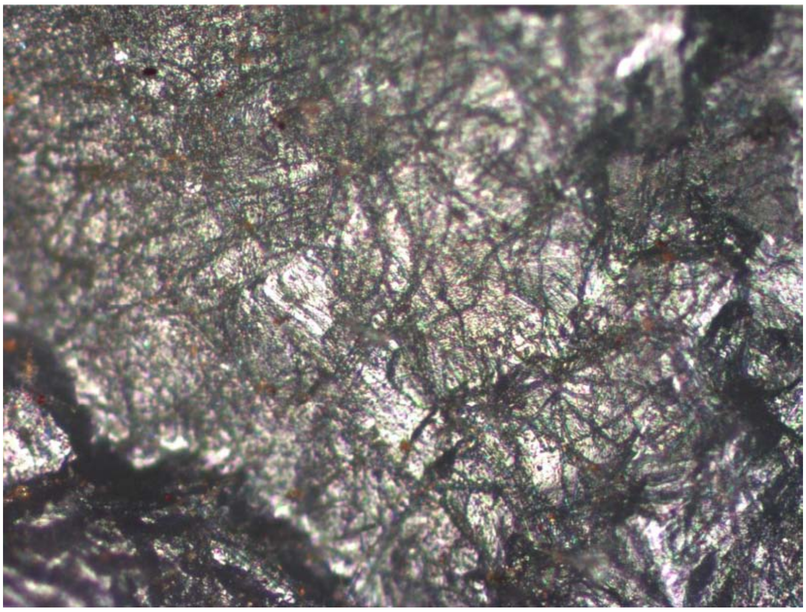


Sample :

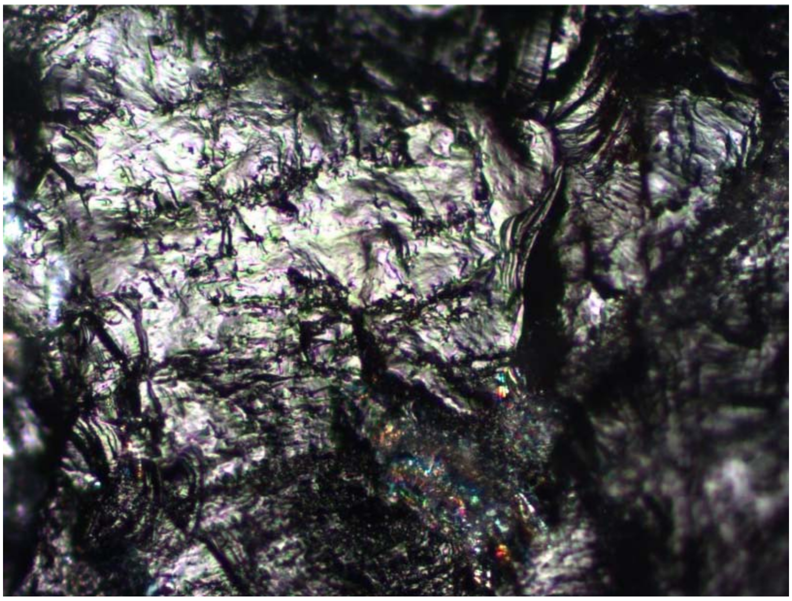


Microscopic Images : Sample from Site 1 and 9 → original state (no preparation for analysis)

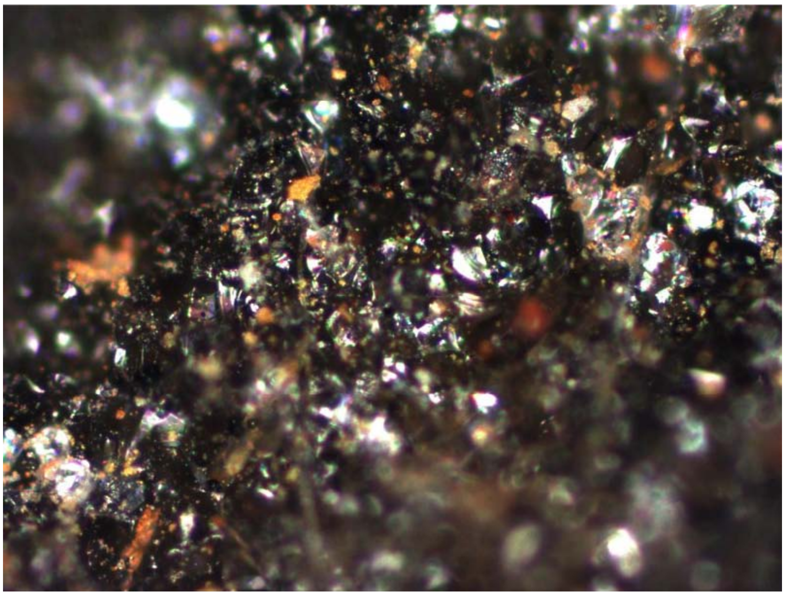
Sample Site 1 : Stone 1 : Quartz (Image ~ 300 x 250 µm)



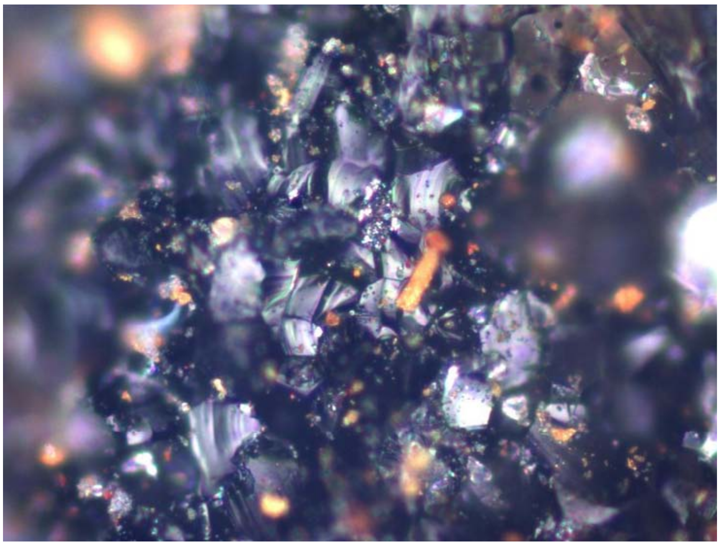
Sample Site 1 : Stone 2 : Quartz (Image ~ 500 x 400 µm)



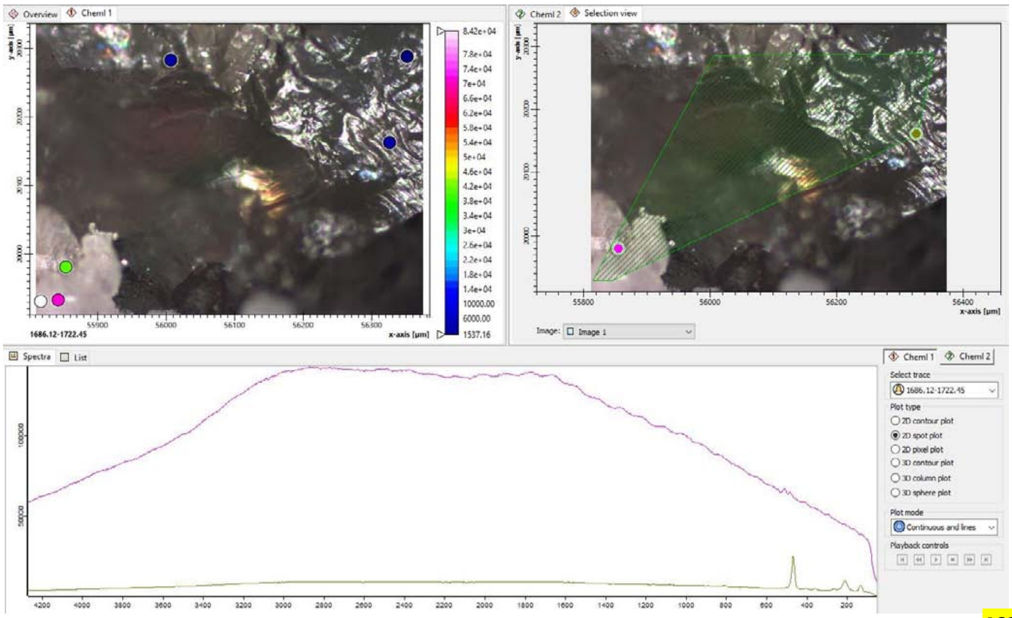
Sample Site 9 : Stone 1 : Quartz (Image: ~ 500 x 400 µm)



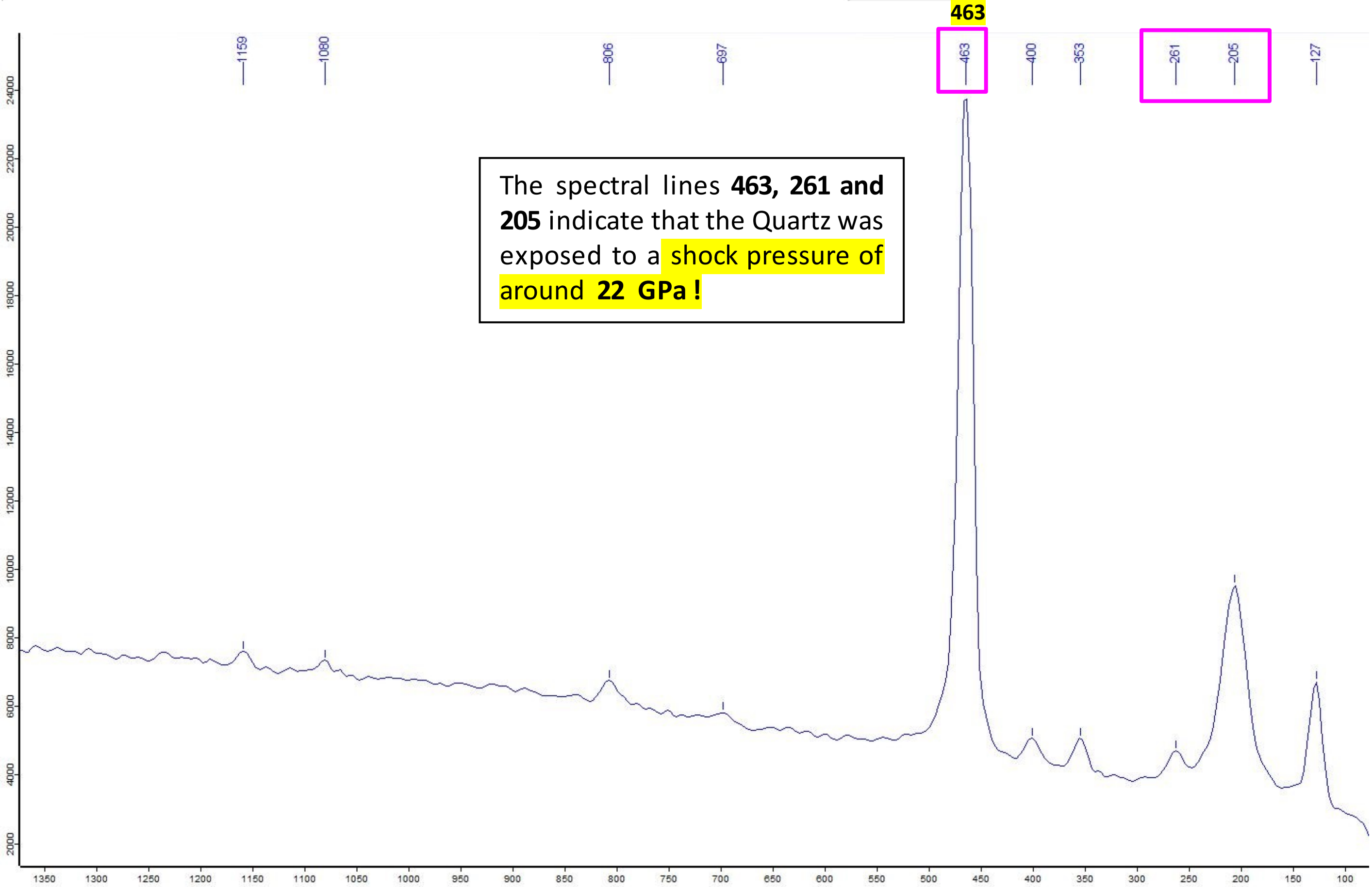
Detail : Image size : ~ 250 x 200 µm

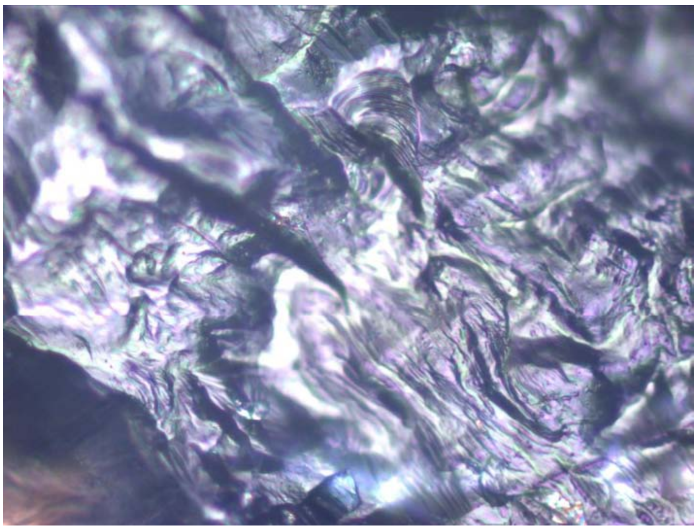


Sample Site 16 : Stone 1_spectra 1 indicates : Quartz



Sample :



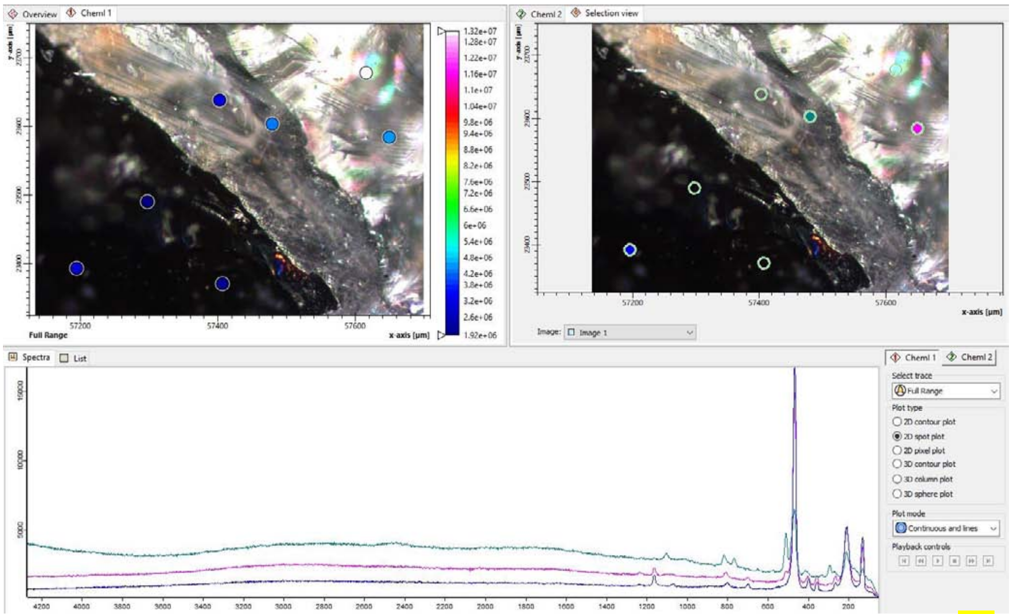


Sample Site 16: Stone 1 : Quartz

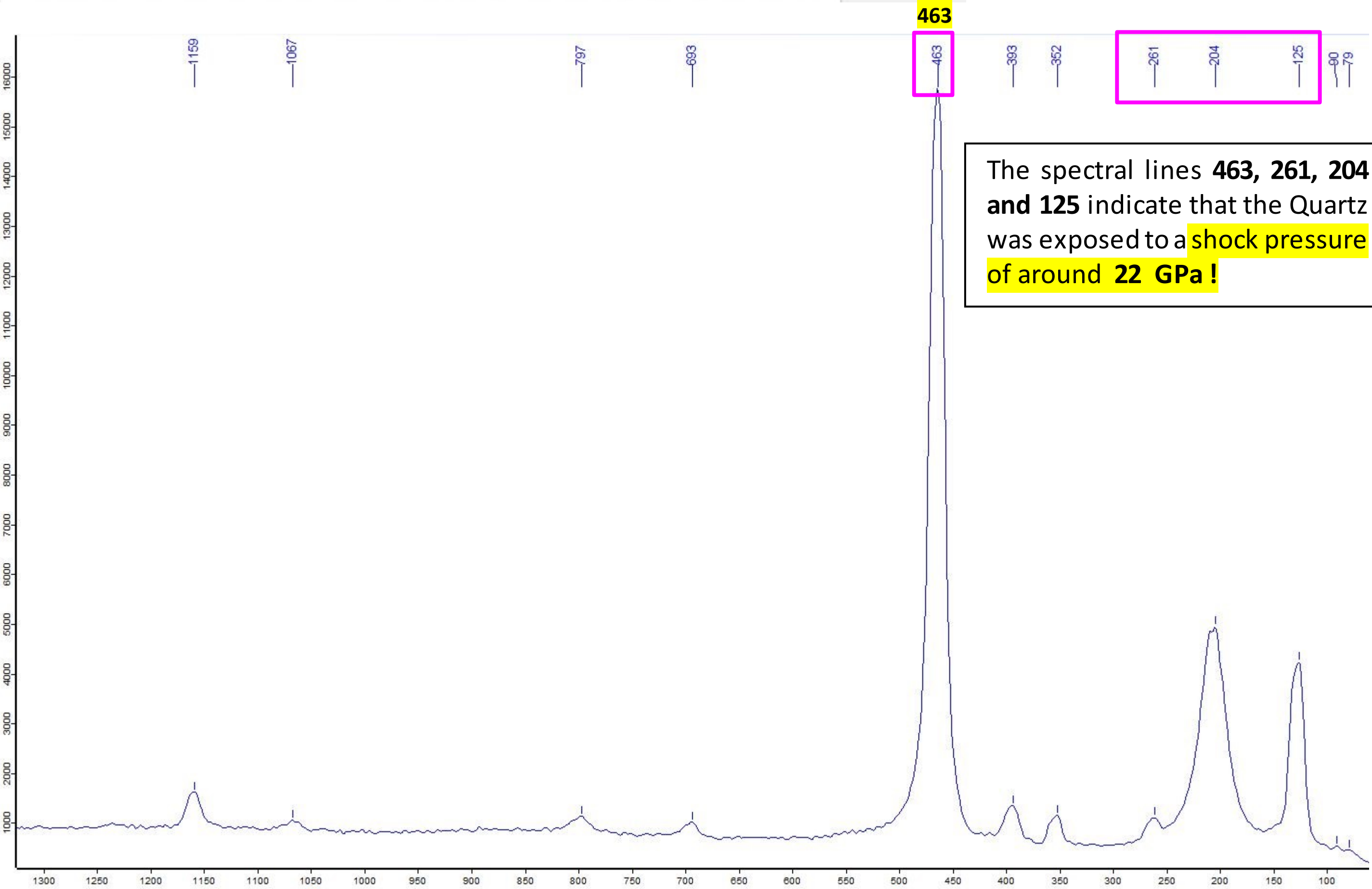
Detail of Microscopic Image

Image size : ~ 250 x 200 µm

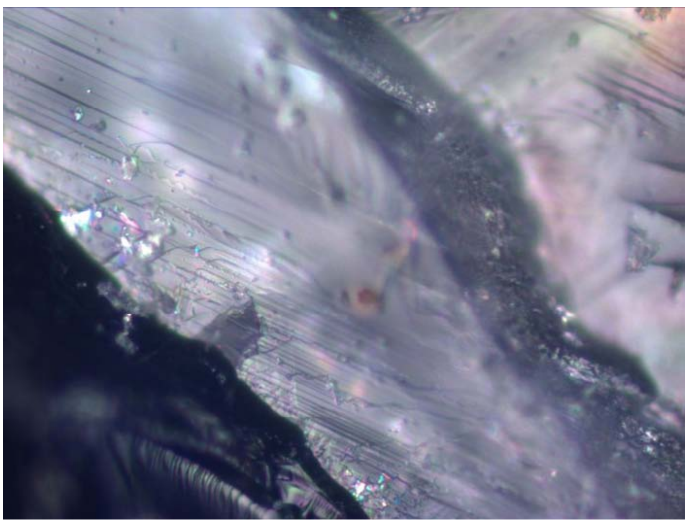
Sample Site 18 : Stone 1_spectra 1 indicates : Quartz



Sample :



The spectral lines **463, 261, 204 and 125** indicate that the Quartz was exposed to a shock pressure of around **22 GPa !**

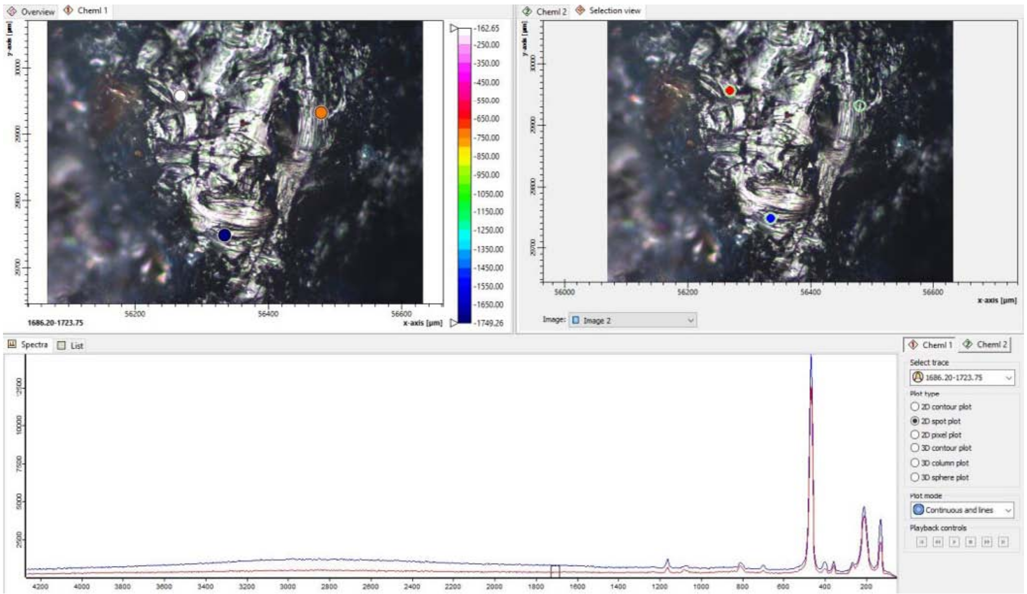


Sample Site 18: Stone 1 : Quartz

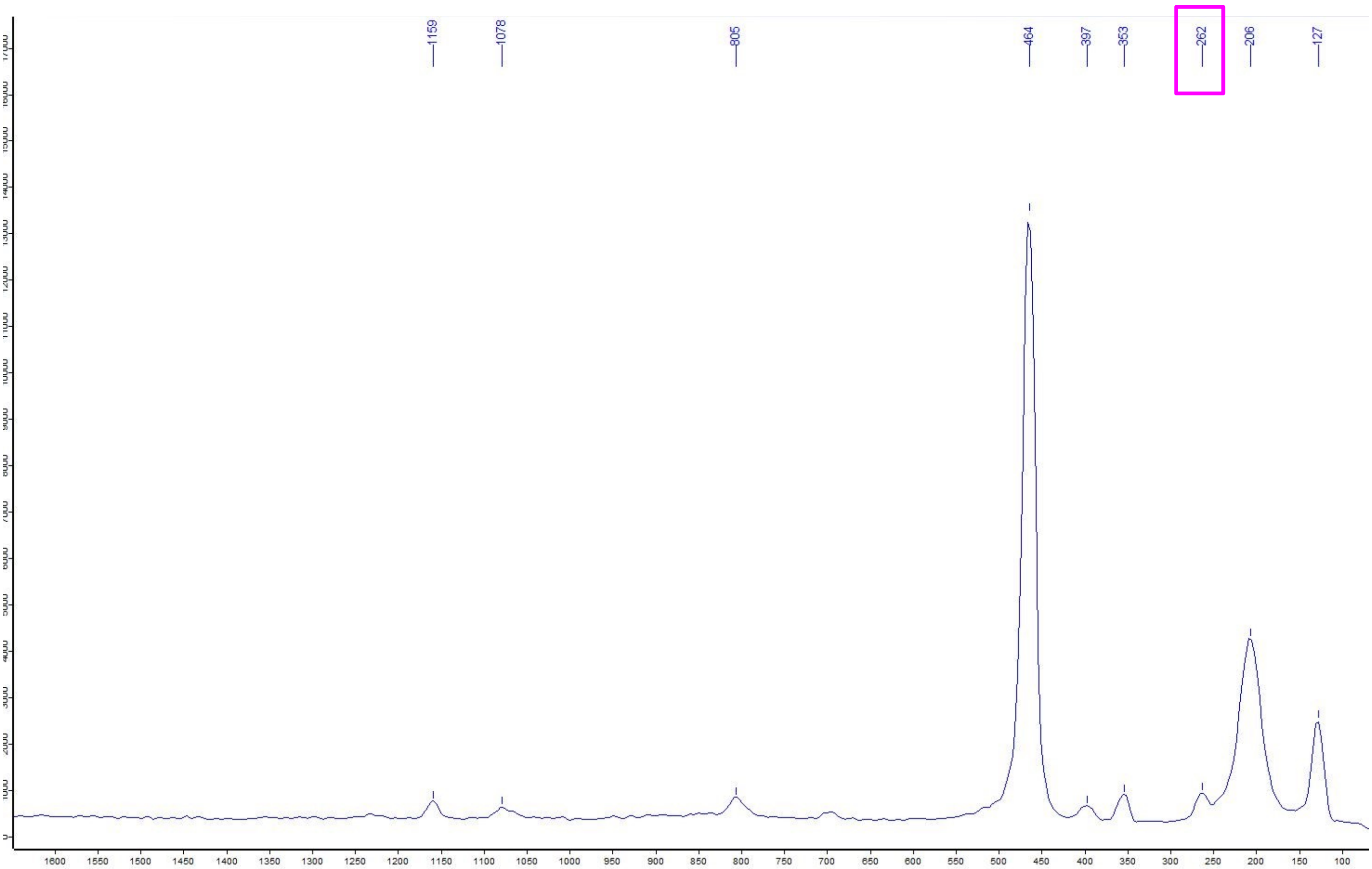
Detail of Microscopic Image

Image size : ~ 250 x 200 µm

Sample Site 2 : Stone 1_spectra 1 indicates : Quartz

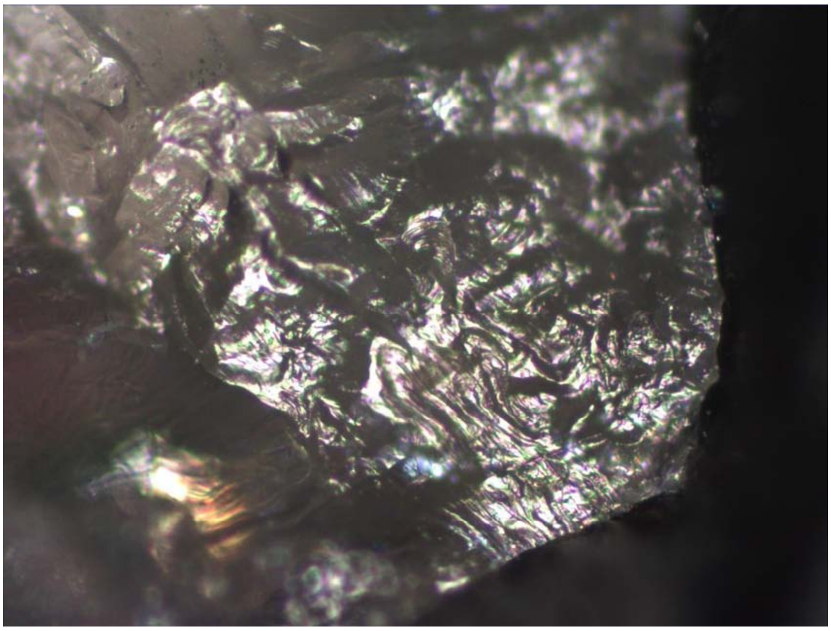


Sample :

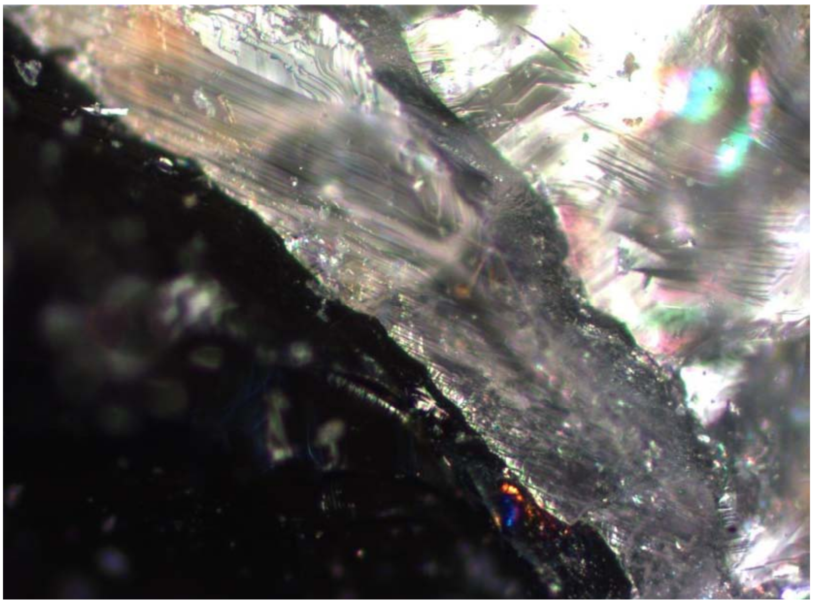


Microscopic Images : Sample from Site 2, 16 and 18 → original state (no preparation for analysis)

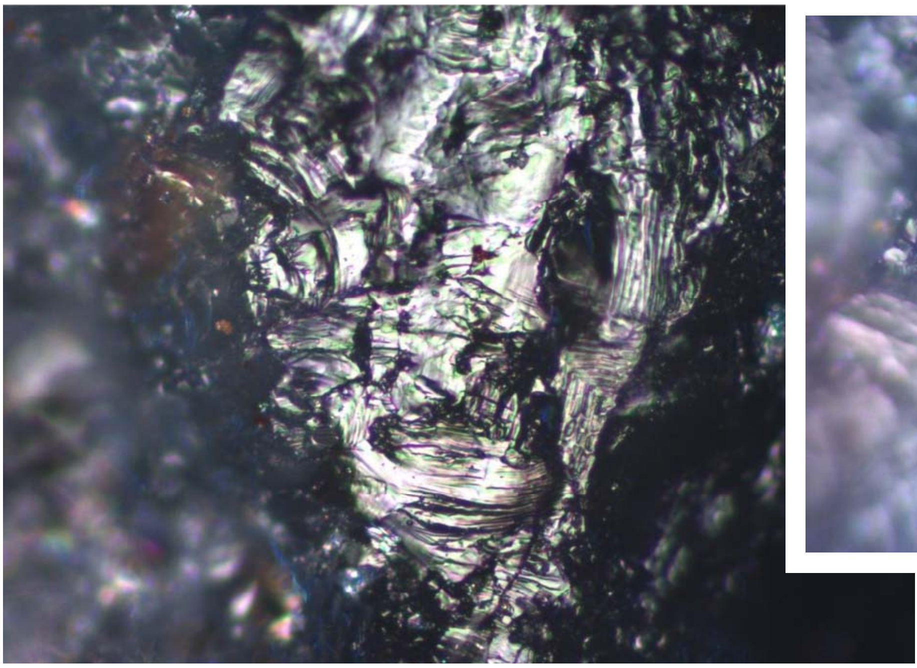
Sample Site 16 : Stone 1 : Quartz (Image ~ 500 x 400 µm)



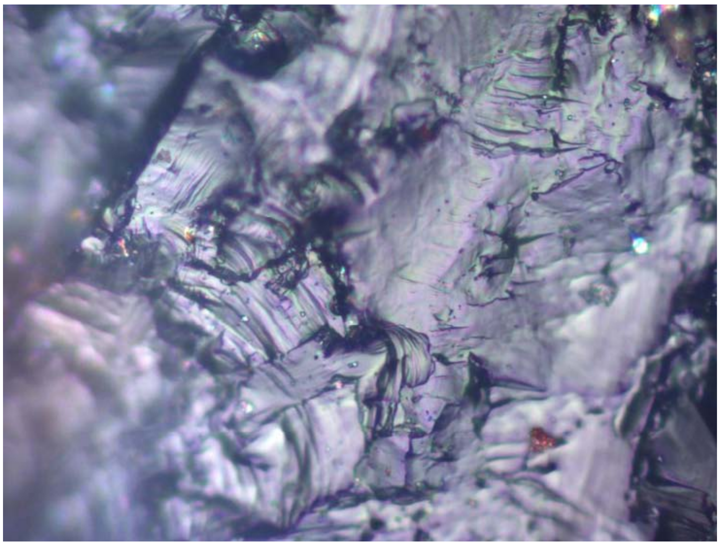
Sample Site 18 : Stone 2 : Quartz (Image ~ 500 x 400 µm)



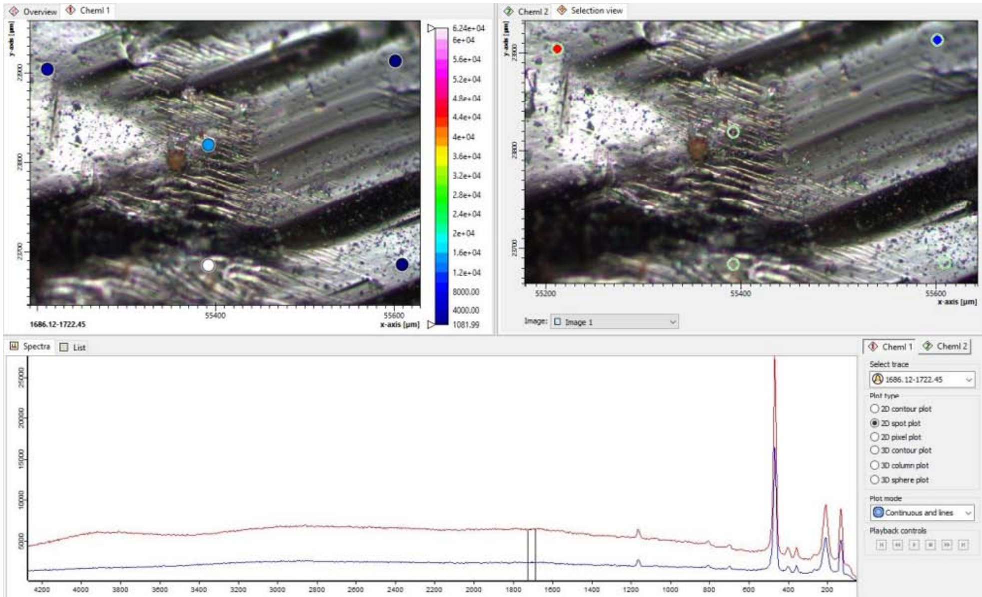
Sample Site 2 : Stone 1 : Quartz (Image: ~ 500 x 400 µm)



Detail : Image size : ~ 250 x 200 µm



Sample Site 16 : Stone 2_spectra 1 indicates : Quartz



Sample :

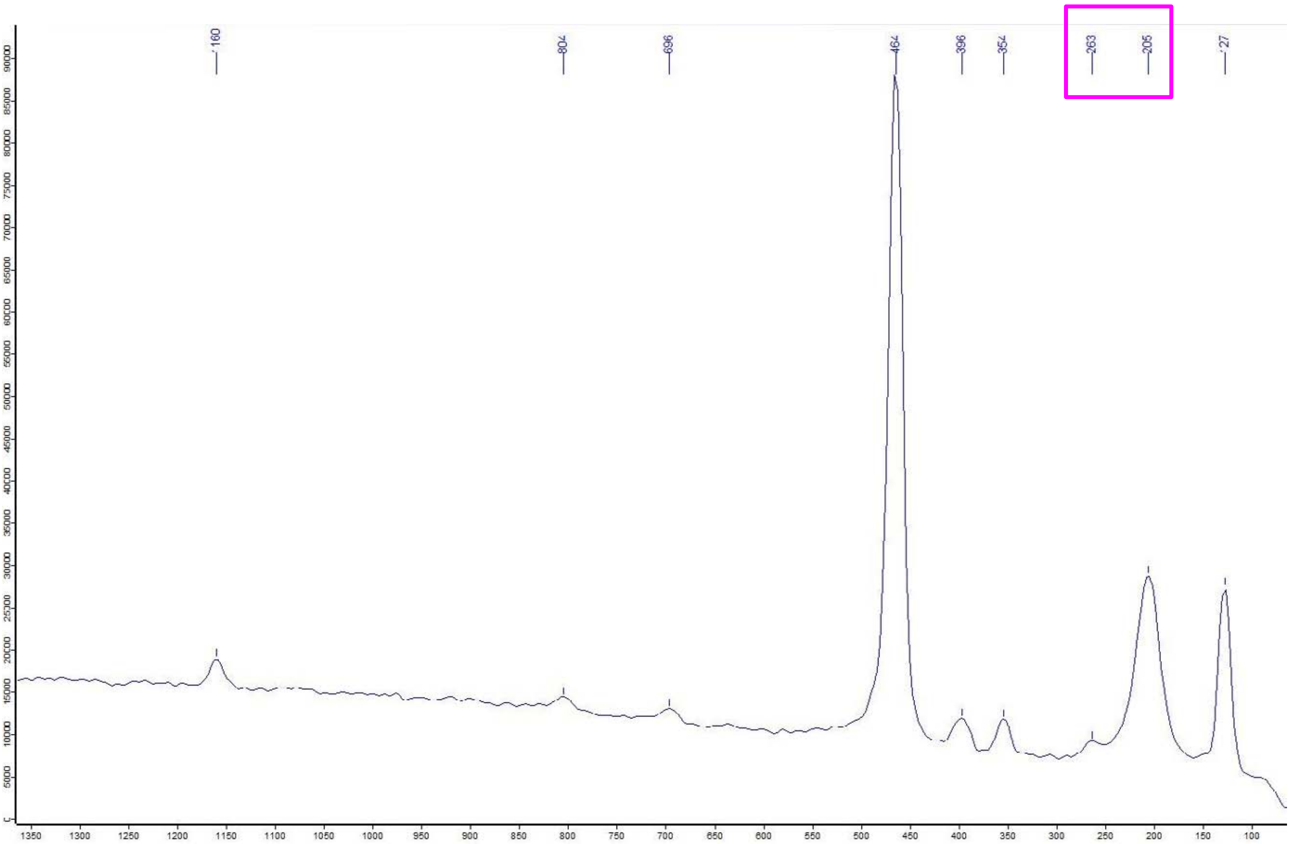
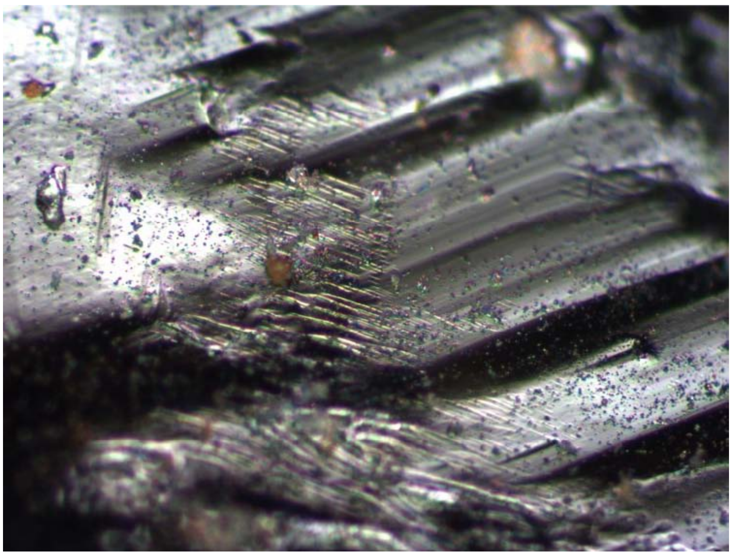
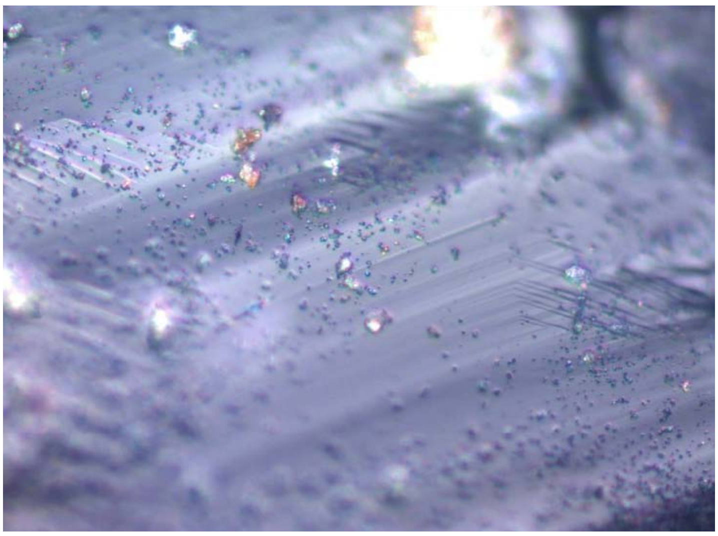


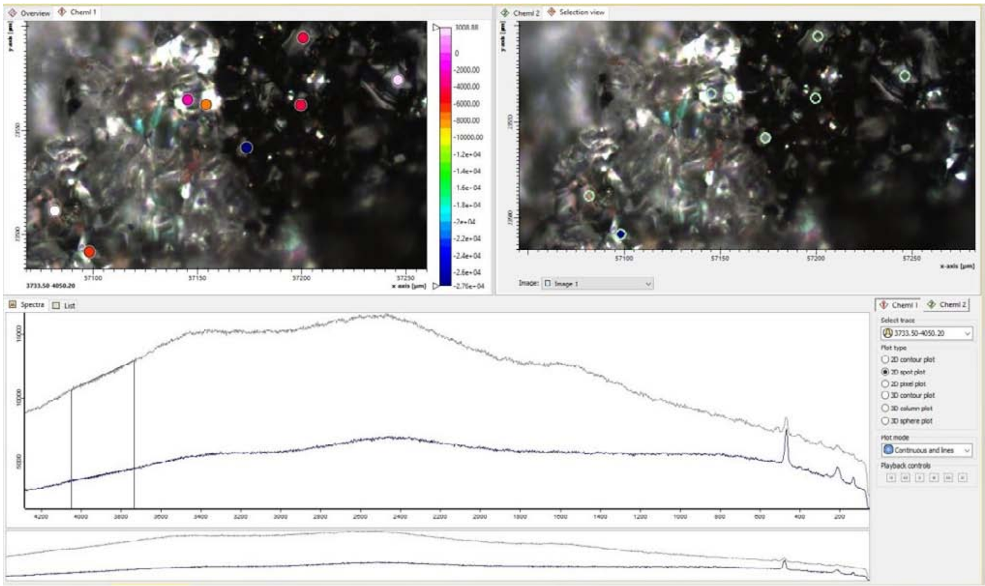
Image size : ~ 400 x 300 µm



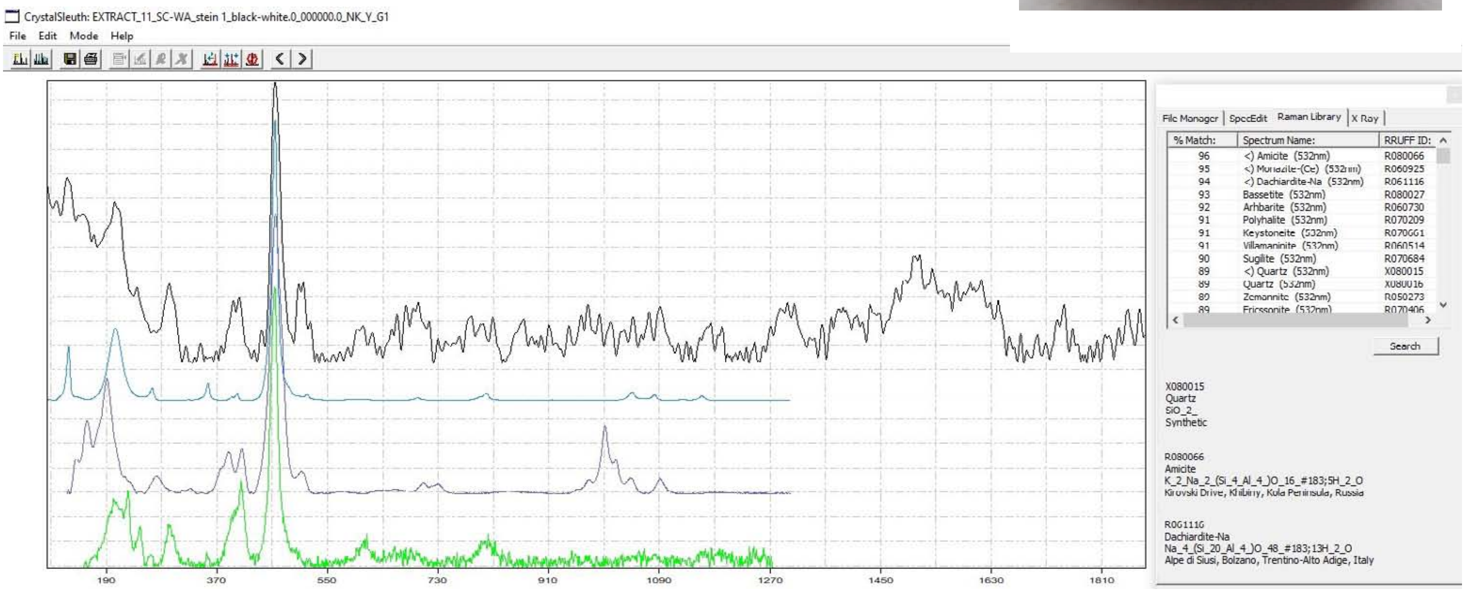
Detail : Image size : ~ 200 x 150 µm



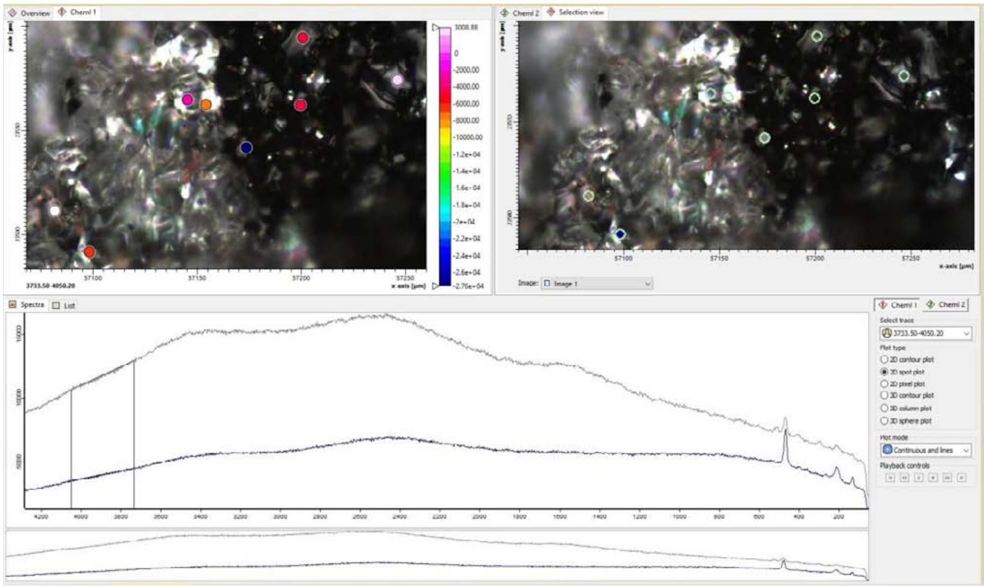
Sample Site 11 : Stone 1_spectra 1 indicates : Amicite_Quartz_Dachiardite-Na (→ see RRUFF_CS results)



Sample :



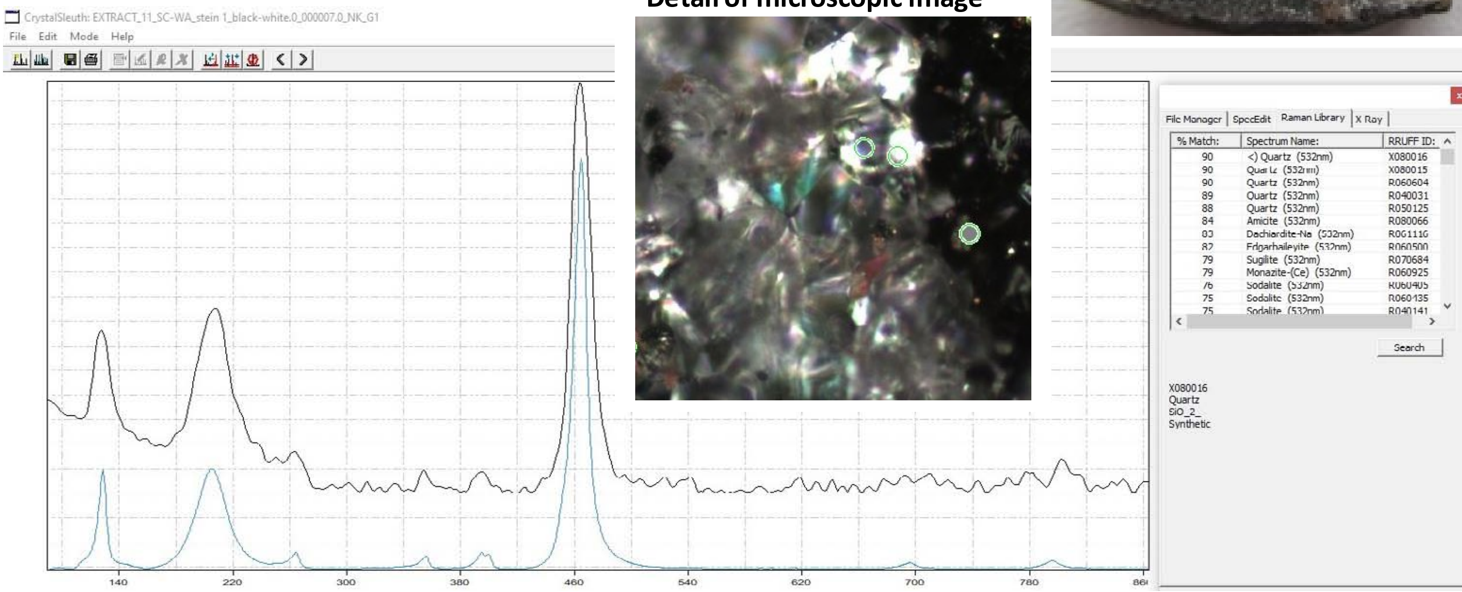
Sample Site 11 : Stone 1_spectra 2 indicates : Quartz_ (→ see RRUFF_CS results)

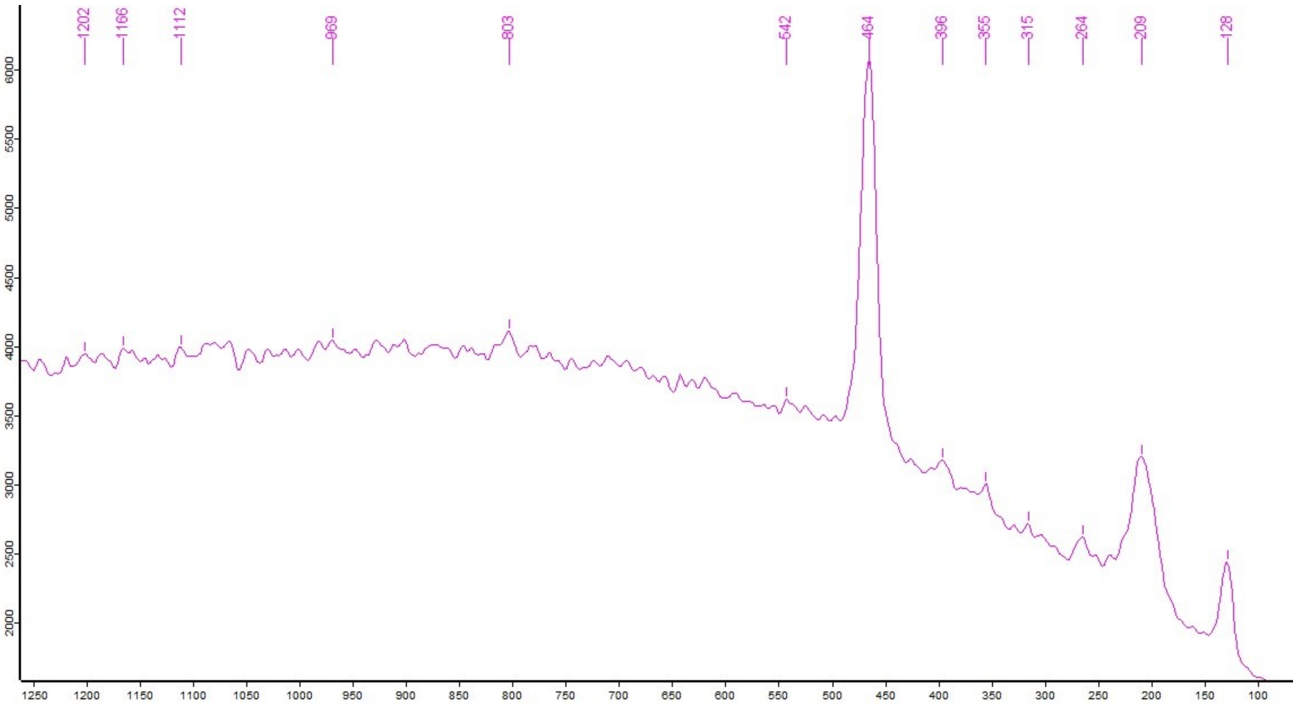


Note the black- and white laminated structure of the Quartz

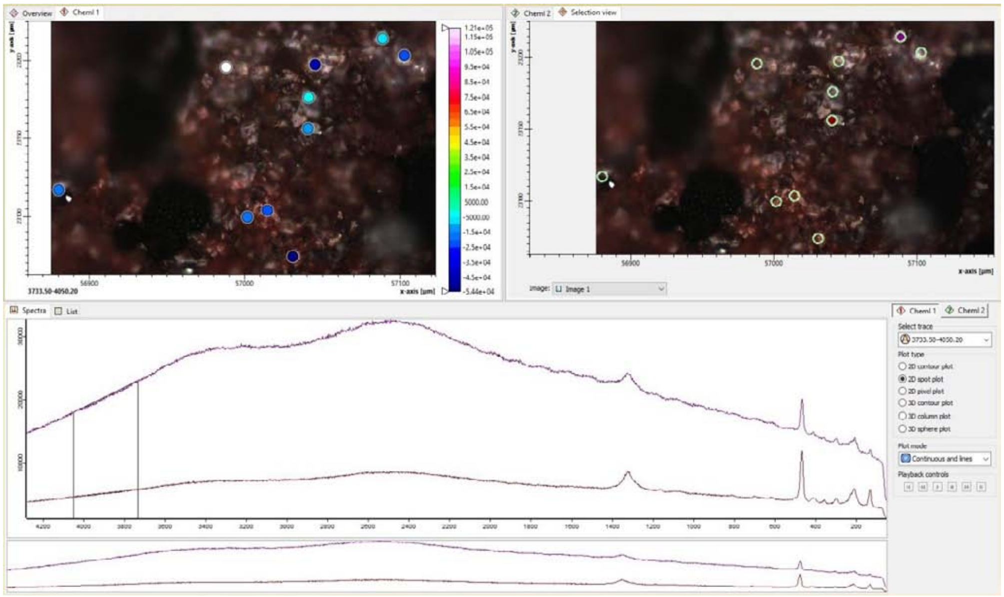
Sample :

Detail of microscopic image





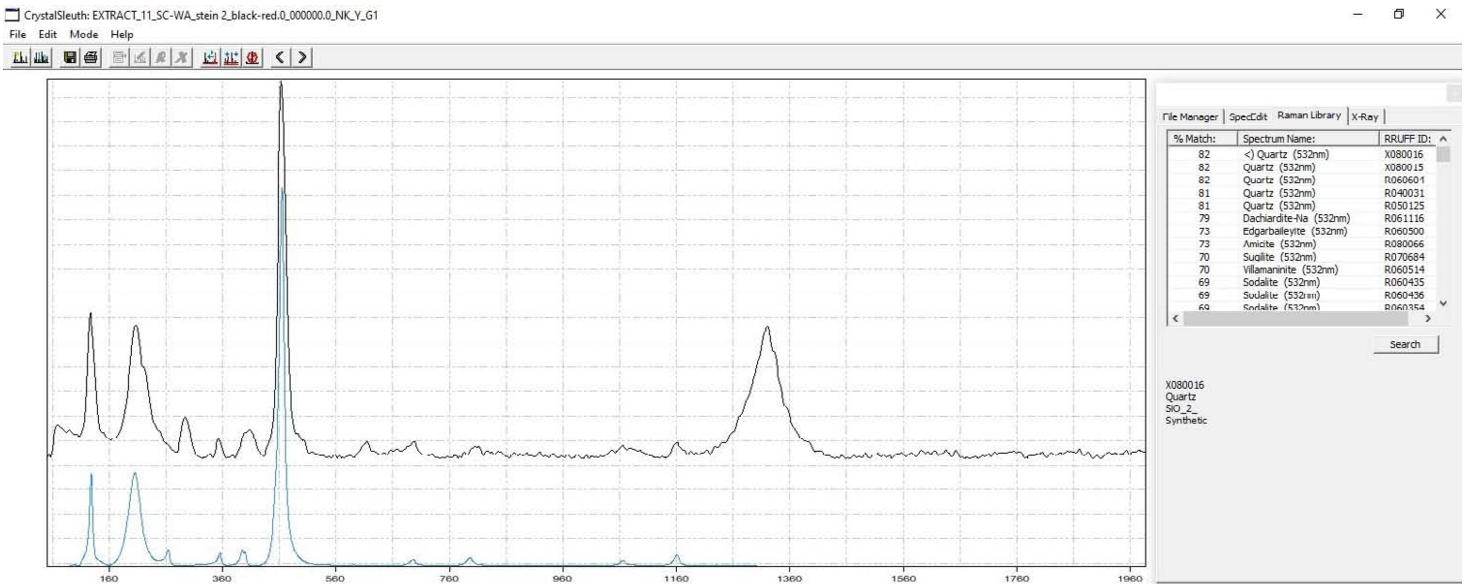
Sample Site 11 : Stone 2_spectra 1 indicates : Quartz_ (→ see RRUFF_CS results)

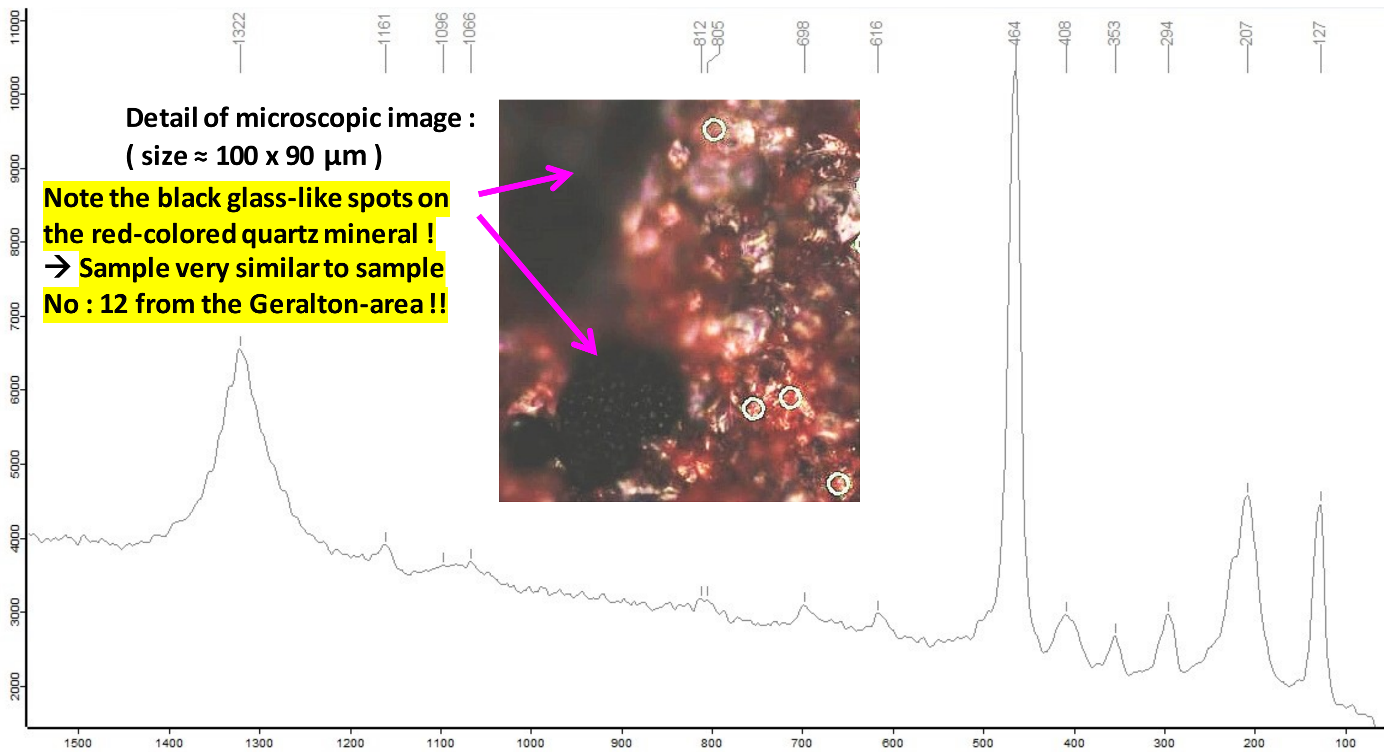


Note the red- and black laminated structure of the Quartz

The spectrum was measured in the red-colored quartz

Sample :

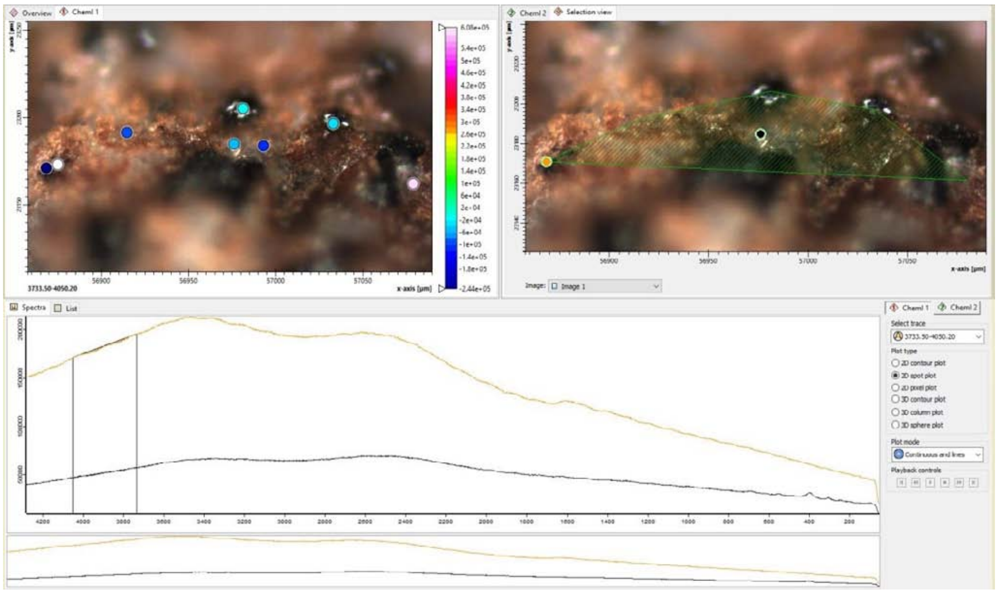




Detail of microscopic image :
(size ≈ 100 x 90 µm)

Note the black glass-like spots on the red-colored quartz mineral !
→ Sample very similar to sample No : 12 from the Geralton-area !!

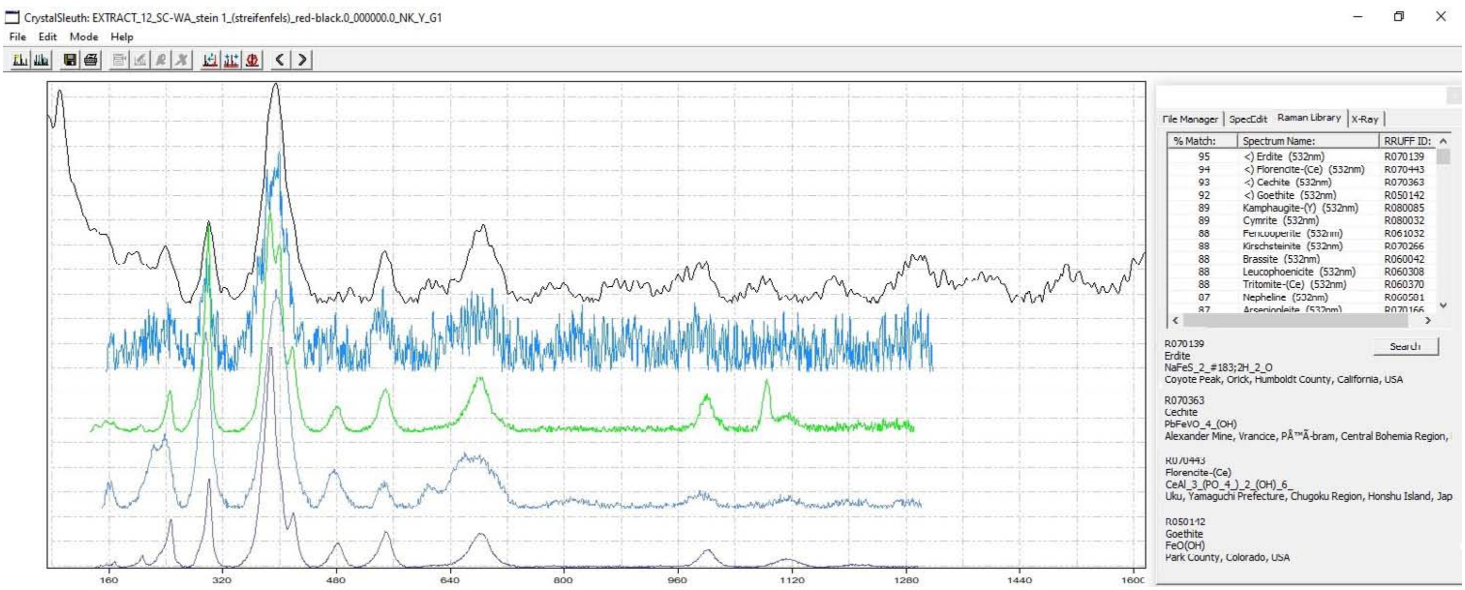
Sample Site 12 : Stone 1_spectra 1 indicates : Erdite_Cechite_Florencite-(Ce)_Geothite (→ see RRUFF_CS)

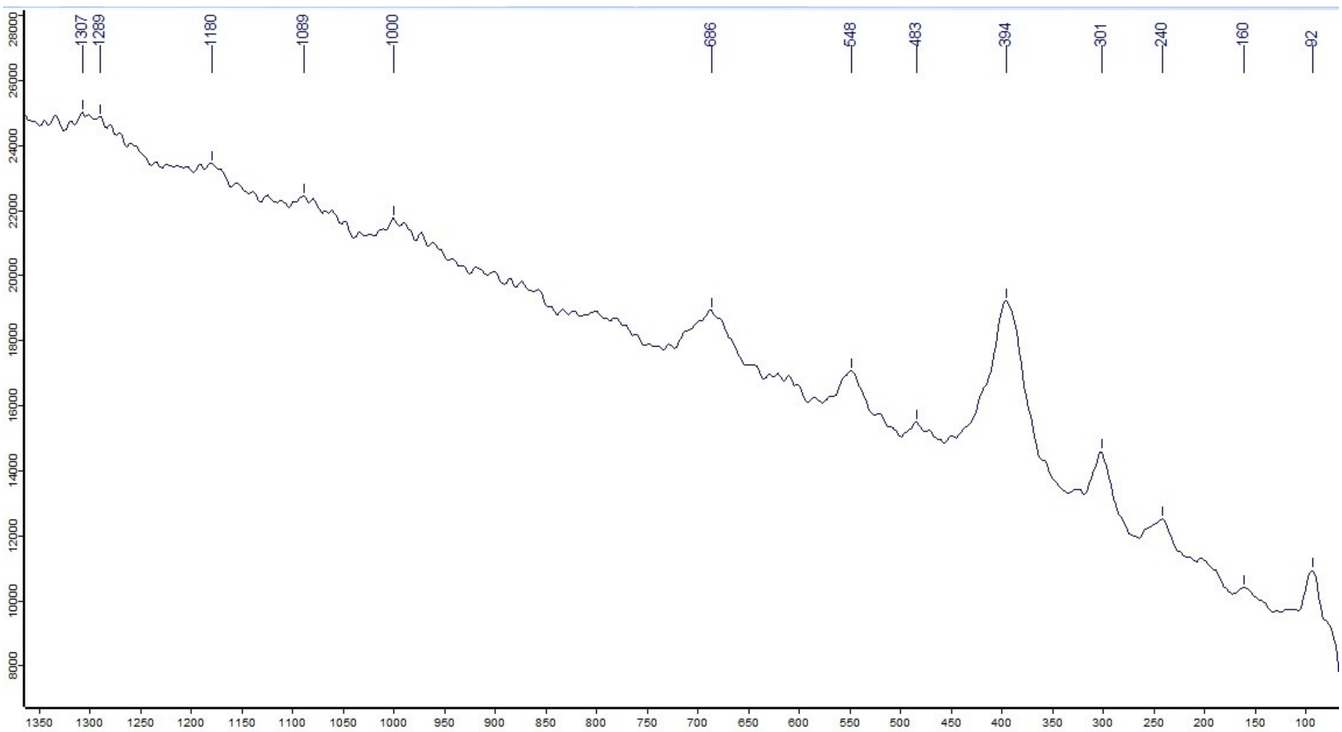


Note the laminated structure of the mineral

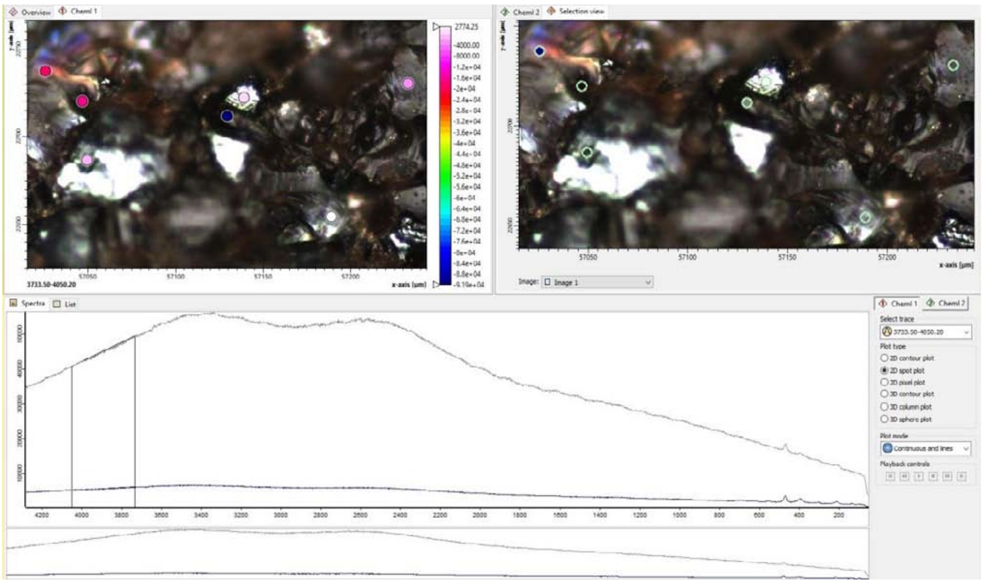
➔ Iron-bearing mineral !

Sample :

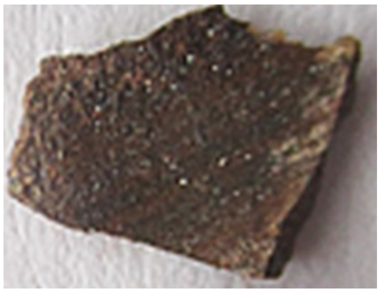


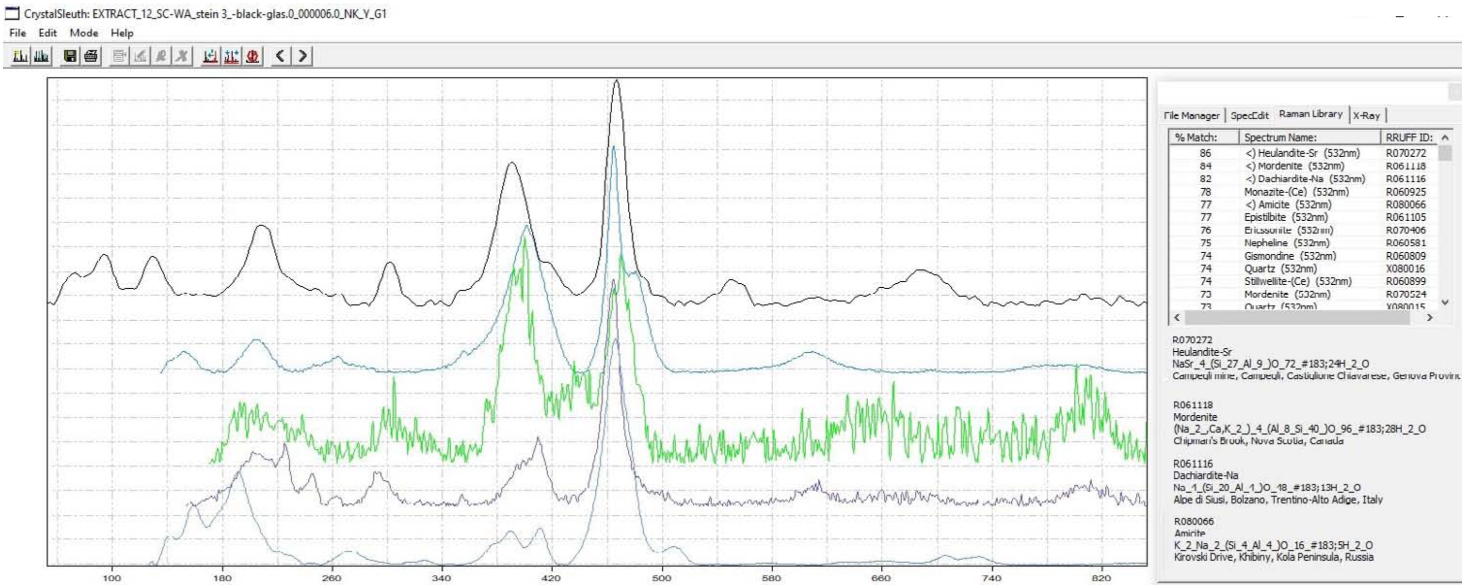


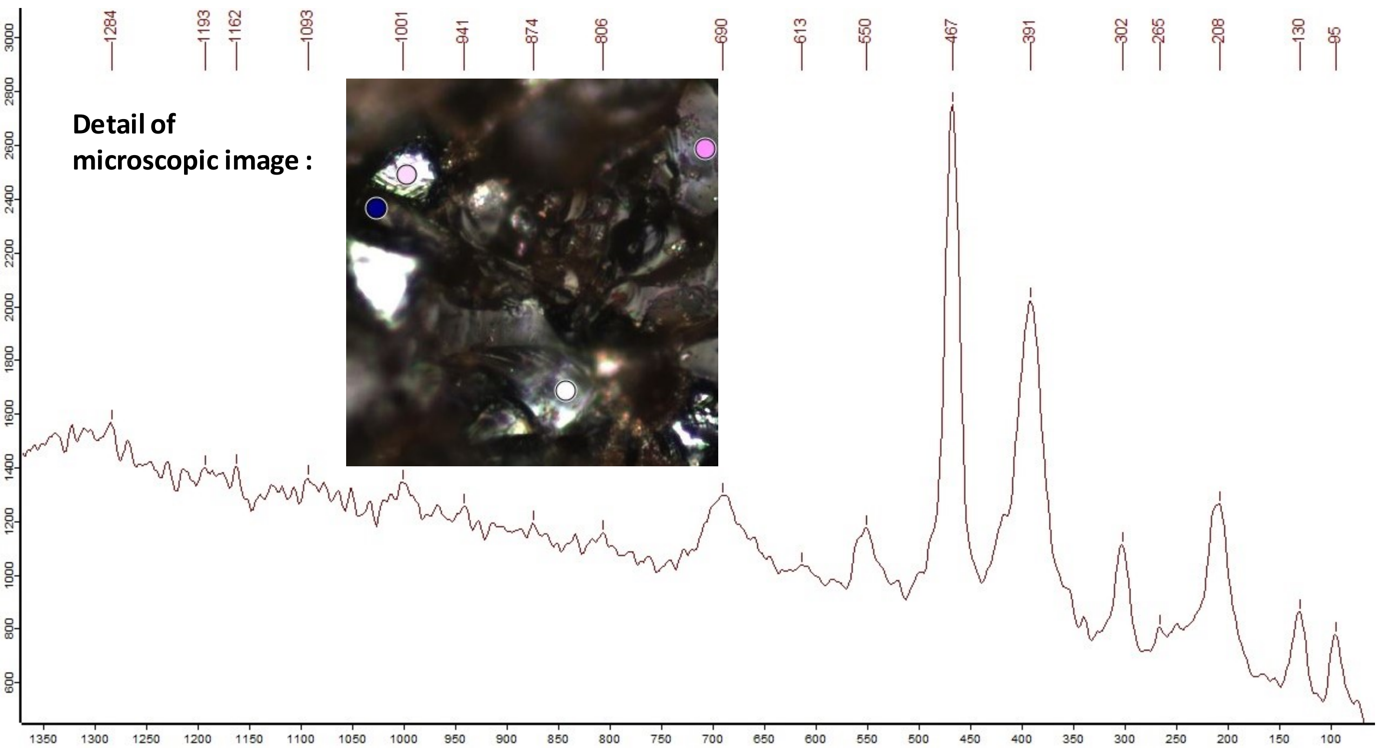
Sample Site 12 : Stone 3_spectra 1 indicates : Heulandite-Sr_Mordenite_Dachiardite-Na_Amicite (→ RRUFF)



Sample :

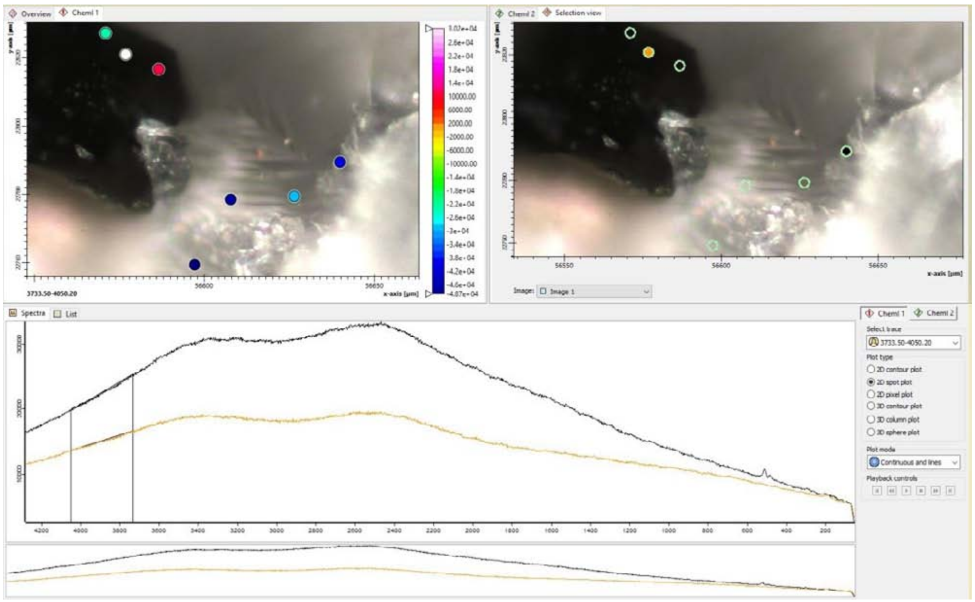




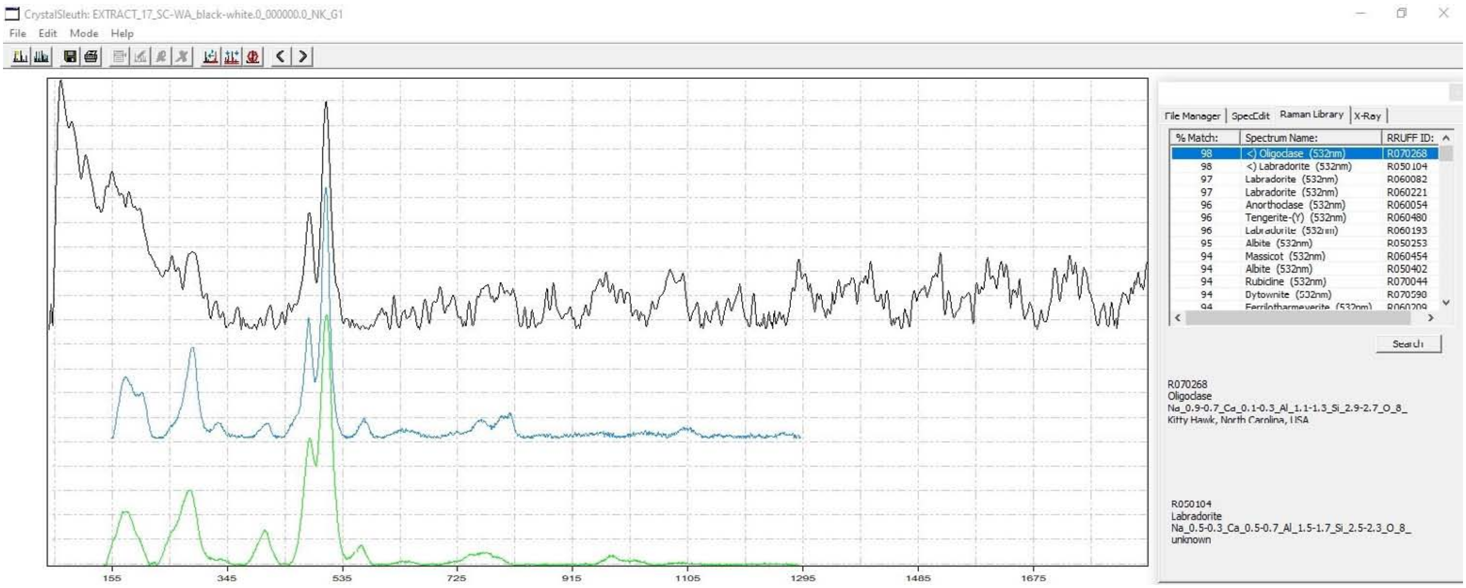


Detail of microscopic image :

Sample Site 17 : Stone 1_spectra 1 indicates : Oligoclase, Labradorite (→ see RRUFF_CS results)



Sample :



Appendix 1 : **Photos of the rock samples from the analysed sample sites :**

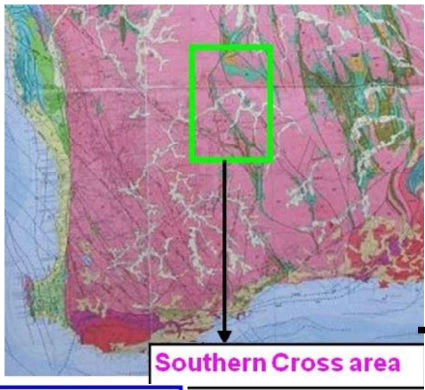
➔ See next page !

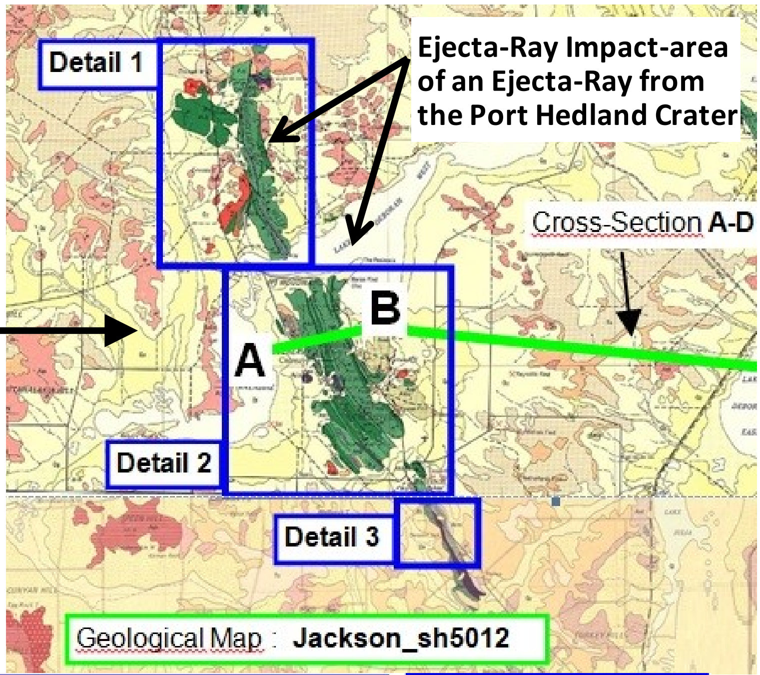
Please note : **Photos of all Sample Sites & Rock Samples are available on my website :**

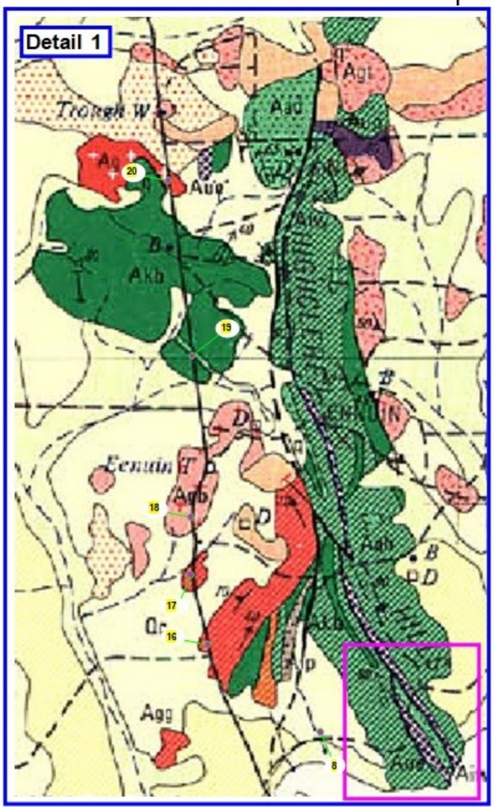
➔ Samples from Southern Cross Area or here : Southern Cross Area

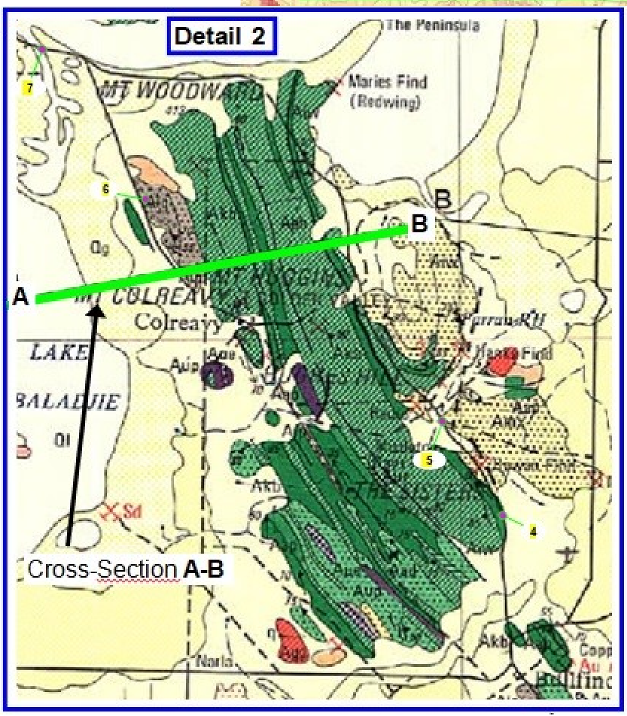
Geological Map of SW-Australia

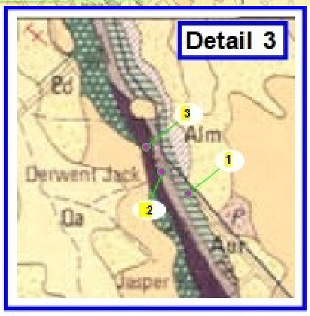
Location where samples were collected :



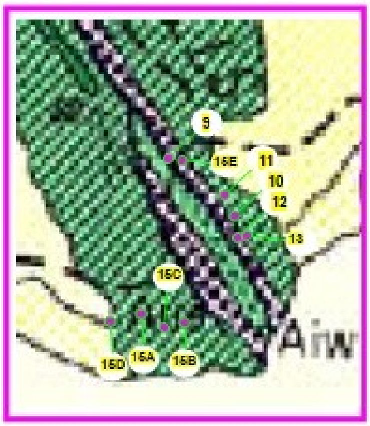




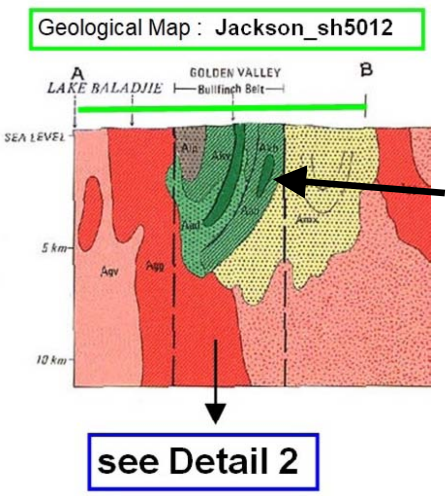




Sample sites No.: 1 to 24 marked in yellow on the maps



Cross-Section A - B

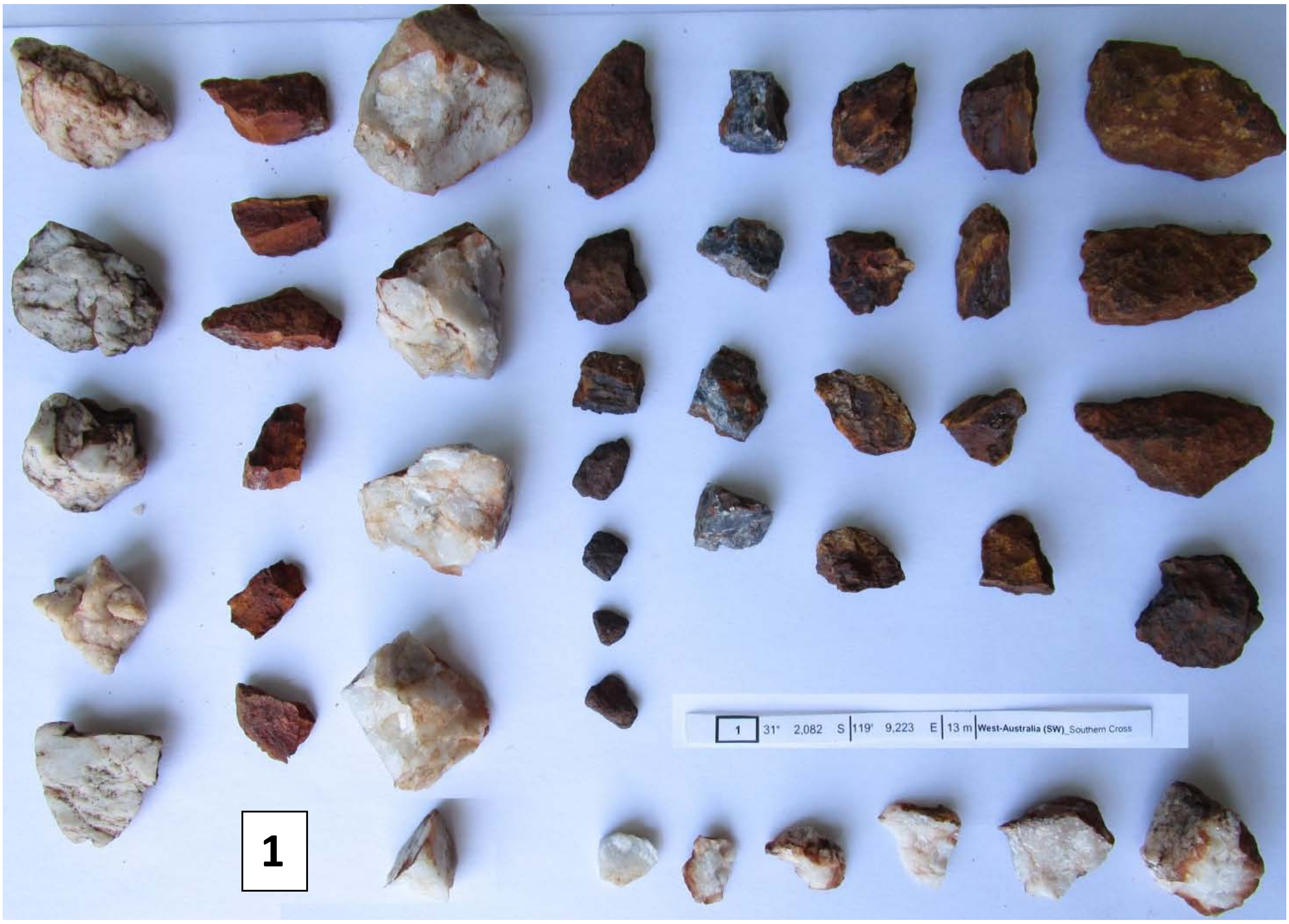


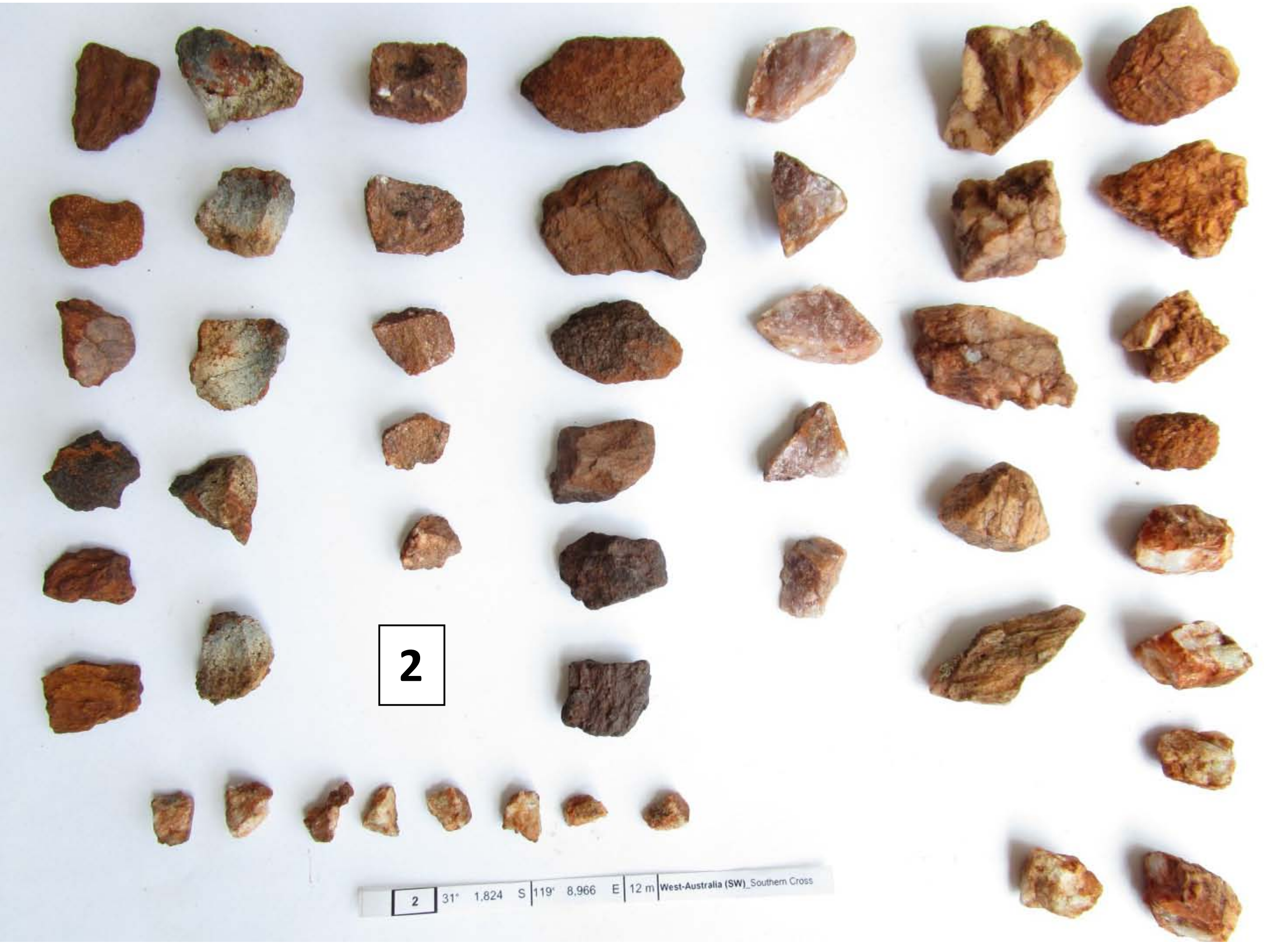
The sections of an ejecta-ray of the Port Hedland Crater (or VLC) → the nearly linear green-colored structures) seem have penetrated the Yilgarn Craton down to a **depth of around 6 km**.

→ Geological Maps can be downloaded here :

http://www.geoscience.gov.au/

Then go to "Geology" **– 1:250K Geological Maps** and search for the required map


1
31° 2,082 S 119° 9,223 E 13 m West-Australia (SW)_Southern Cross
1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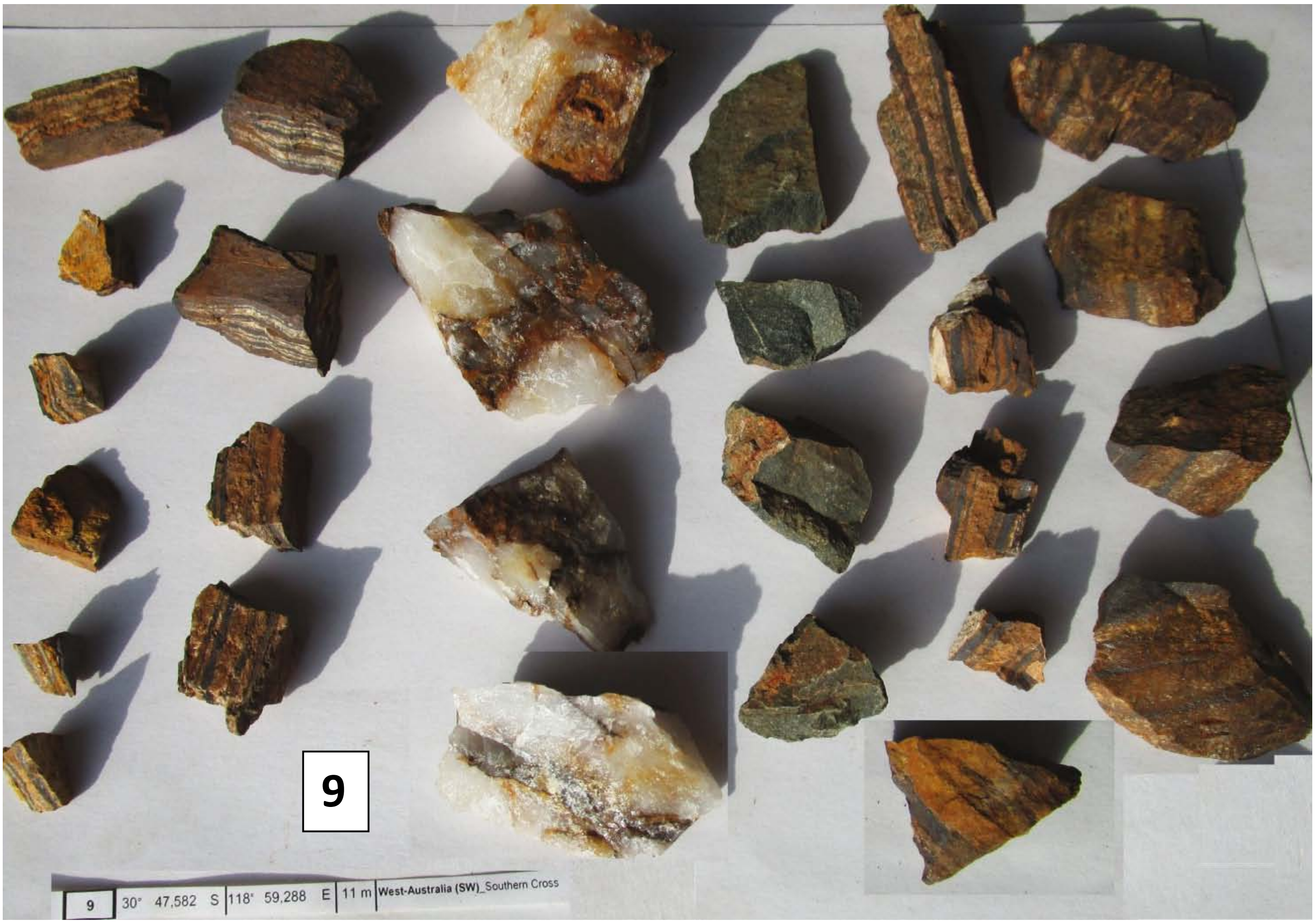
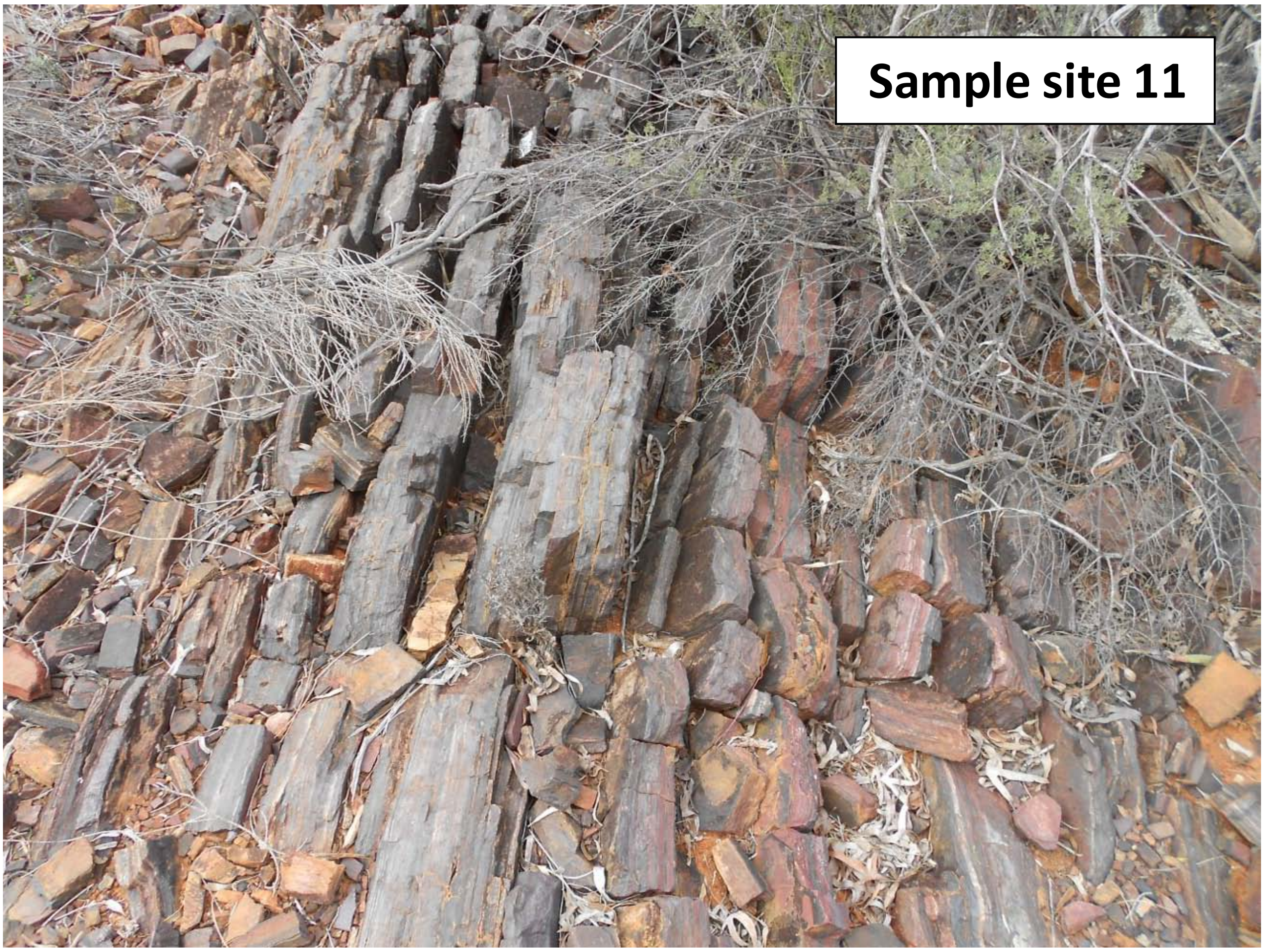
2 31° 1,824 S 119° 8,966 E 12 m West-Australia (SW)_Southern Cross

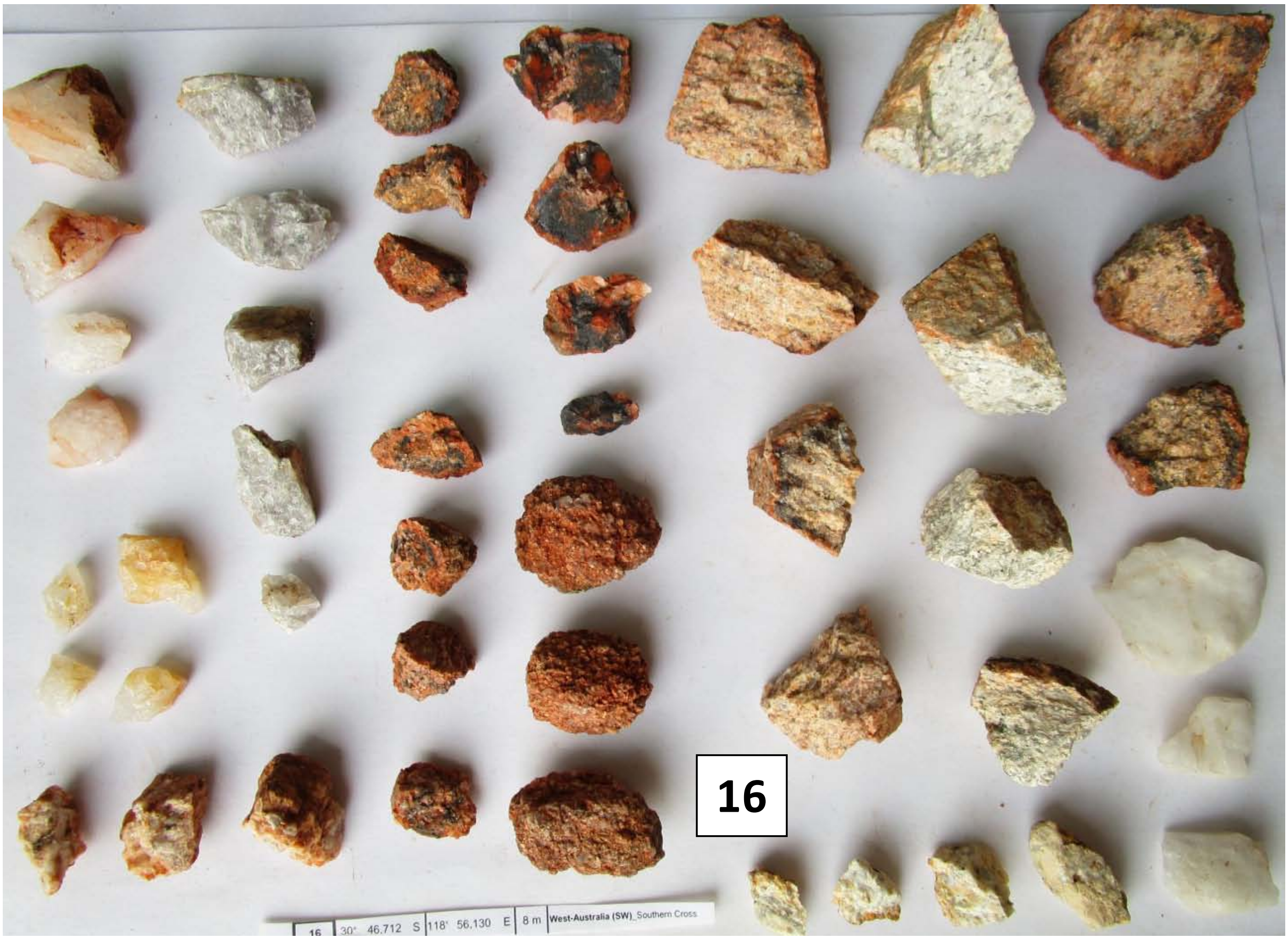

9
9
30° 47,582 S
118° 59,288 E
11 m
West-Australia (SW)_Southern Cross

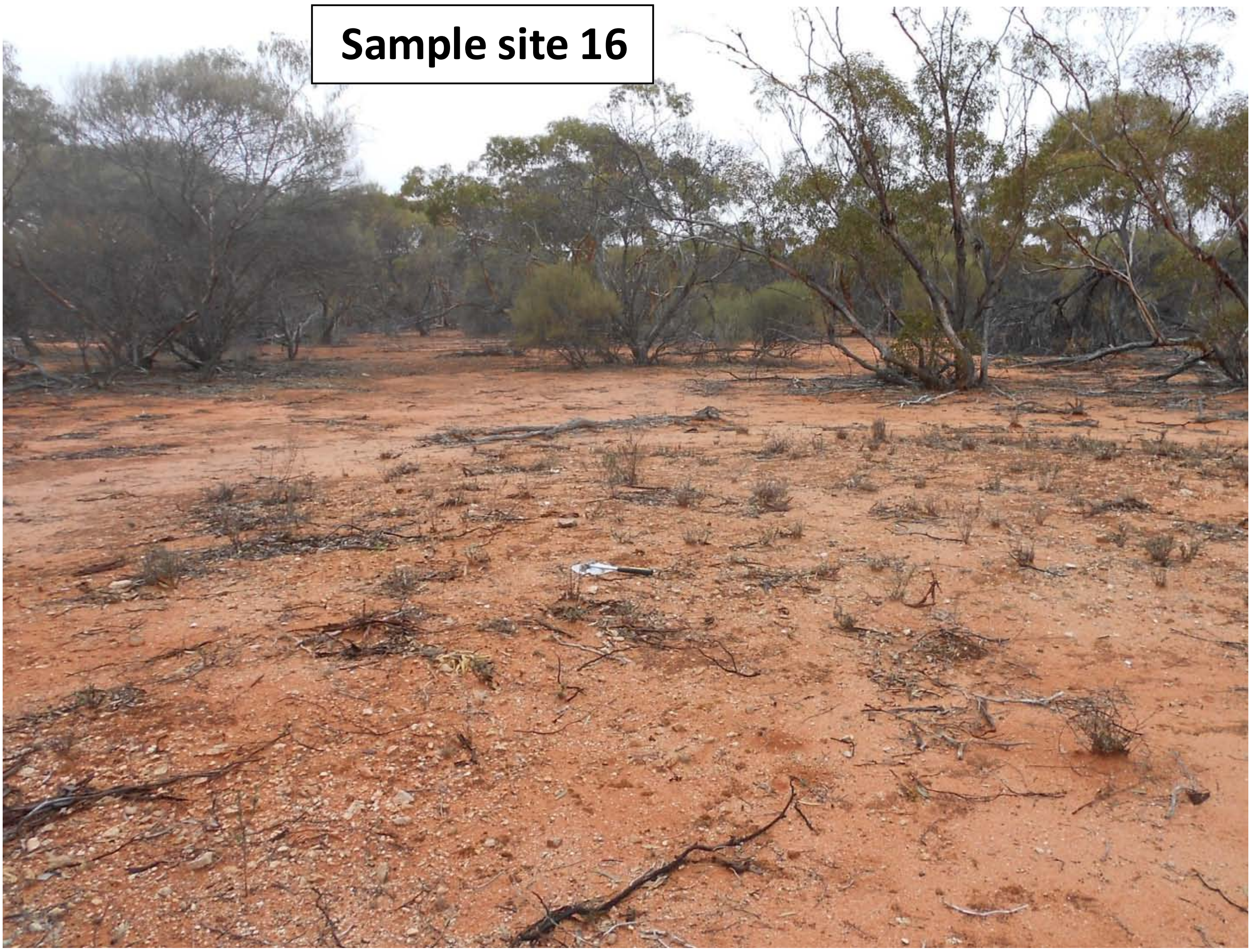

Sample site 9


11
11 | 30° 47,754 S | 118° 59,522 E | 8 m | West-Australia (SW)_Southern Cross

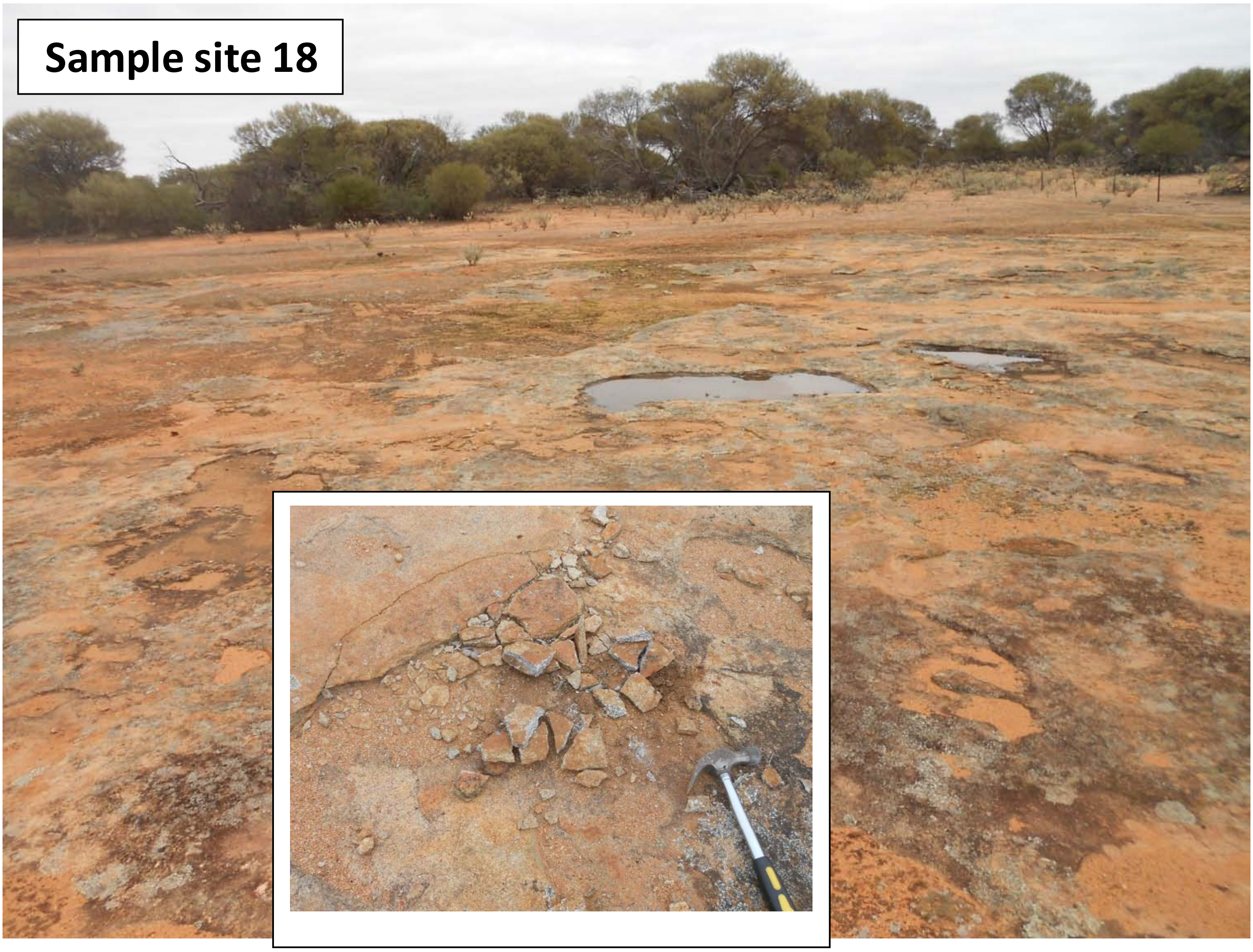

Sample site 11

Sample site 12


16
16 | 30° 46,712 S | 118° 56,130 E | 8 m | West-Australia (SW)_Southern Cross


Sample site 16


18
18 30° 44,728 S 118° 55,851 E 8 m West-Australia (SW)_Southern Cross


Sample site 18

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

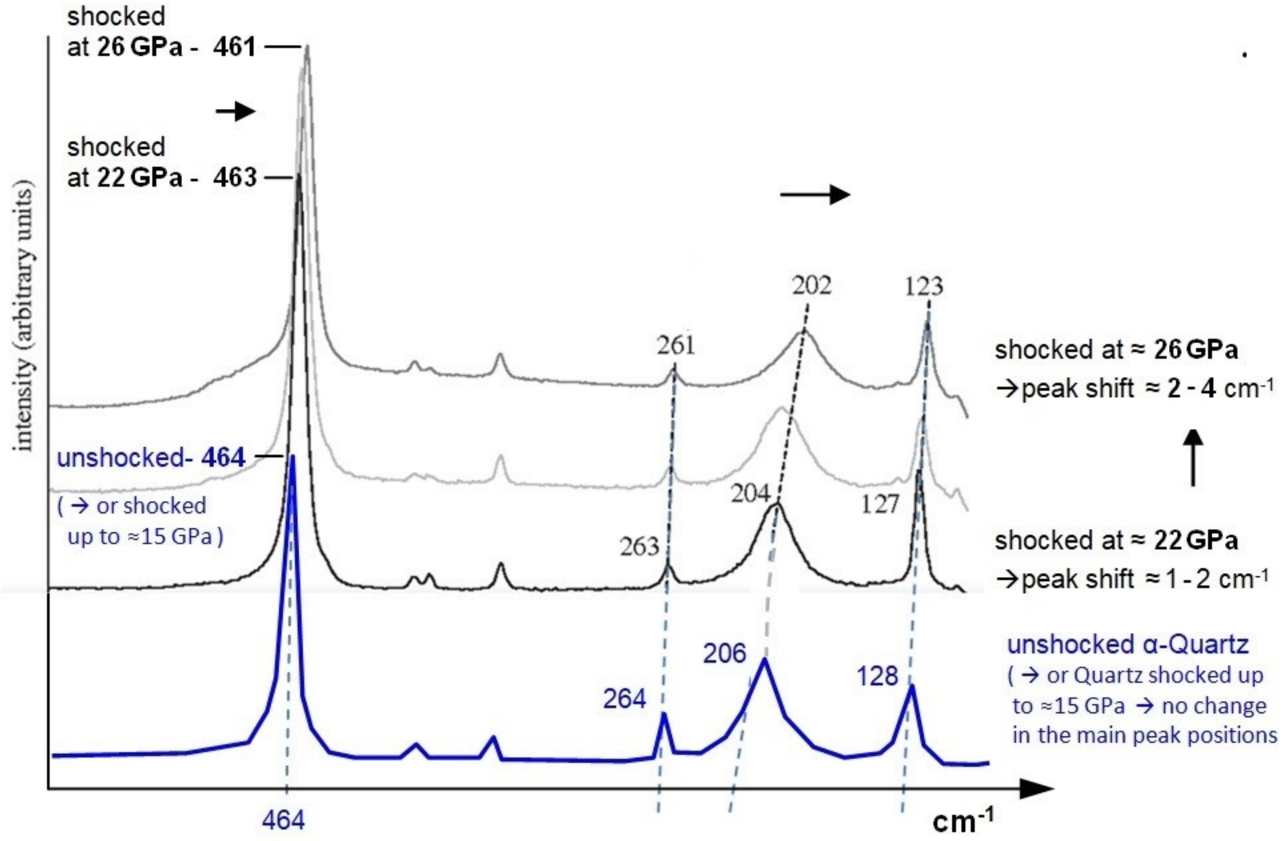
In order to verify a sample site as an impact site or impact structure, shock-metamorphic effects must be discovered in the rocks of the sample site. This can be done by different methods.

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.

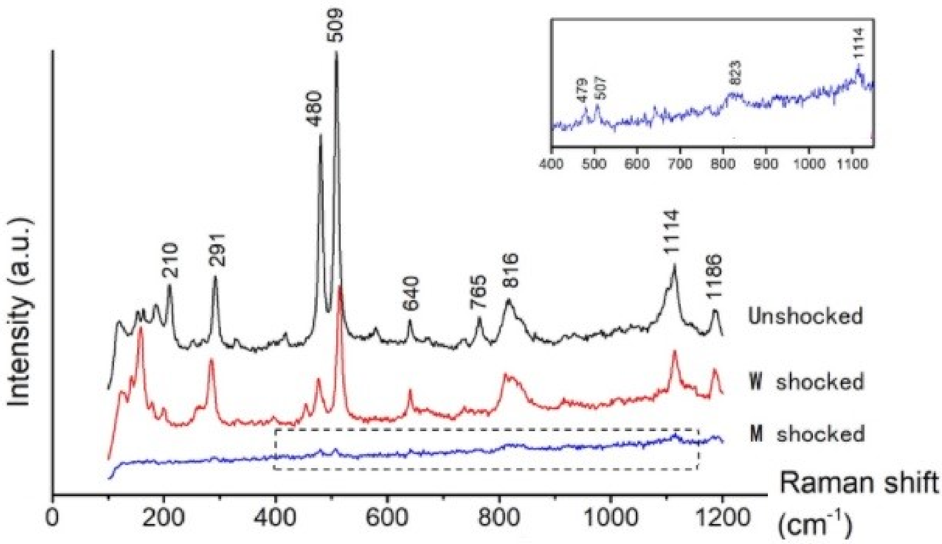
Mc Millan et al. (1992) and others have shown that the main RAMAN-peaks of Quartz shift towards lower frequencies if the Quartz was exposed the a shock-pressure > 15 GPa. → see diagram below

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 Sample Sites & Rock Samples are available on : Samples from Southern Cross Area (or : Southern Cross Area)

Find more information to the linear Ejecta-Ray structures in W-Australia in Parts 2 & 3 of my hypothesis - by Harry K. Hahn
Please read pages 14-16, 20-21 & 24-27 of Part 3 (P3) & page 33 of Part 2 (P2) of my hypothesis (→ weblinks below !)

Please also read my Raman-analyses to rock samples from the Kalgoorlie area ; Geralton-area & Margaret-River area !!
→ You can find these analyses either on www.vixra.org or on www.archive.org → under my author name : Harry K. Hahn

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

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

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