Impact-area of Ejecta-Rays from the Port Hedland Crater or from the VLC, located near Kalgoorlie (Western Australia)

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

Summary :

The Gravity Anomaly Map indicates that **Ejecta-material from the Ø 400 x 350 km Port Hedland Crater or from the Victoria Lake Crater (VLC) in East-Africa probably impacted here and formed these linear structures.** The Port Hedland Crater and the Victoria Lake Crater (VLC), which are both unknown craters yet, in all probability are large secondary craters that were caused by the Permian-Triassic Impact Event.
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 24-28 of **Part 3** (**P3**) and page 33 of **Part 2** (**P2**) of my hypothesis.

The geological map shows large-scale structures (→ejecta lobes) in the Kalgoorlie-area which have strong similarities to structures caused by ejecta-blankets (-lobes) originating from an Impact Crater. These structures consist of rock-types different to the rock-types of the surrounding plains of the Yilgarn Craton. Compare these structures to the ejecta-rays (-lobes) from the Graterri Crater on Mars ! These ejecta-ray-structures penetrate the Yilgarn-Craton approximately down to a depth of 10 km !
In the Kalgoorlie area the Super-Pit gold-mine is located. The Gold and other rare- & heavy elements found in the area surely were ingredients of the PT-Impactor, the origin of the ejecta that impacted here.

I have collected some rock-samples from these ejecta-ray- (lobe-) structures in the Kalgoorlie 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 precisely is the case !!

The Raman-spectra of quartz from the Sample Sites 2, 4, 5, 13, 21, 27 & 31 provide first evidence for an Impact Event as the probable cause of these Ejecat-ray- (lobe-) structures in the Kalgoorlie Area. So far the samples from the Klagoorlie-area provided the best evidence for an Ejecta-Impact area !!

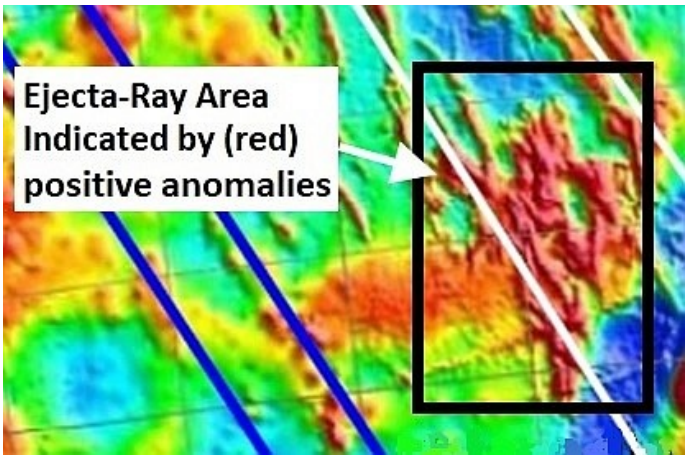
The following shifts of the main Raman-peaks, of the analysed quartz grains, to lower frequencies (which all indicate an impact shock event) were measured : 462, 261, 204 & 125 cm^{-1} (Site 2_stone 1); 463, 260 & 205 (Site 2_stone 2); 463,260,204 (Site 4); 463,260/266 (Site 5); 463,261,125 (Site 21); 463,261,205,125 (Site 27); 463,257/267,204,125 (Site 31); 260,126 (Site 5_st.2) & 204, 126 cm^{-1} (Site 13)
(→see explanation in **Appendix 1** at page **28** : Overview : The Raman bands (peaks) of shocked Quartz)

Microscopic images of a number of analysed quartz grains **will provide further proof for a shock event PDFs** (planar deformation features) seem to be present in some samples ! (→ images on **pages 4 to 17**)
All spectra were made with a **BRUKER Senterra-II Raman Microscope** (wavenumber precision <0.1cm^{-1})

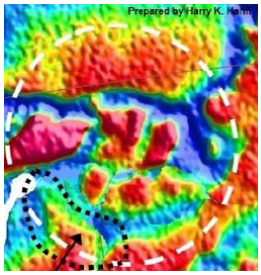
→ Images of the analysed rock samples and photos of the sample sites are in the Appendix at **page 18**.
→ More images of all sample sites are available on www.permiantriassic.de or www.permiantriassic.at
→ **References : see page 29** / and pages 14-16, 20-21 and 24-28 of **Part 3** (**P3**) of my hypothesis.

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.

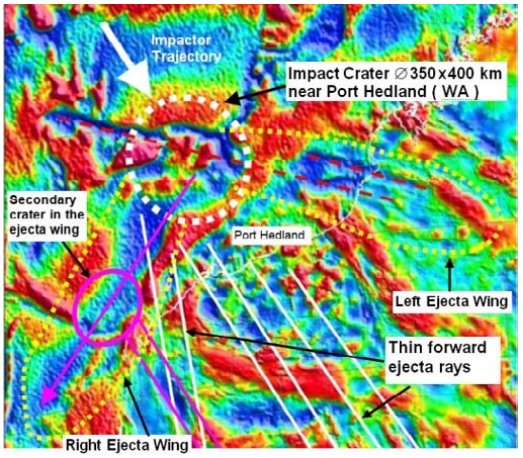
Gravity Anomaly Map of the Kalgoorlie Area



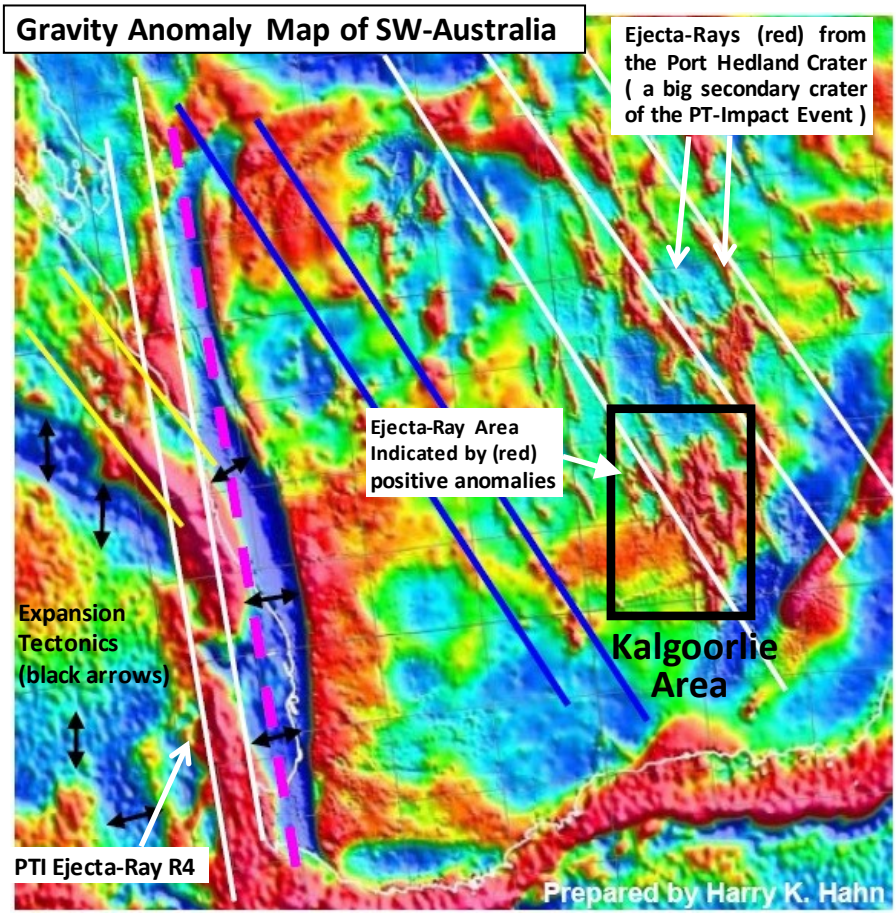
Ø 400 x 350 km Port Hedland Crater



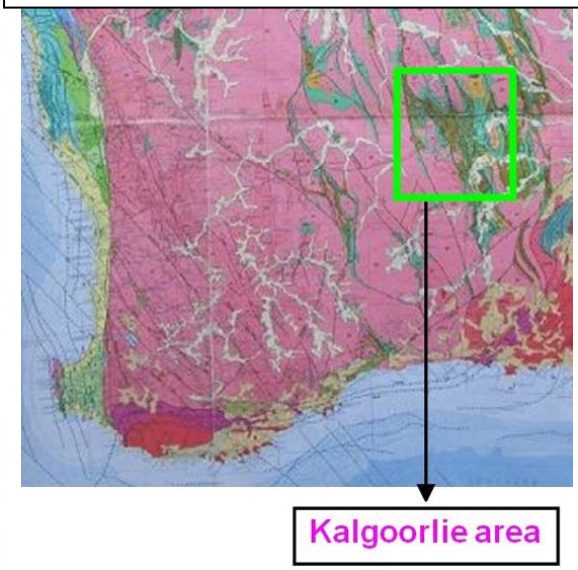
Port Hedland Crater (= Bengal Bay Crater) + surrounding area (Gravity Anomaly Map)



Gravity Anomaly Map of SW-Australia



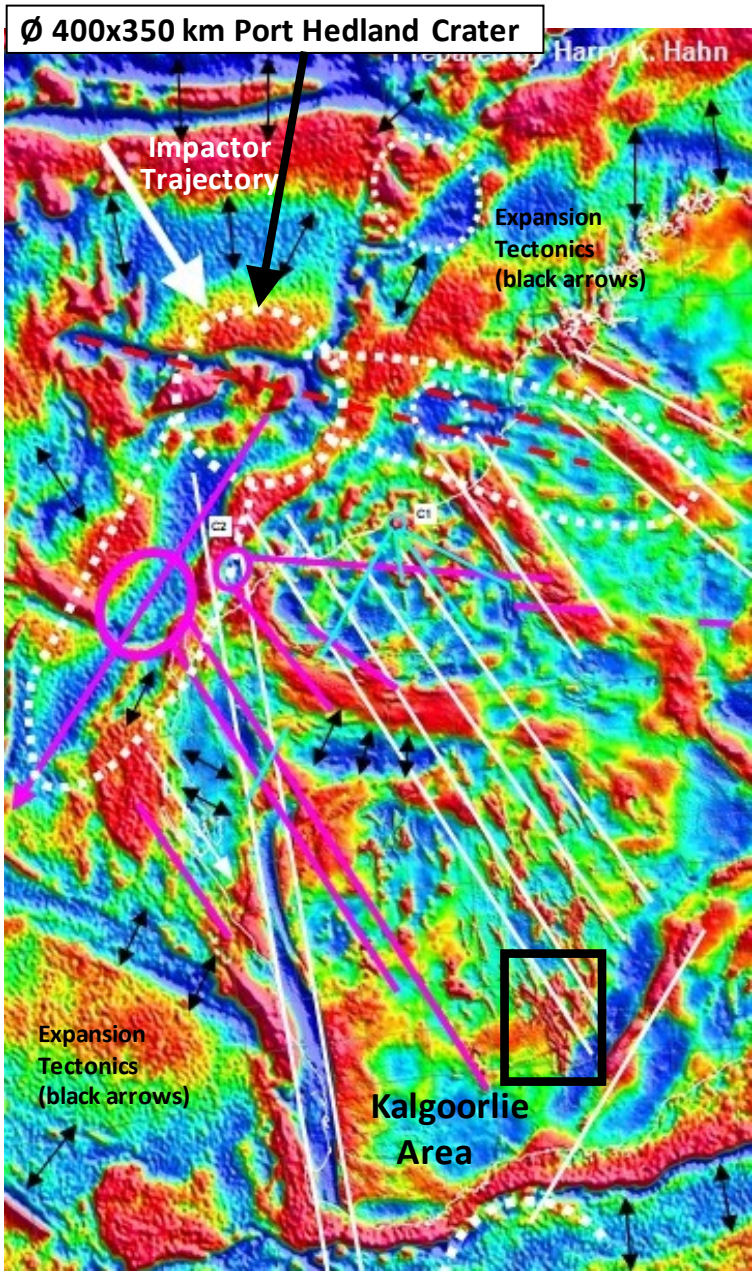
Geological Map of South-West-Australia
→ with sample site area marked on the map

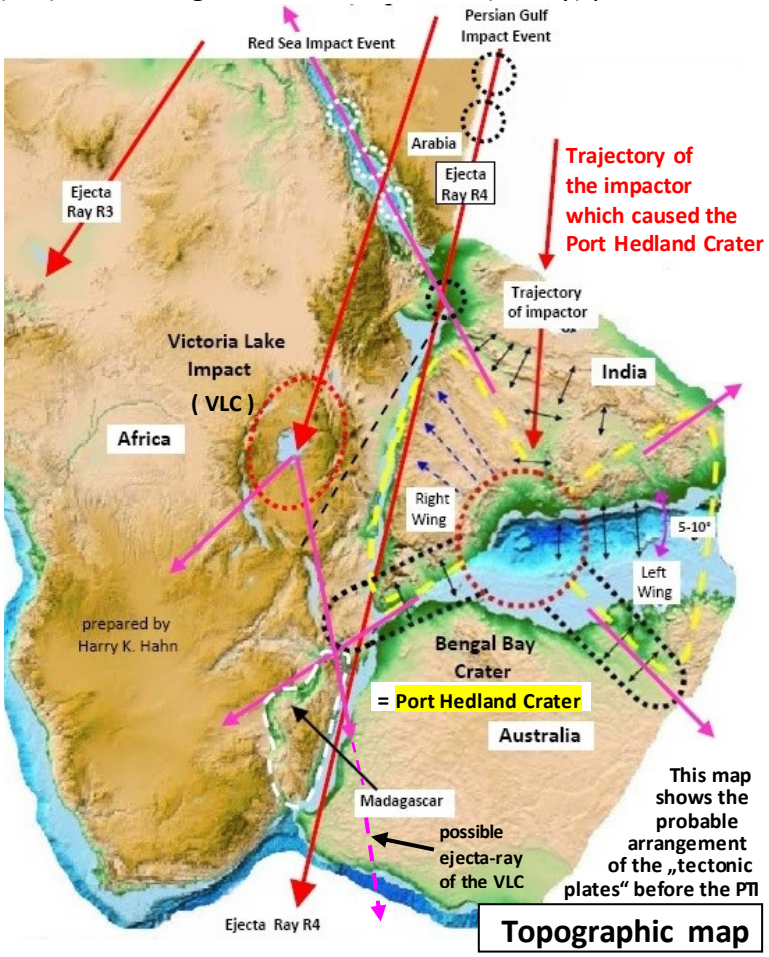


The Ejecta-Ray area near the mining-town Kalgoorlie is marked in green on the Geological Map above

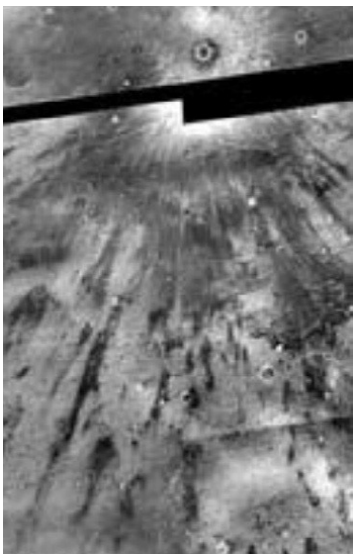
The thin ejecta-ray-structures visible on the gravity anomaly map of Western Australia as linear red (positive) anomalies, were caused either by the **Ø400x350km** Port Hedland Crater (=Bengal Bay Crater) or by the Victoria Lake Impact Crater. According to my Permian-Trassic Impact (PTI) hypothesis the Port Hedland Crater and VLC are big secondary-craters caused by the **PT-Impact**. Bengal Bay in India probably was also caused by the Port Hedland (=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.

Ø 400x350 km Port Hedland Crater





Topographic map

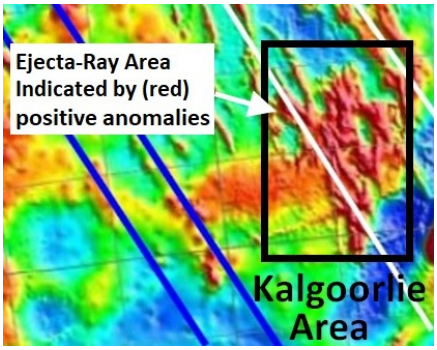


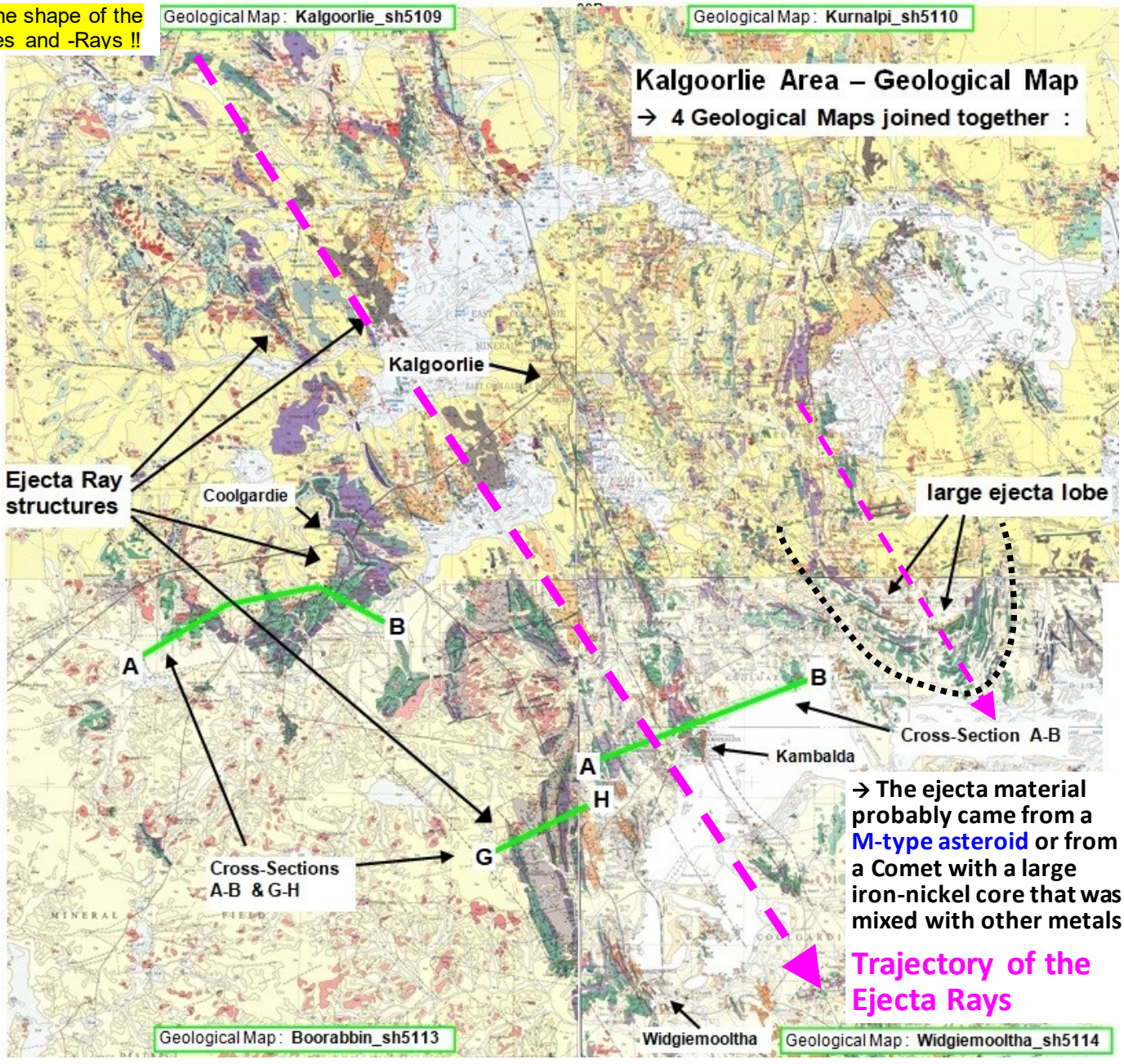
Graterri Crater on Mars:

Compare the shape of the Ejecta-Lobes and -Rays !!

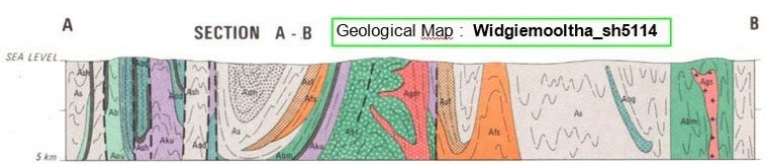
Ejecta-Rays have formed the Kalgoorlie Area (→ an important Mining Area):

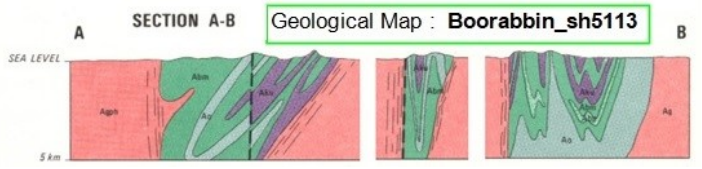
A comparison of the ejecta-ray-stuctures of the **Graterri Crater on planet Mars** with the structures visible on the geological map of the Kalgoorlie Area shows clear similarities. The ray- & lobe- structures have similar shapes as the longish & „lumpy" ejecta-structures caused by the **Graterri Impact Crater**, → an Impact Crater on a planet with atmosphere. The strongest indication for an ejecta-impact area comes from the Gravity Anomaly Map **(→ see map)**. The red-colored positive anomalies are arranged in a parallel pattern on the Yilgarn Craton. Source of the ejecta-rays is the Port-Hedland Crater or the VLC-Crater according to my **PTI—hypothesis.** In Kalgoorlie the large **Super-Pit gold-mine** is located. The gold here is mainy present in **Telluride Minerals** within Pyrite. **Tellur & Gold are rare elements which surely were ingredients of the PT-Impactor** together with other rare- & heavy elements found in the area like Rare Earth Metals, Nickel, Co, Ag, Zn, Cu, Cr, V etc.



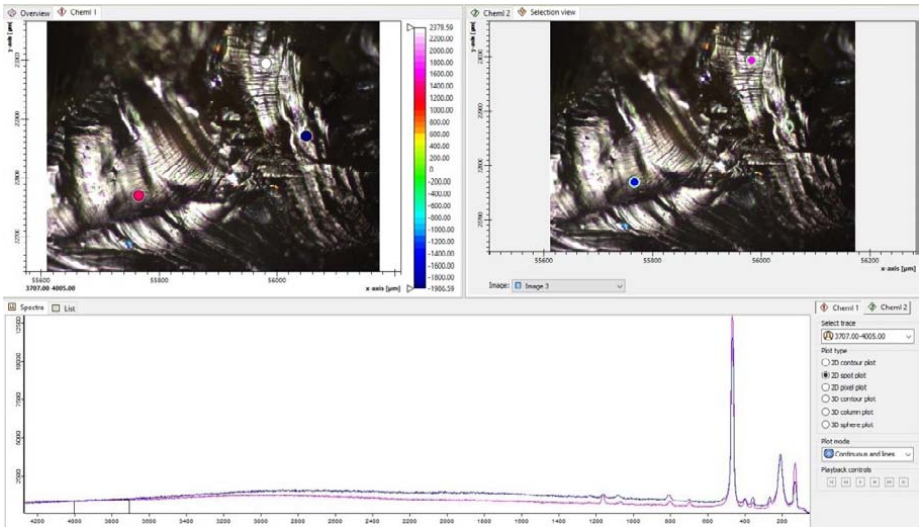


The cross-sections show that the ejecta-rays of the Port Hedland Crater (the nearly linear multi- colored structures visible on the geological map) have penetrated the Yilgarn Craton down to a **depth of around 5 to 10 km** !

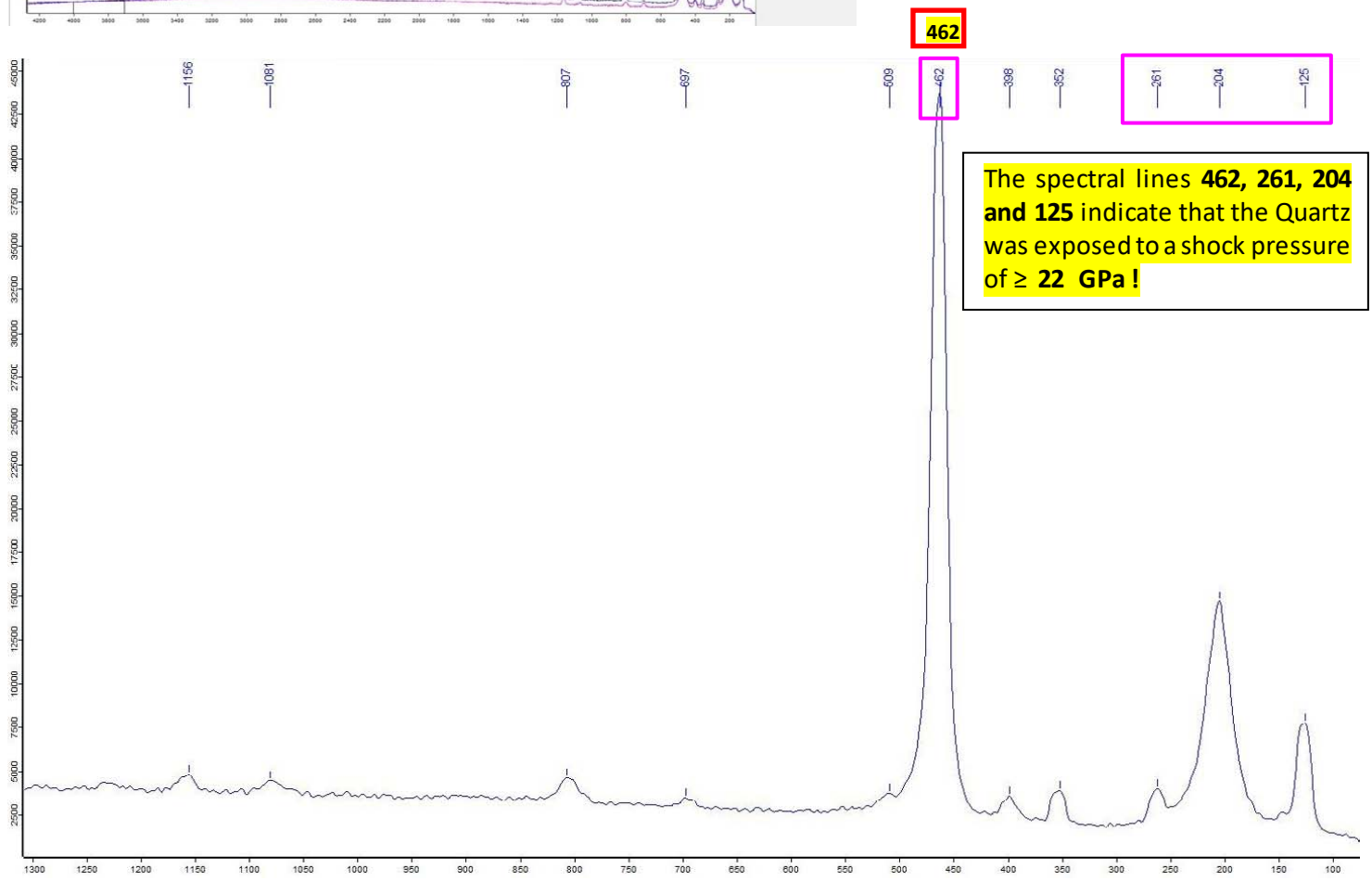




Sample Site 2 : Stone 1_spectra 1 indicates : Quartz

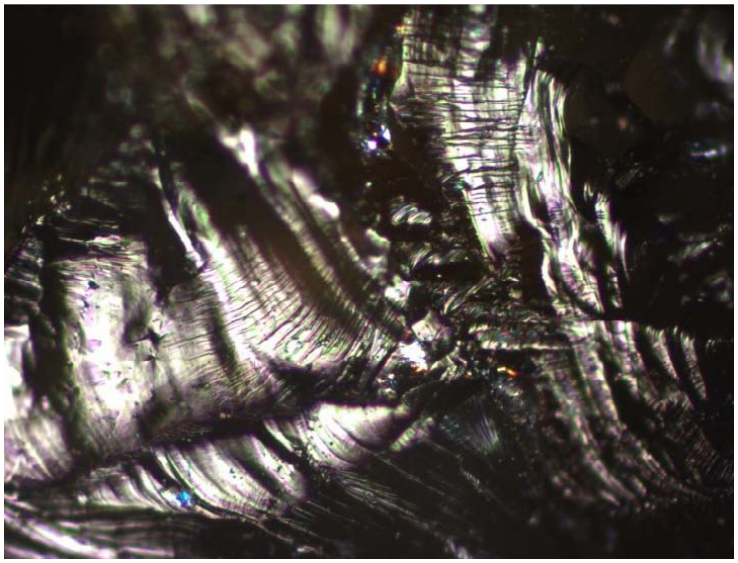


Sample :

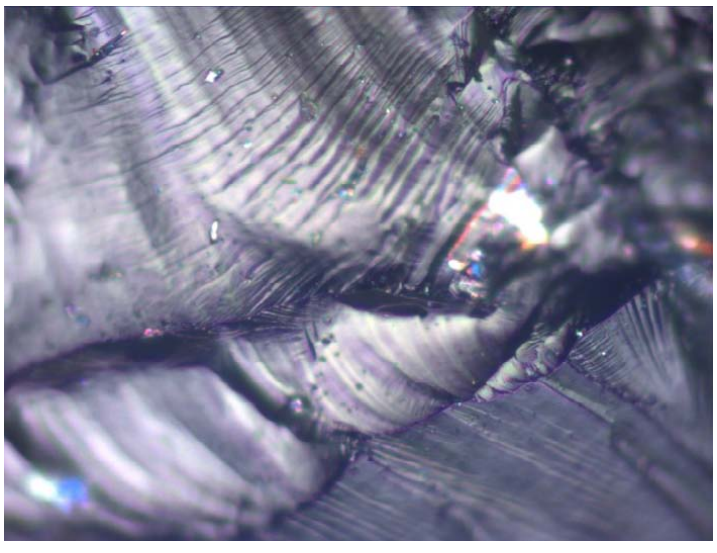


The spectral lines **462, 261, 204 and 125** indicate that the Quartz was exposed to a shock pressure of ≥ **22 GPa !**

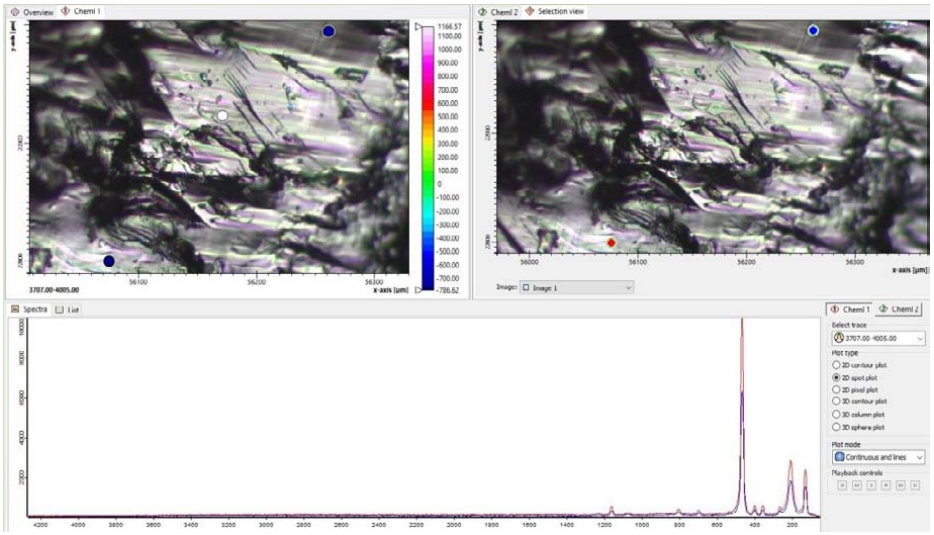
Detail : Image size : ~ 500 x 400 µm



Detail : Image size : ~ 250 x 200 µm



Sample Site 2 : Stone 2_spectra 1 indicates : Quartz



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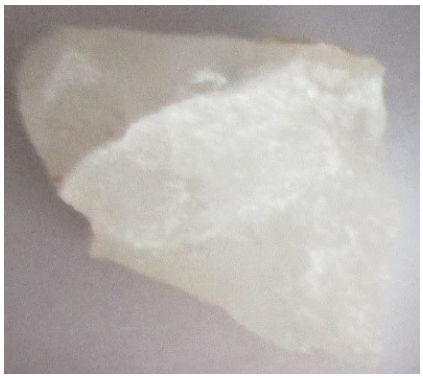
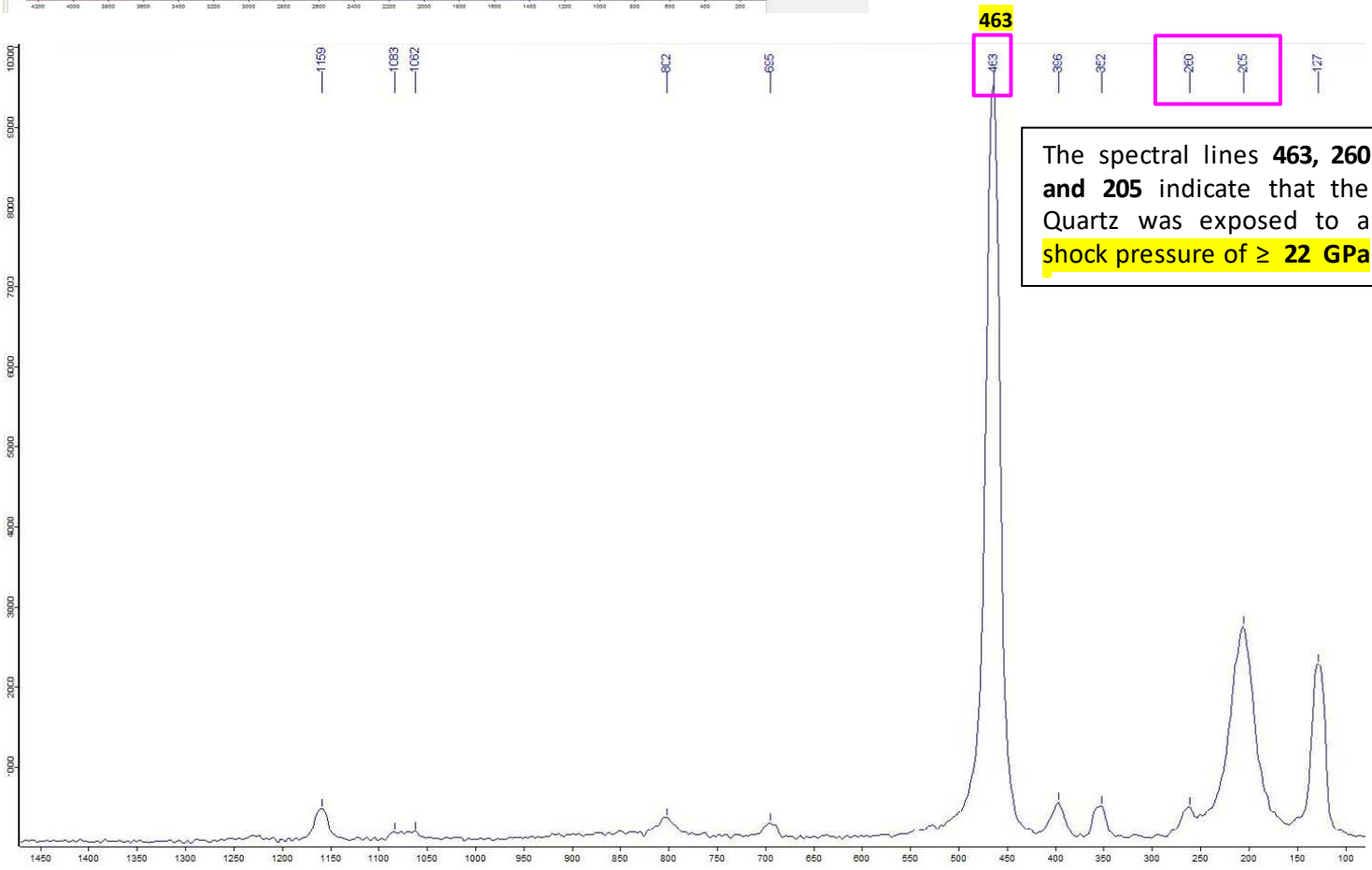
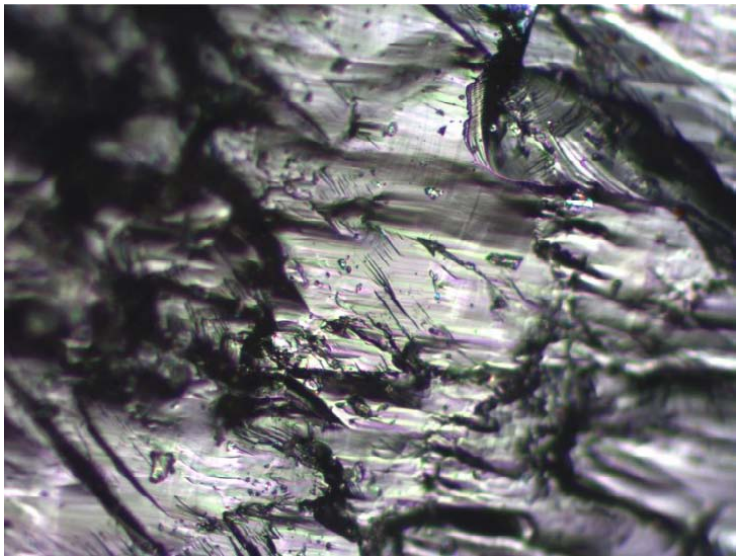


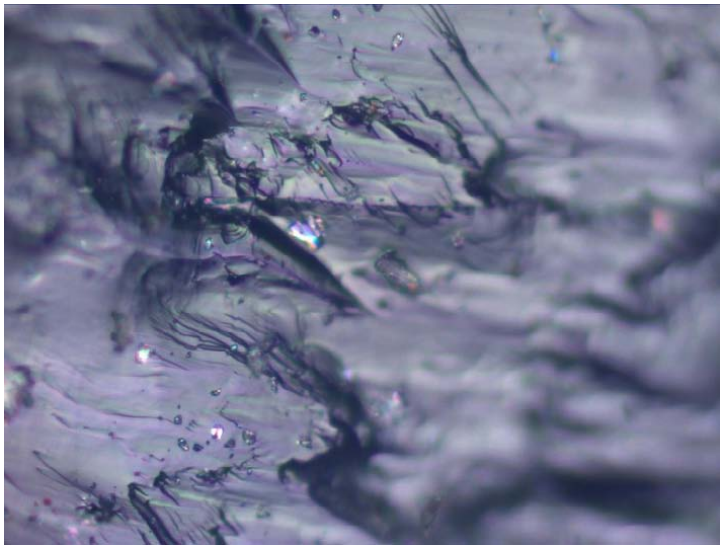


The spectral lines **463, 260 and 205** indicate that the Quartz was exposed to a shock pressure of ≥ **22 GPa**

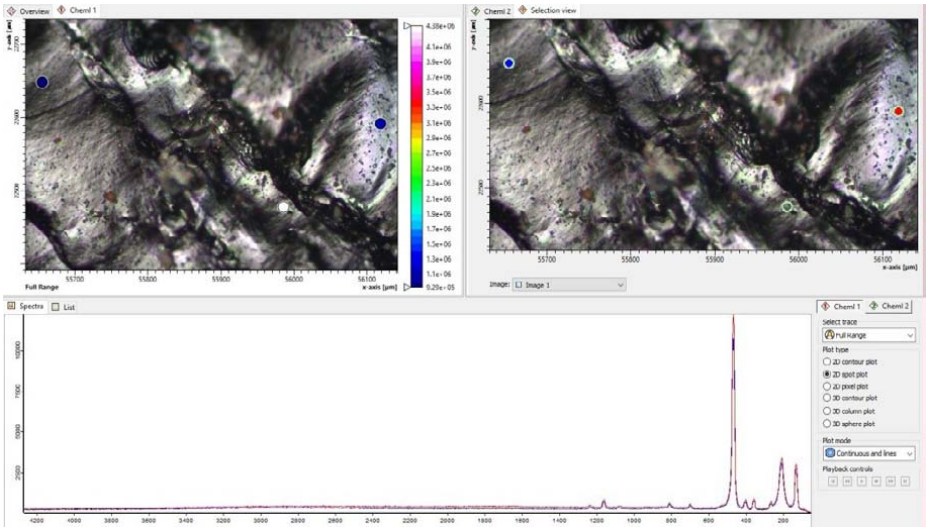
Detail : Image size : ~ 300 x 200 µm



Detail : Image size : ~ 150 x 100 µm



Sample Site 4 : Stone 1_spectra 1 indicates : Quartz



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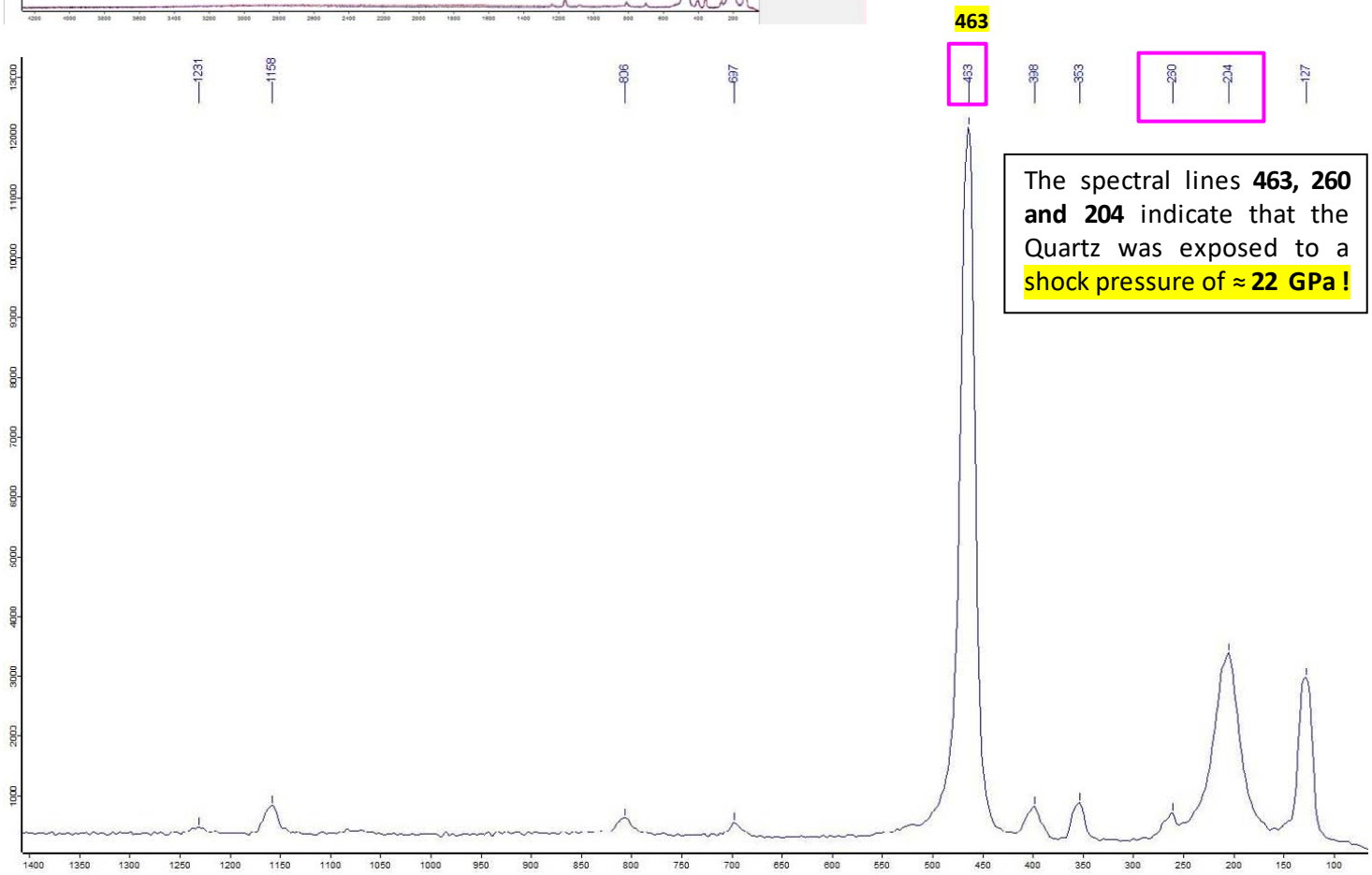
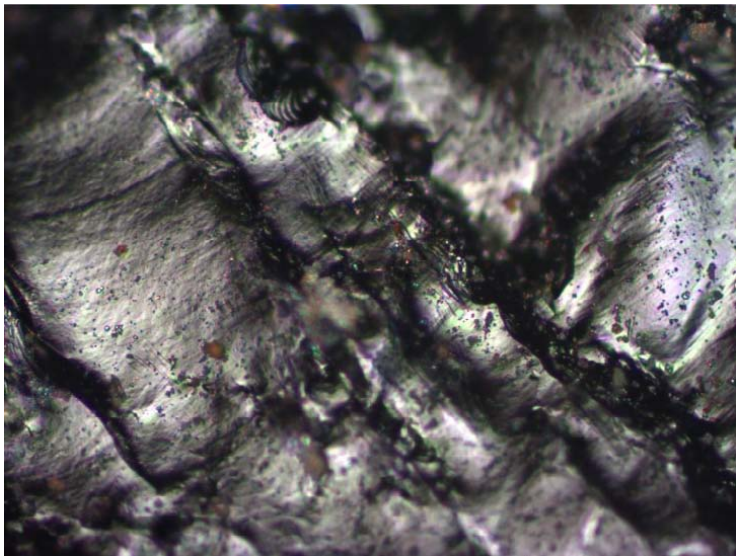
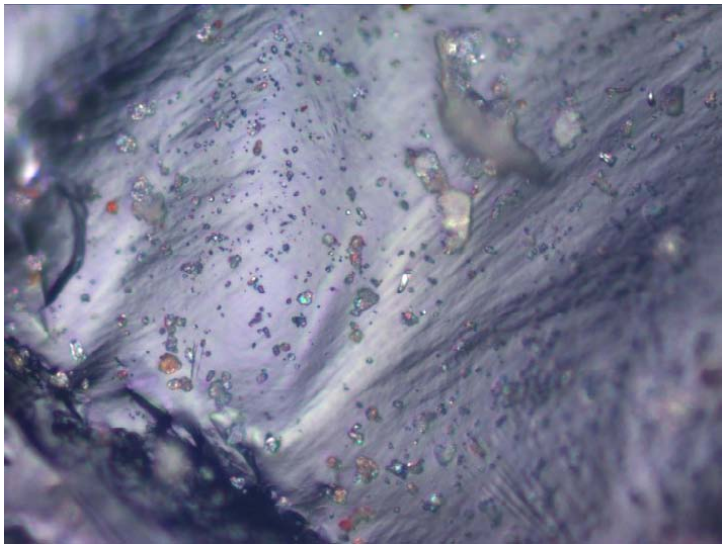


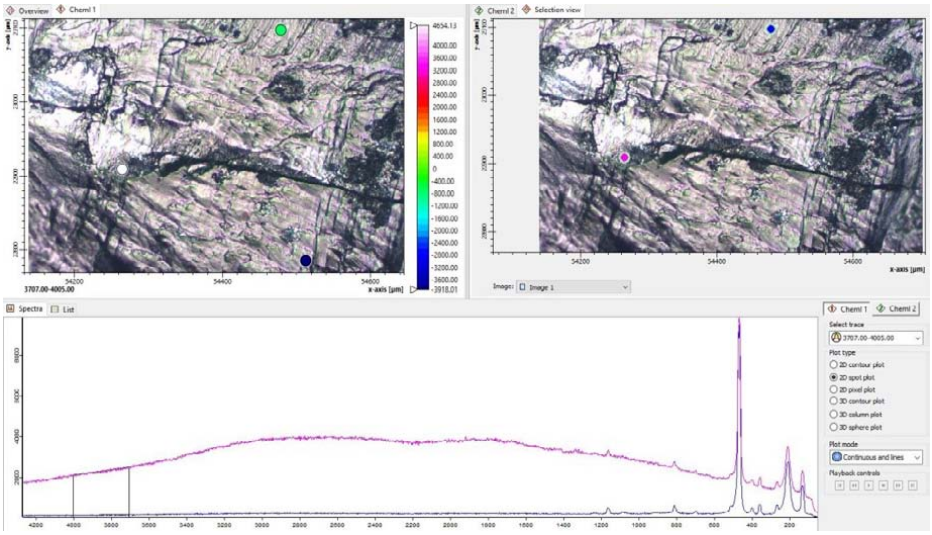
Detail : Image size : ~ 500 x 400 µm



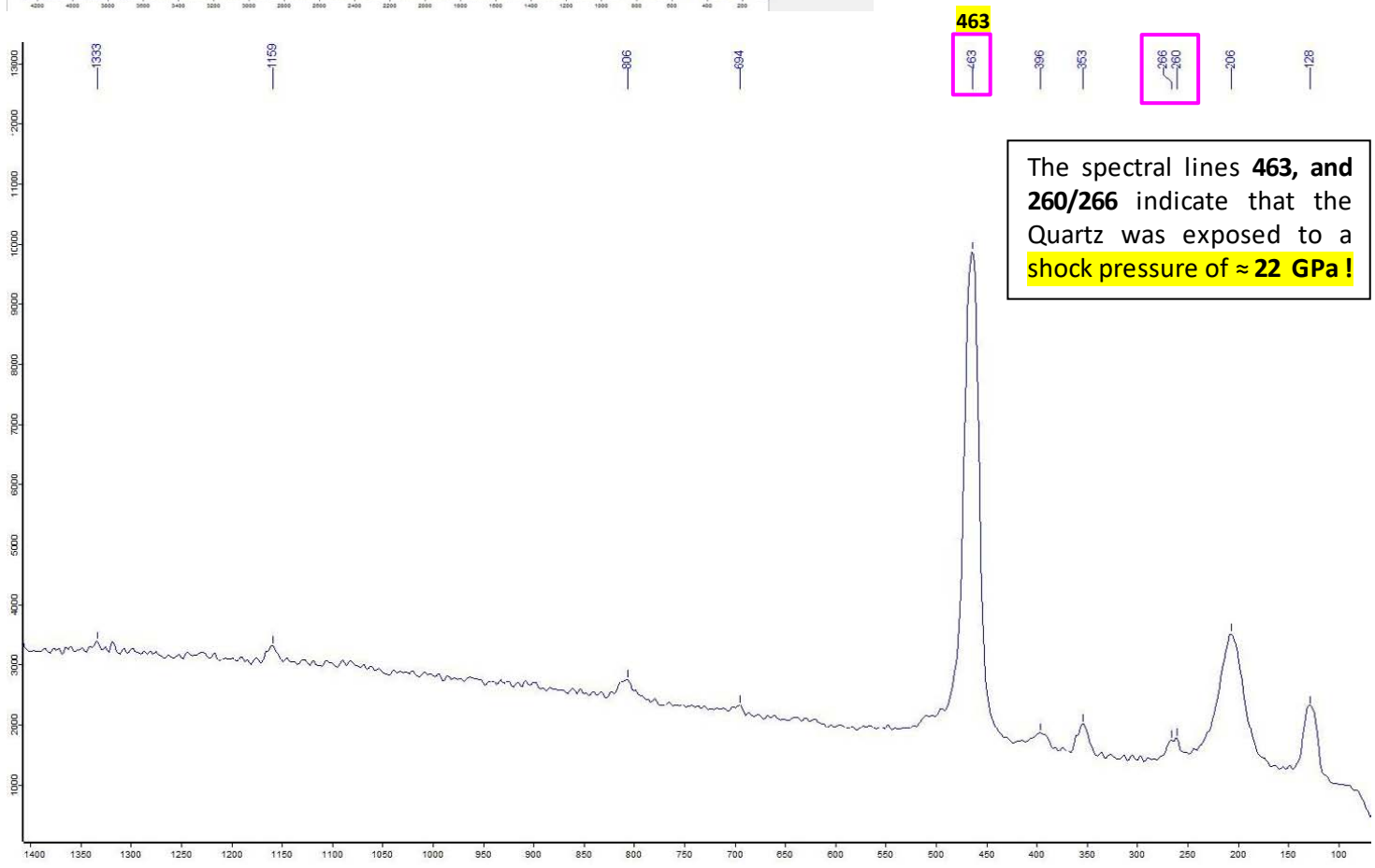
Detail : Image size : ~ 250 x 200 µm



Sample Site 5 : Stone 1_spectra 1 indicates : Quartz

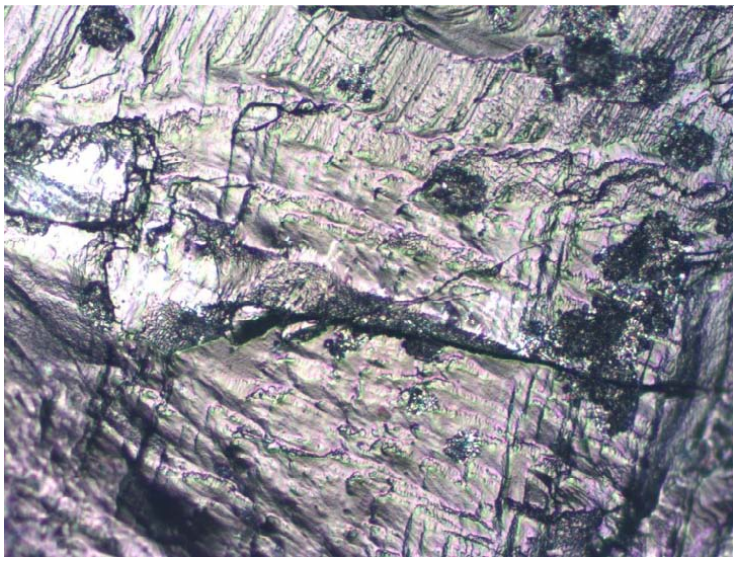


Sample :



The spectral lines **463, and 260/266** indicate that the Quartz was exposed to a shock pressure of ≈ **22 GPa !**

Detail : Image size : ~ 500 x 400 µm



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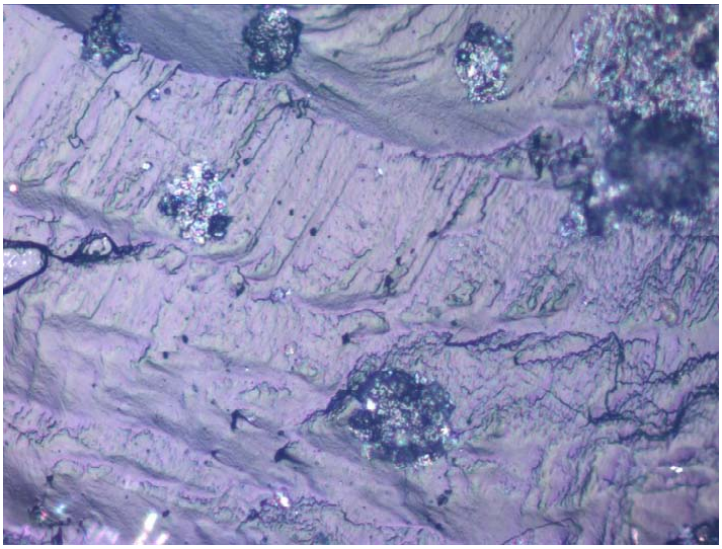
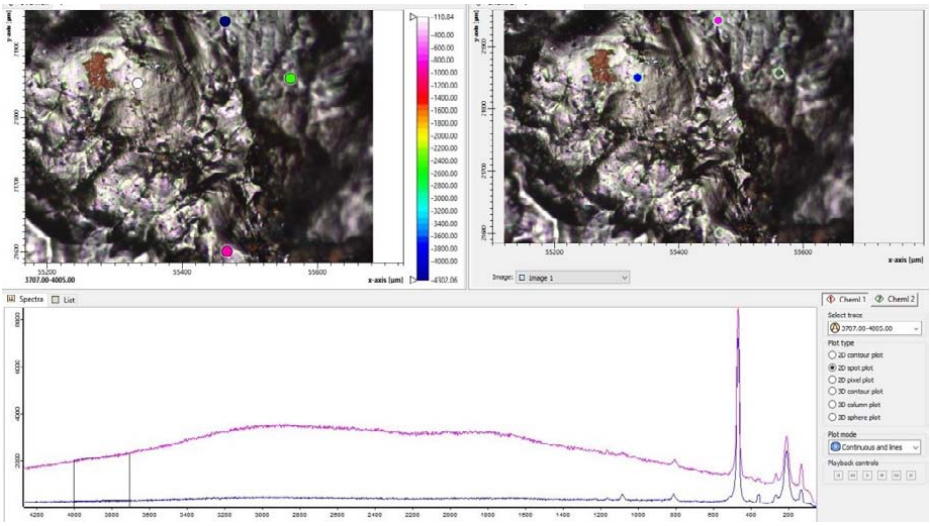


Sample Site 21 : Stone 1_spectra 1 indicates : Quartz



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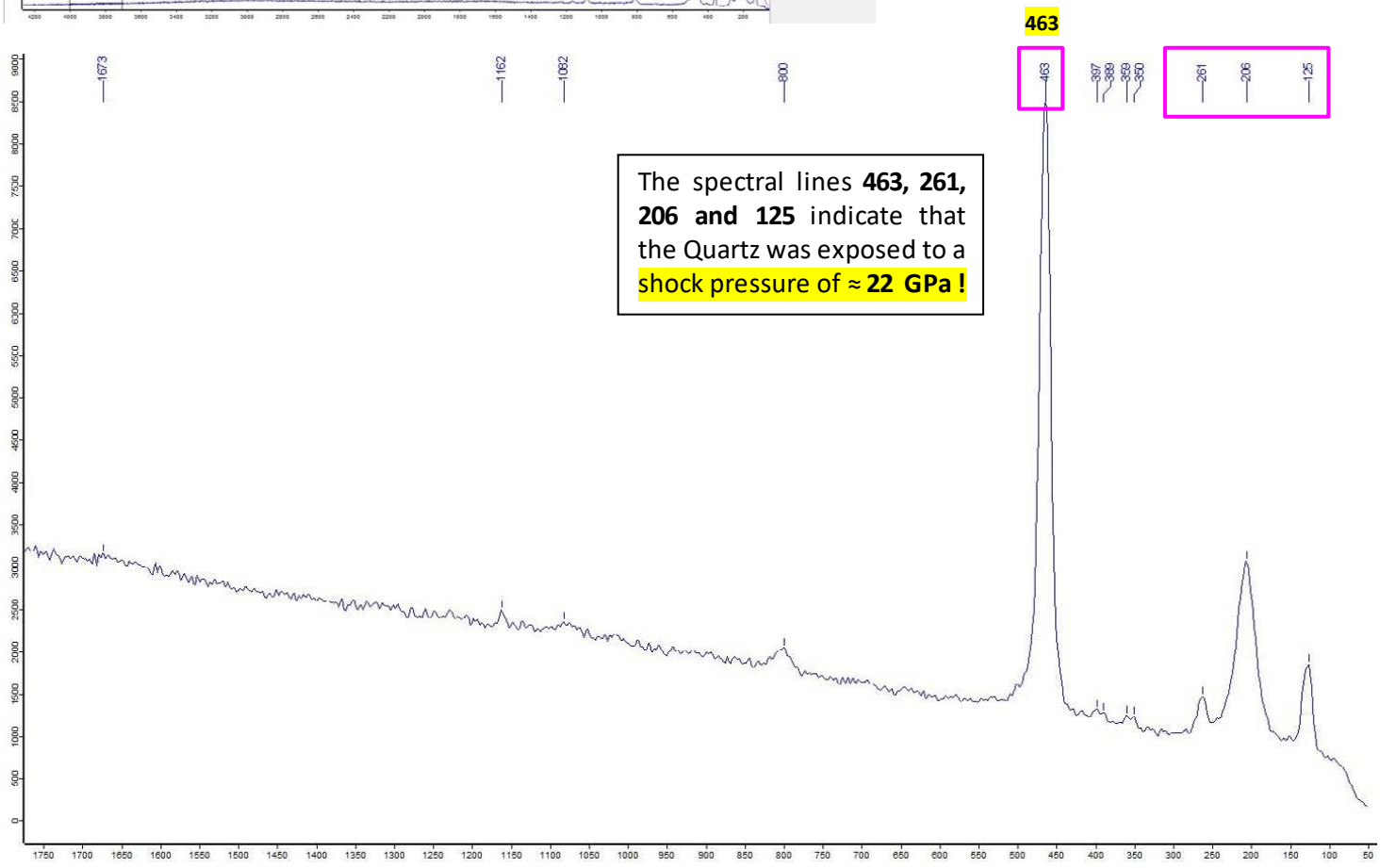
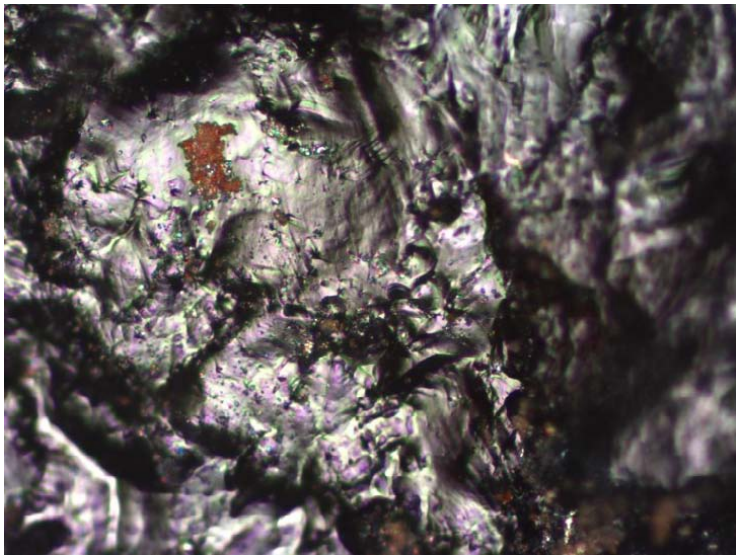
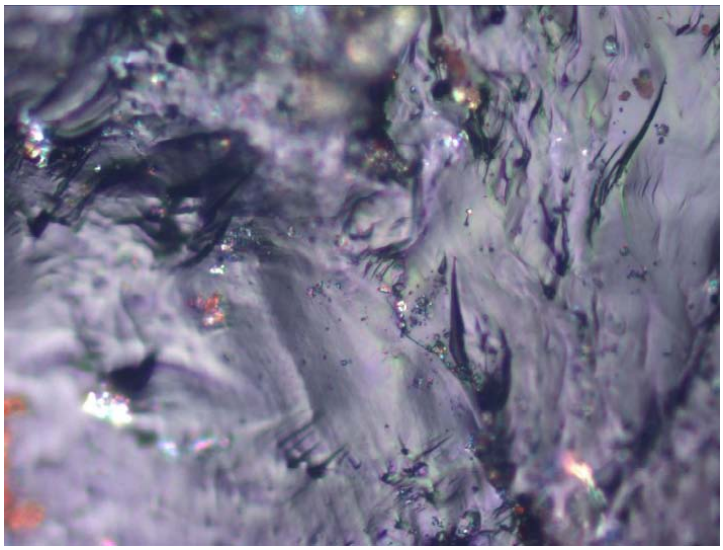


The spectral lines **463, 261, 206 and 125** indicate that the Quartz was exposed to a shock pressure of ≈ **22 GPa !**

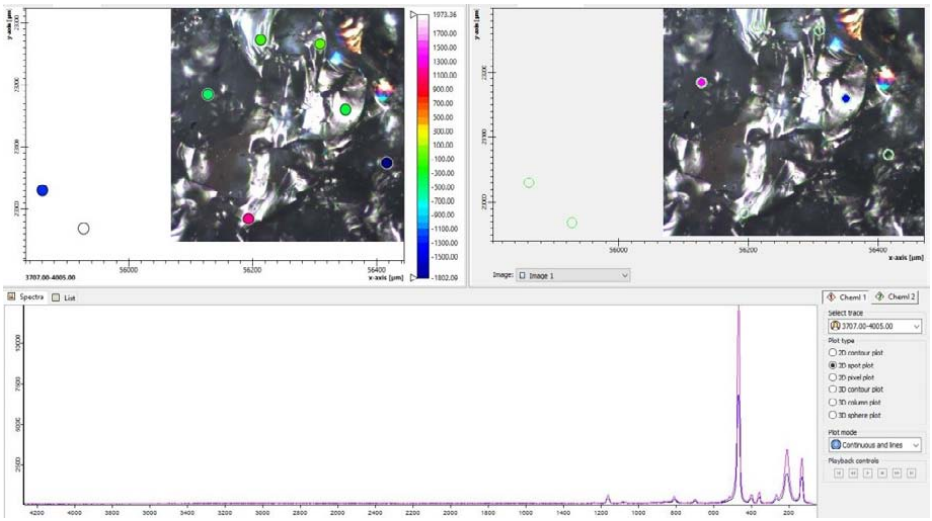
Detail : Image size : ~ 500 x 400 µm



Detail : Image size : ~ 250 x 200 µm



Sample Site 27 : Stone 1_spectra 1 indicates : Quartz



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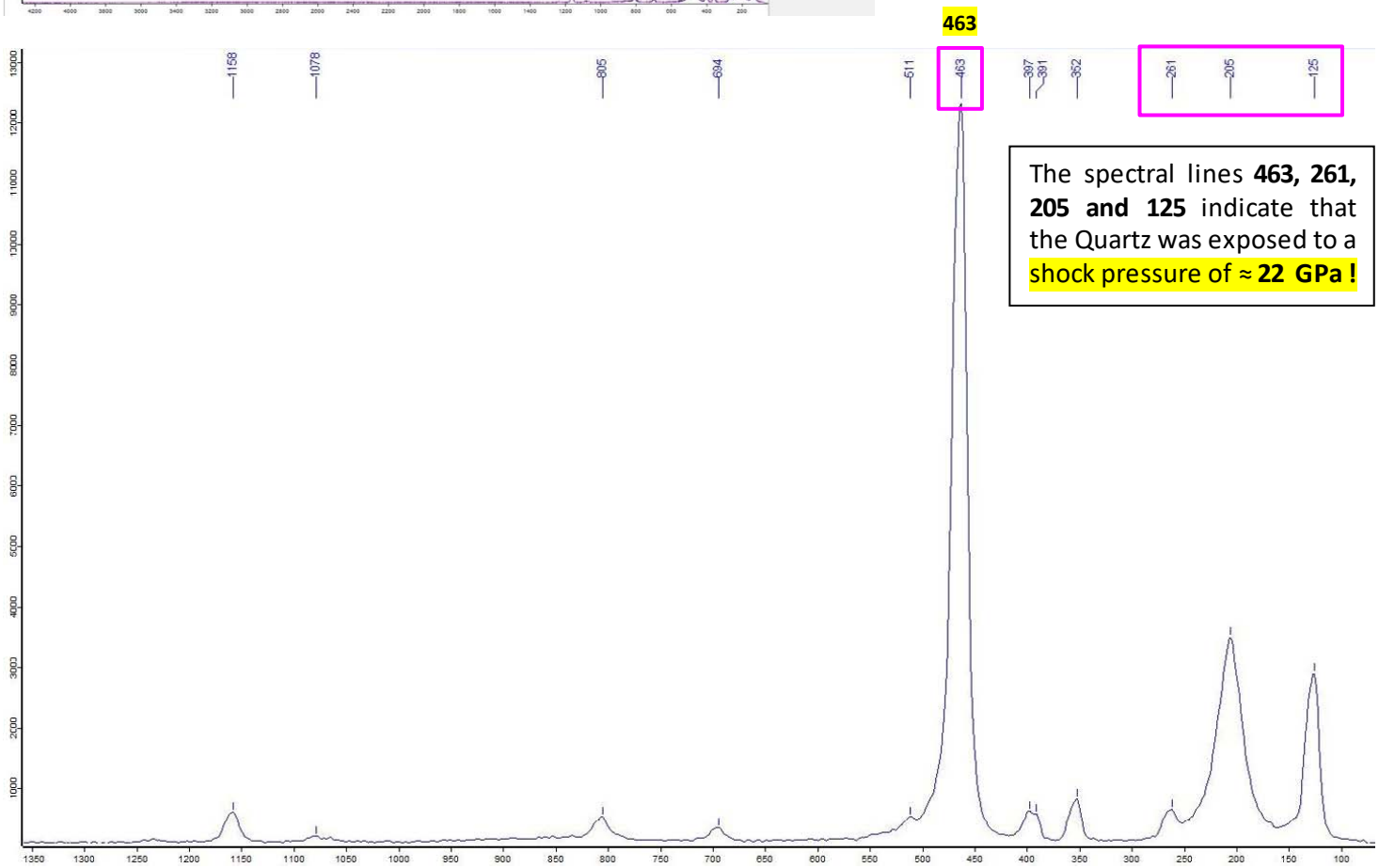
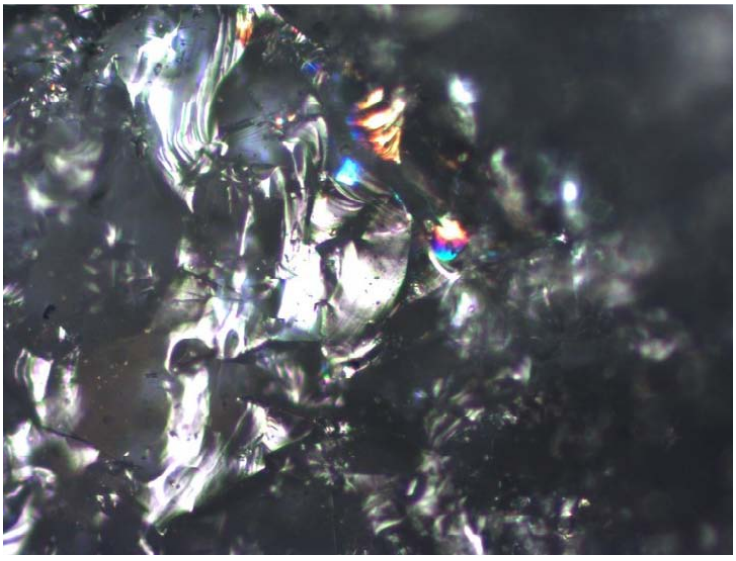
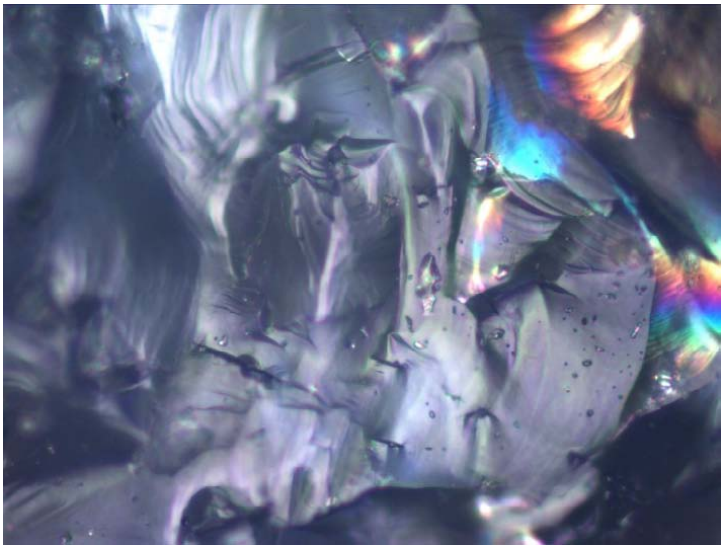


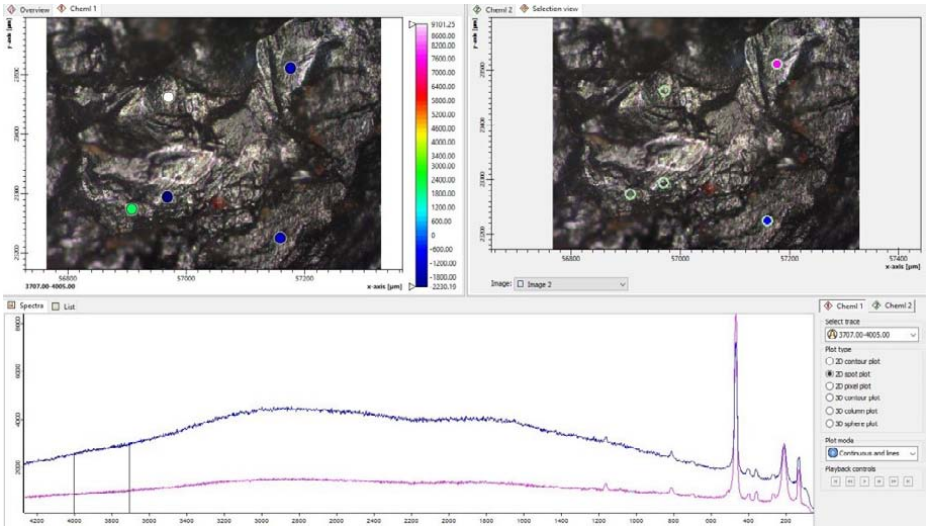
Detail : Image size : ~ 500 x 400 µm



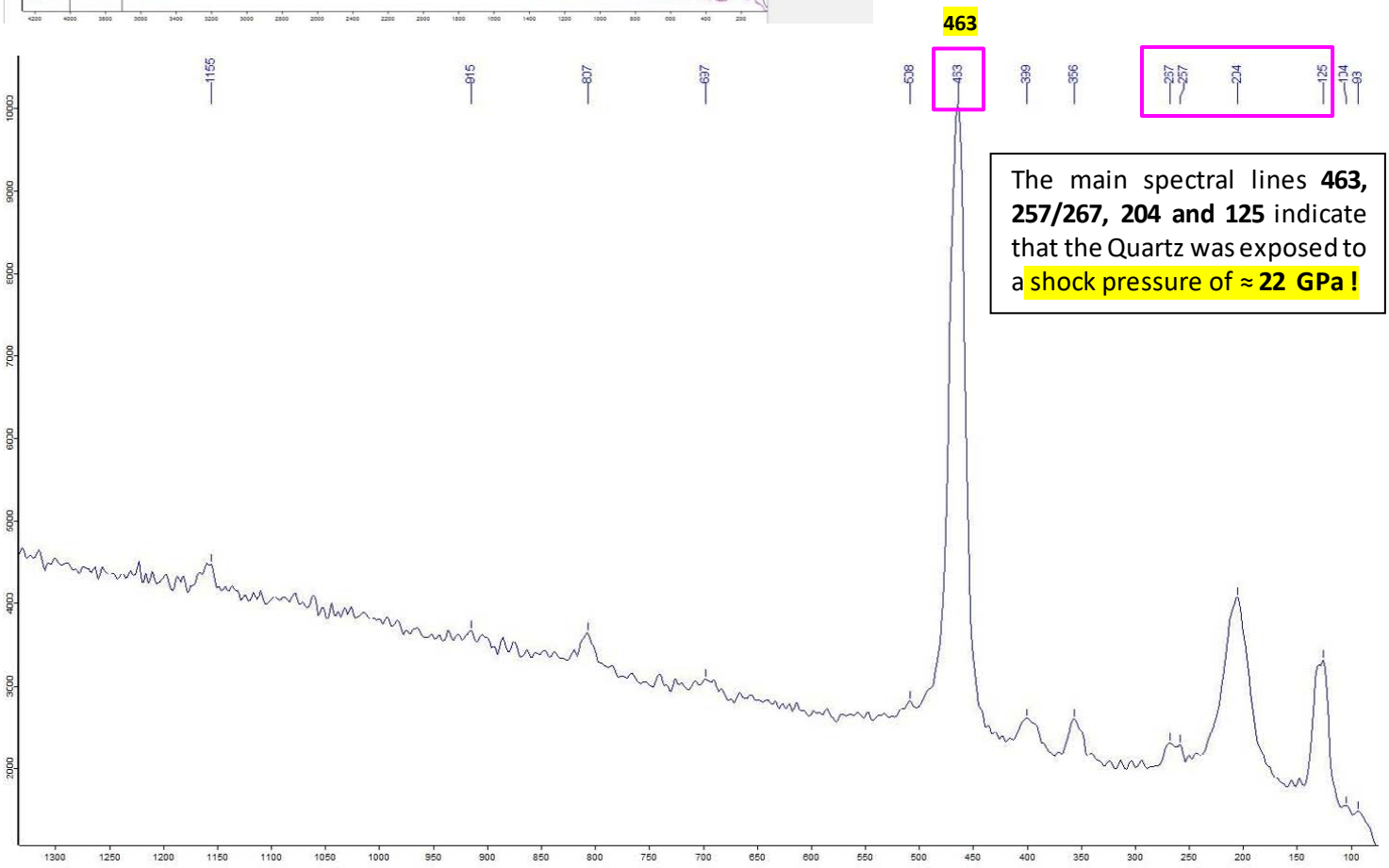
Detail : Image size : ~ 250 x 200 µm



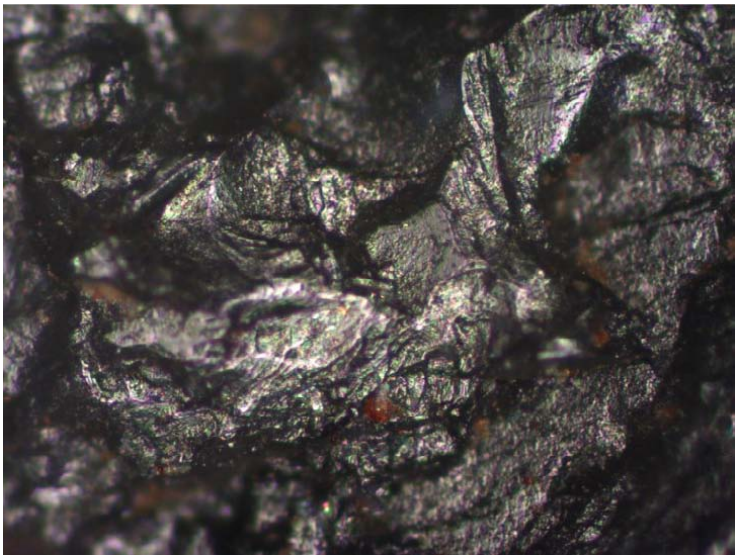
Sample Site 31 : Stone 1_spectra 1 indicates : Quartz



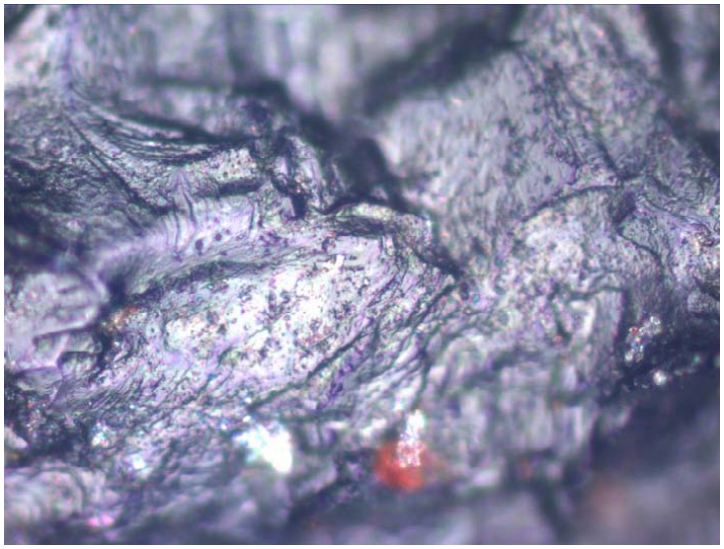
Sample :



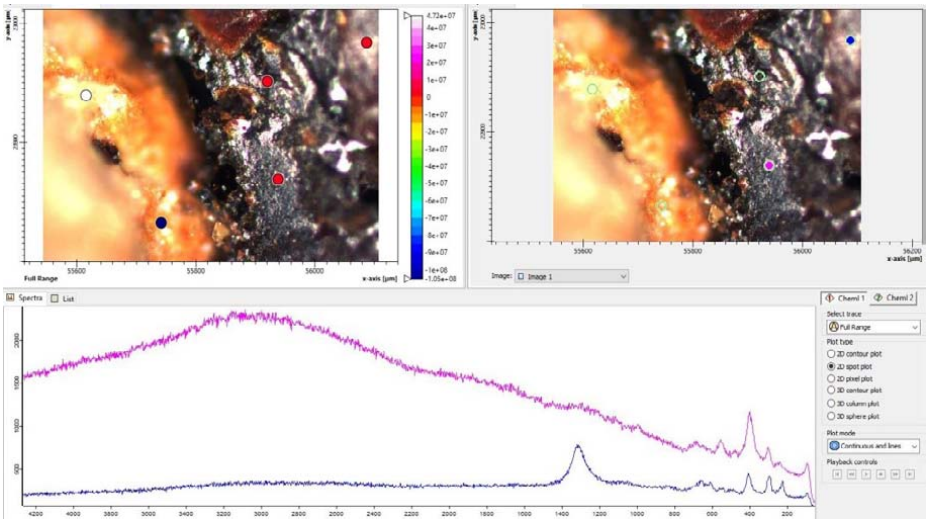
Detail : Image size : ~ 500 x 400 µm



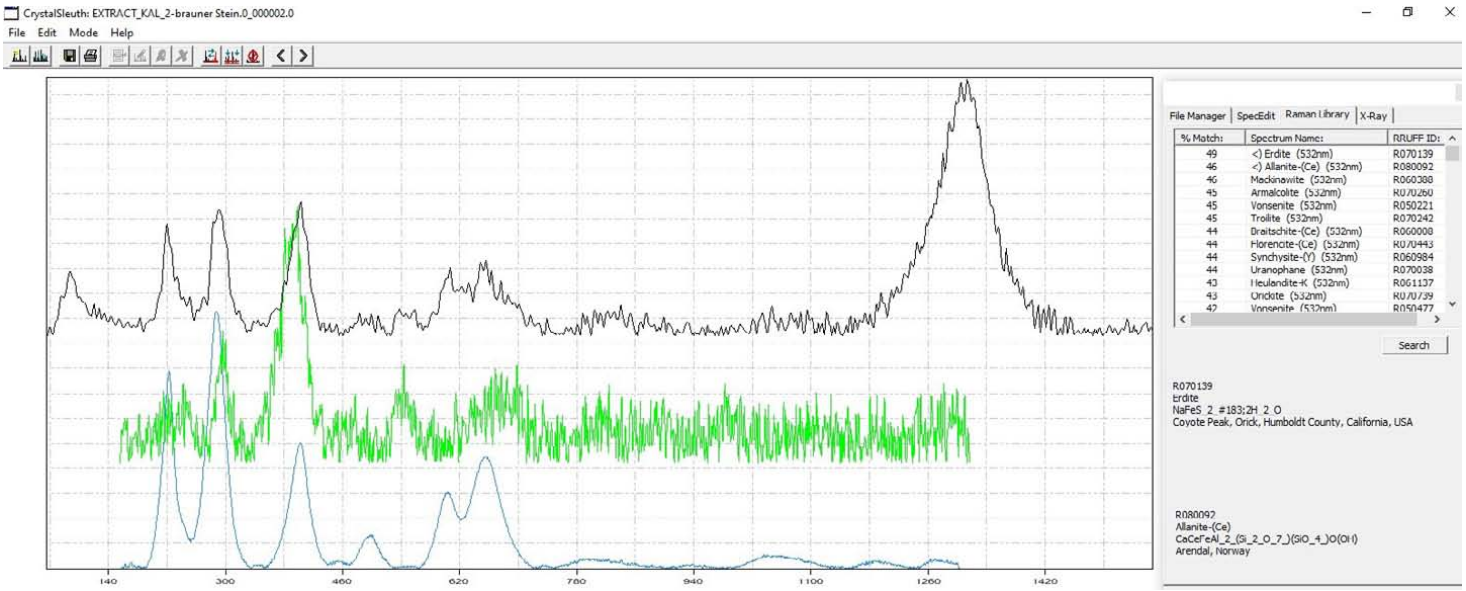
Detail : Image size : ~ 250 x 200 µm

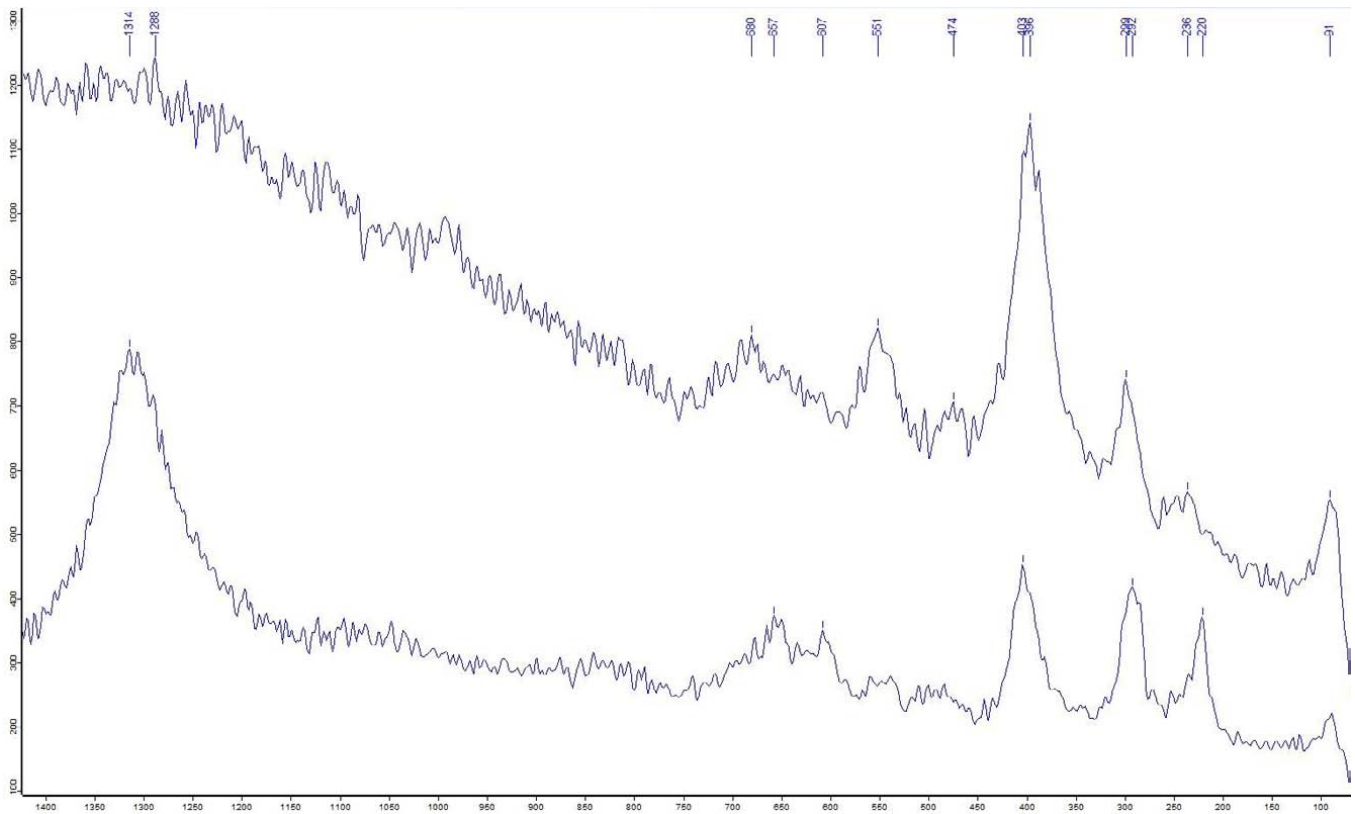


Sample Site 2 : Stone 3_spectra 1 indicates : Erdite, Allanite

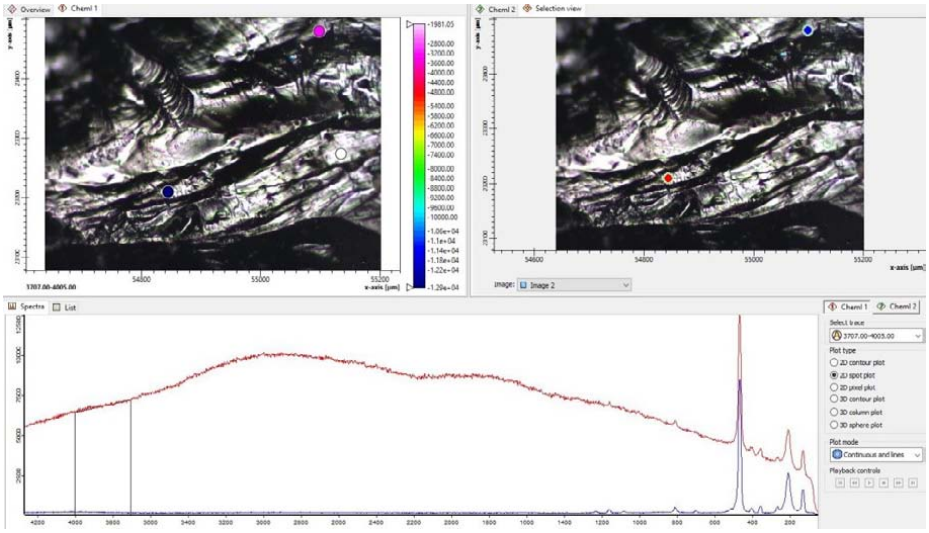


Sample :





Sample Site 5 : Stone 2_spectra 1 indicates : Quartz



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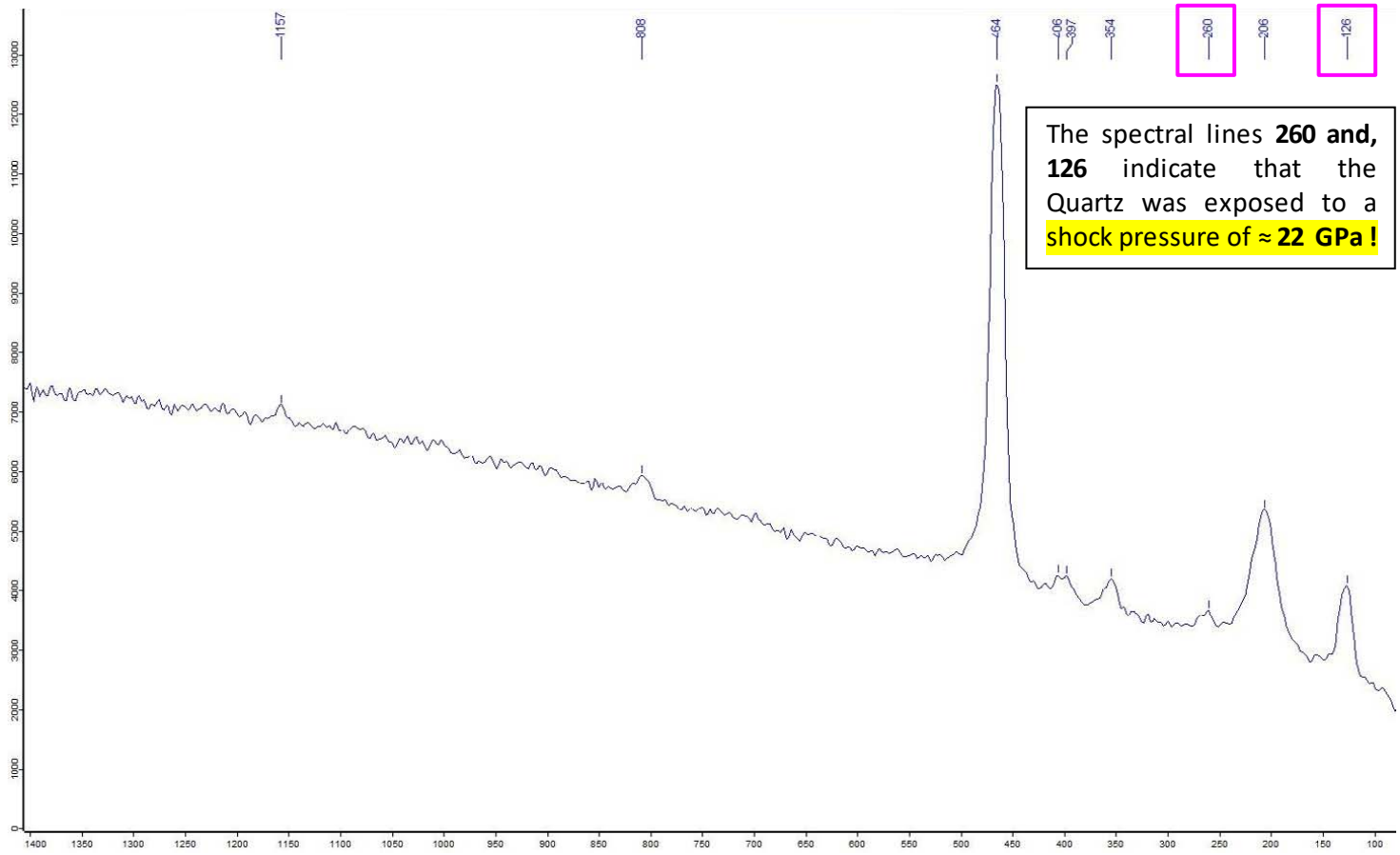
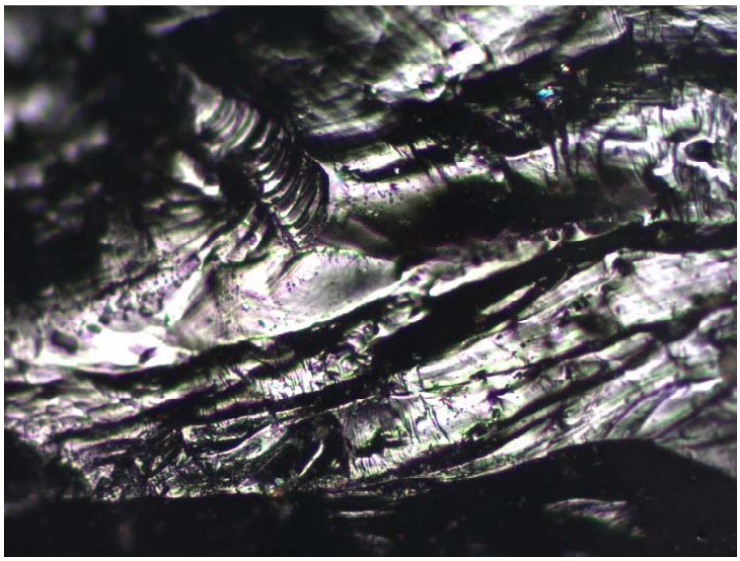
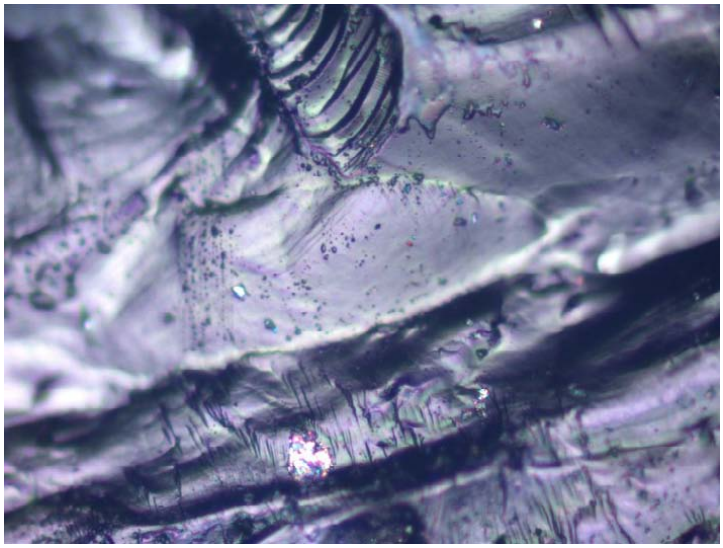


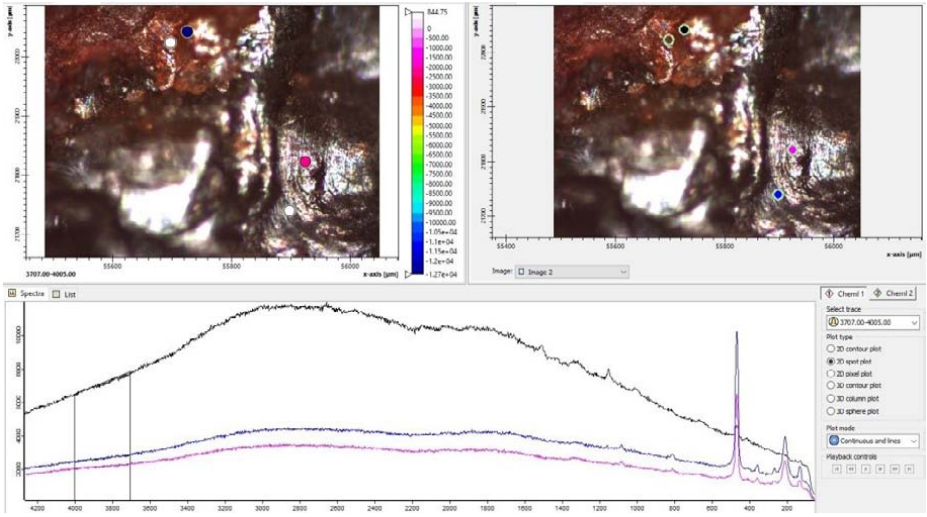
Detail : Image size : ~ 500 x 400 µm



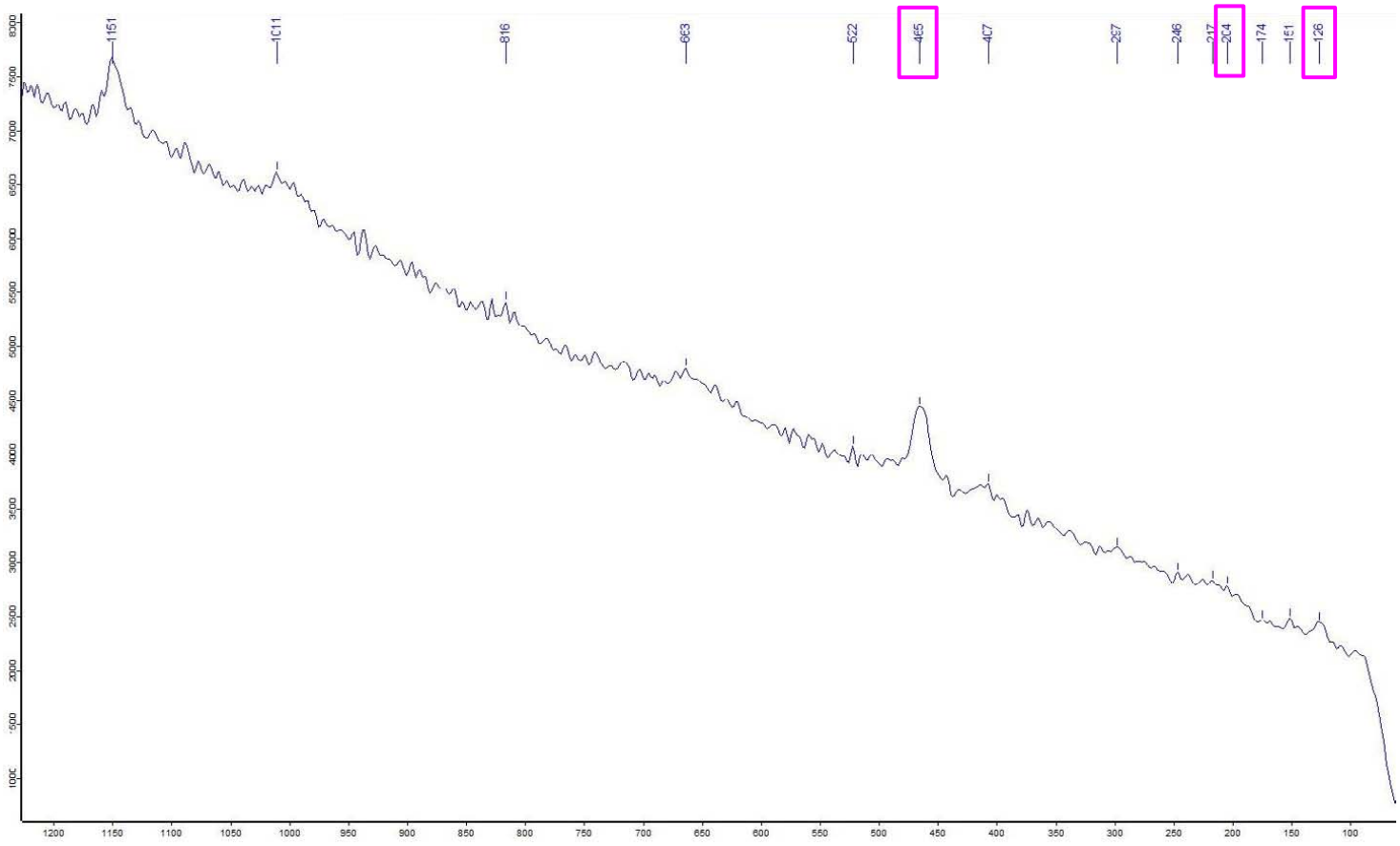
Detail : Image size : ~ 250 x 200 µm



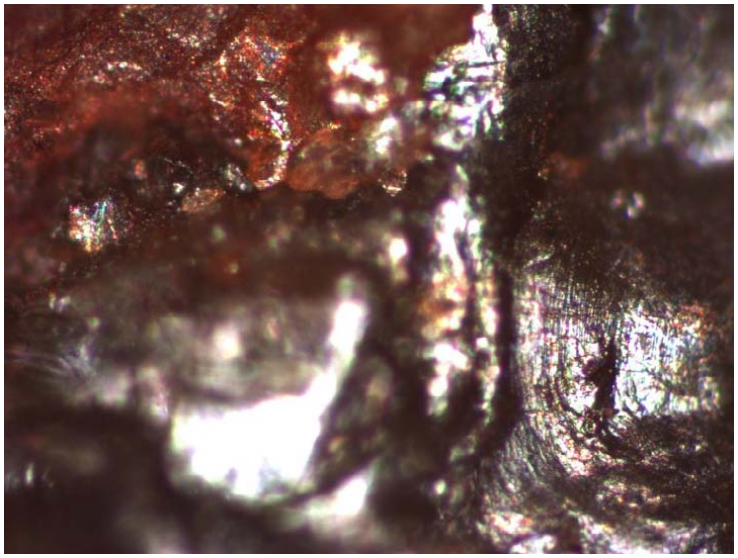
Sample Site 13 : Stone 1_spectra 1 indicates : Quartz



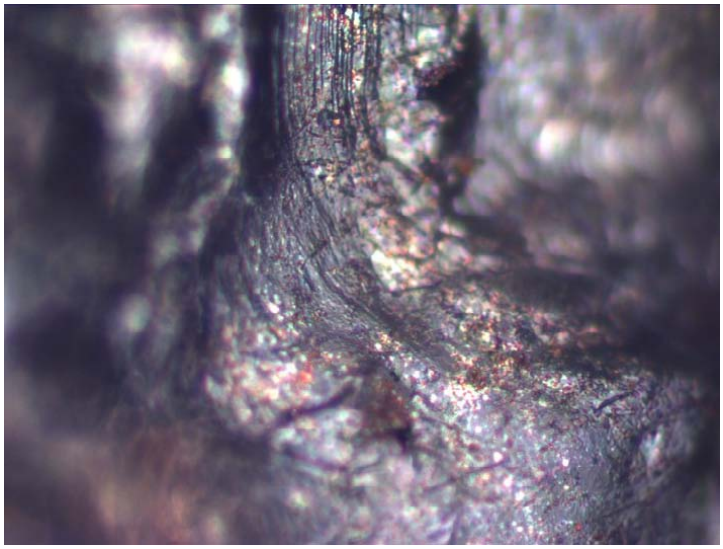
Sample :



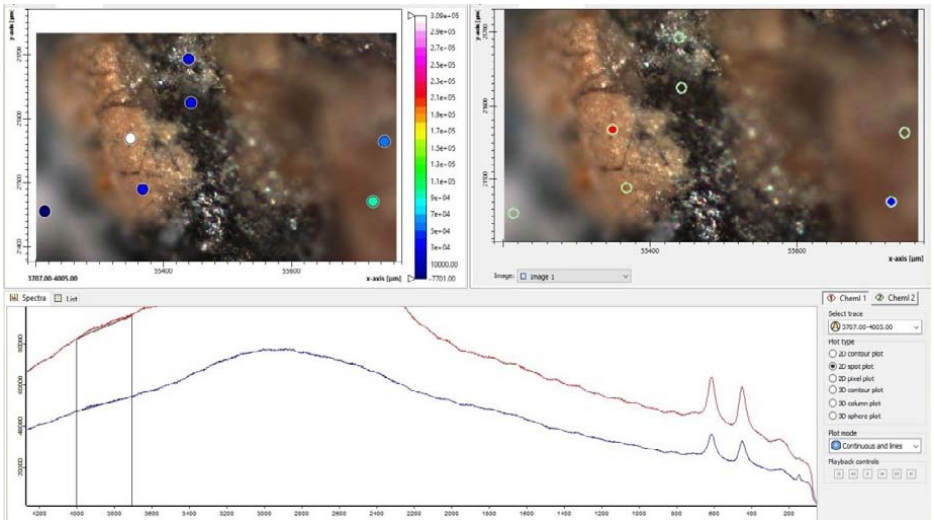
Detail : Image size : ~ 500 x 400 µm



Detail : Image size : ~ 250 x 200 µm

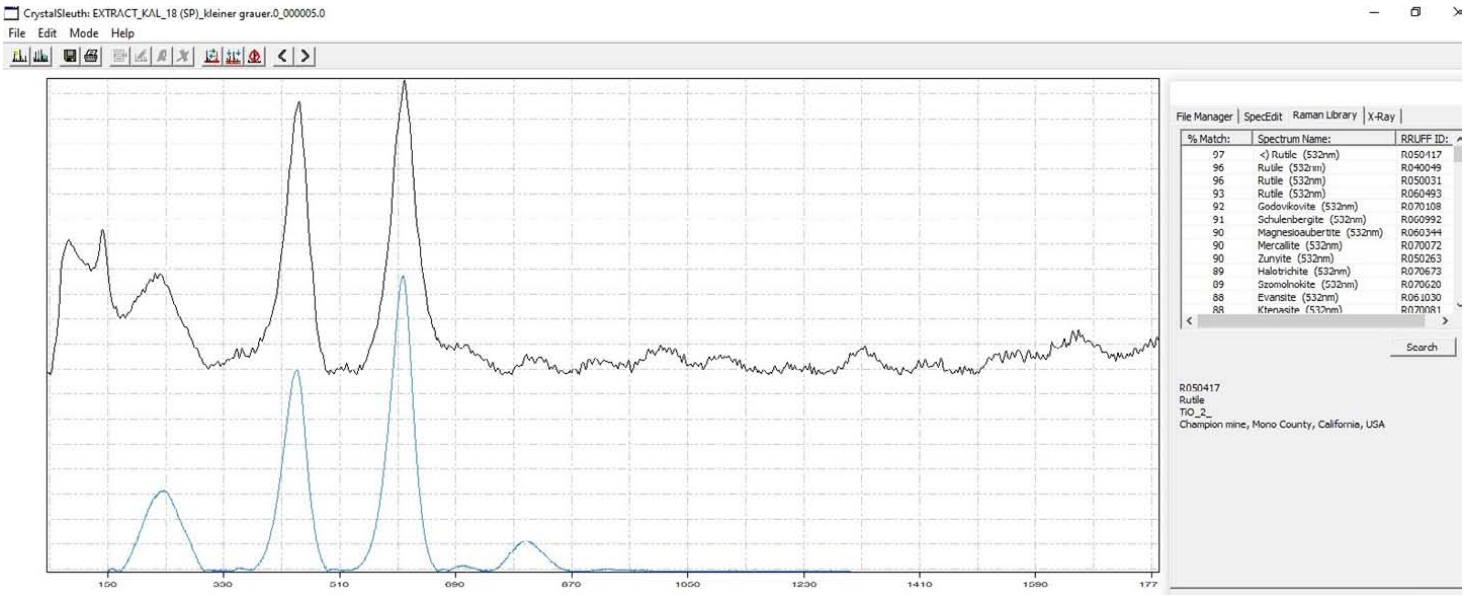


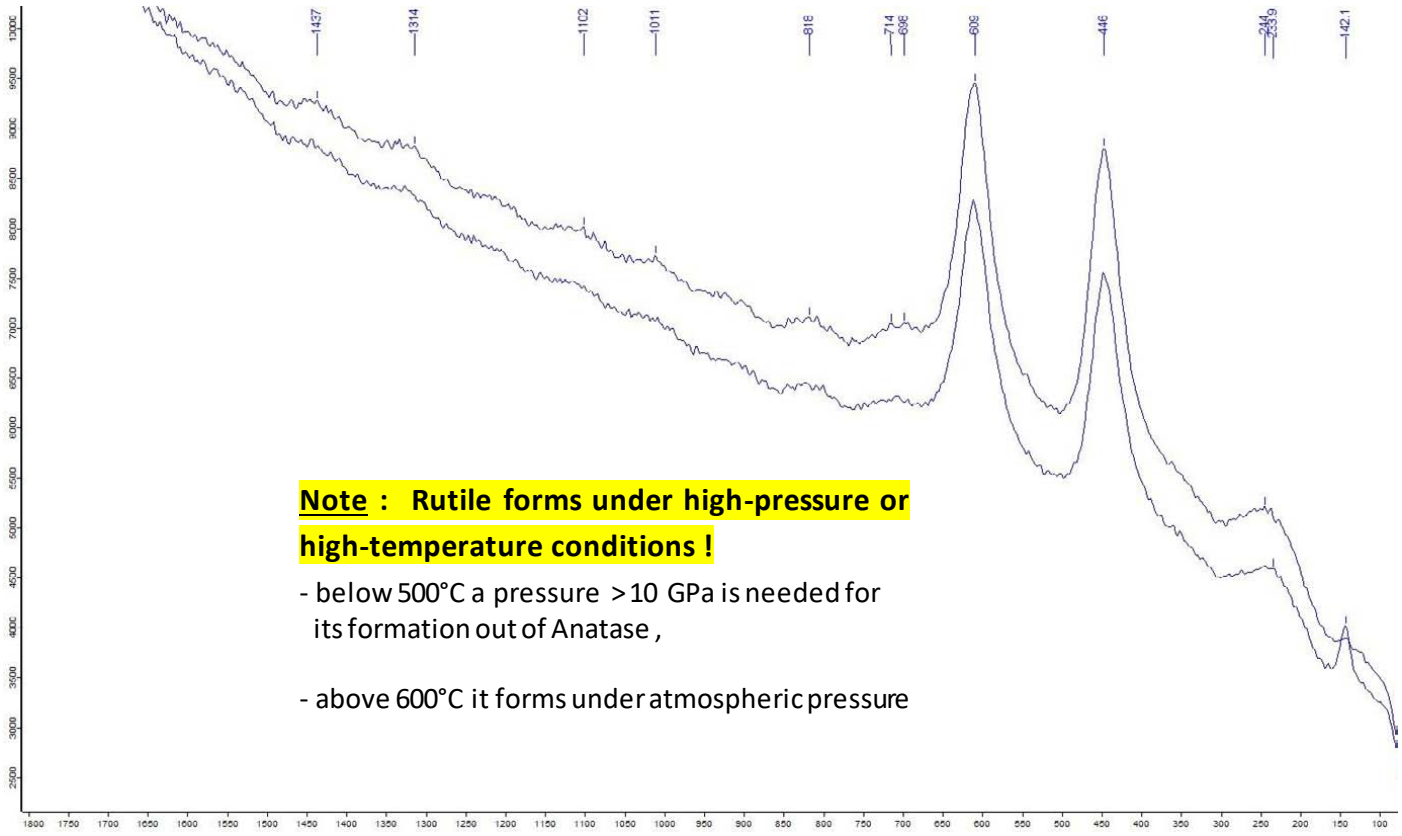
Sample Site 18 : Stone 1_spectra 1 indicates : Rutile (Titanium-Dioxid)



→ **Sample from the Super-Pit Gold Mine**

Sample :



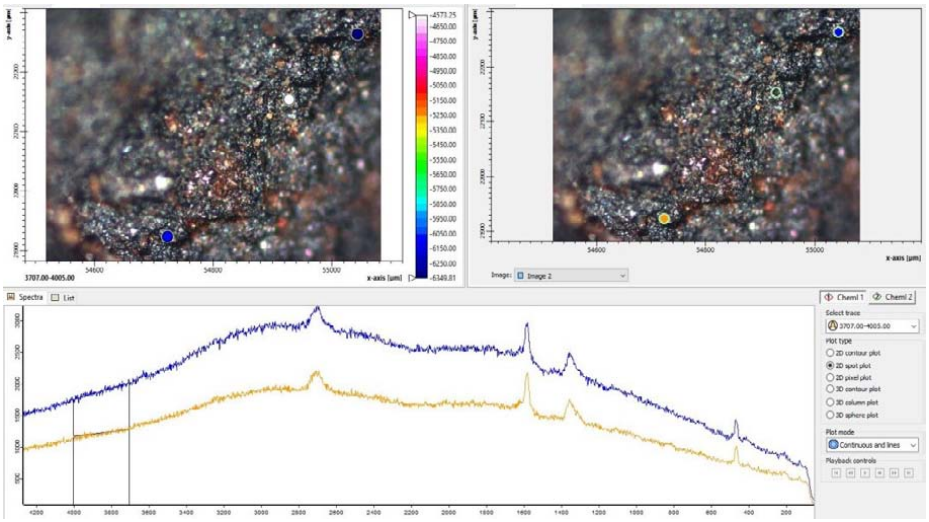


Note : Rutile forms under high-pressure or high-temperature conditions !

- below 500°C a pressure >10 GPa is needed for its formation out of Anatase ,

- above 600°C it forms under atmospheric pressure

Sample Site 21 : Stone 3_spectra 1 indicates : Graphite, Emplectite, Sugilite



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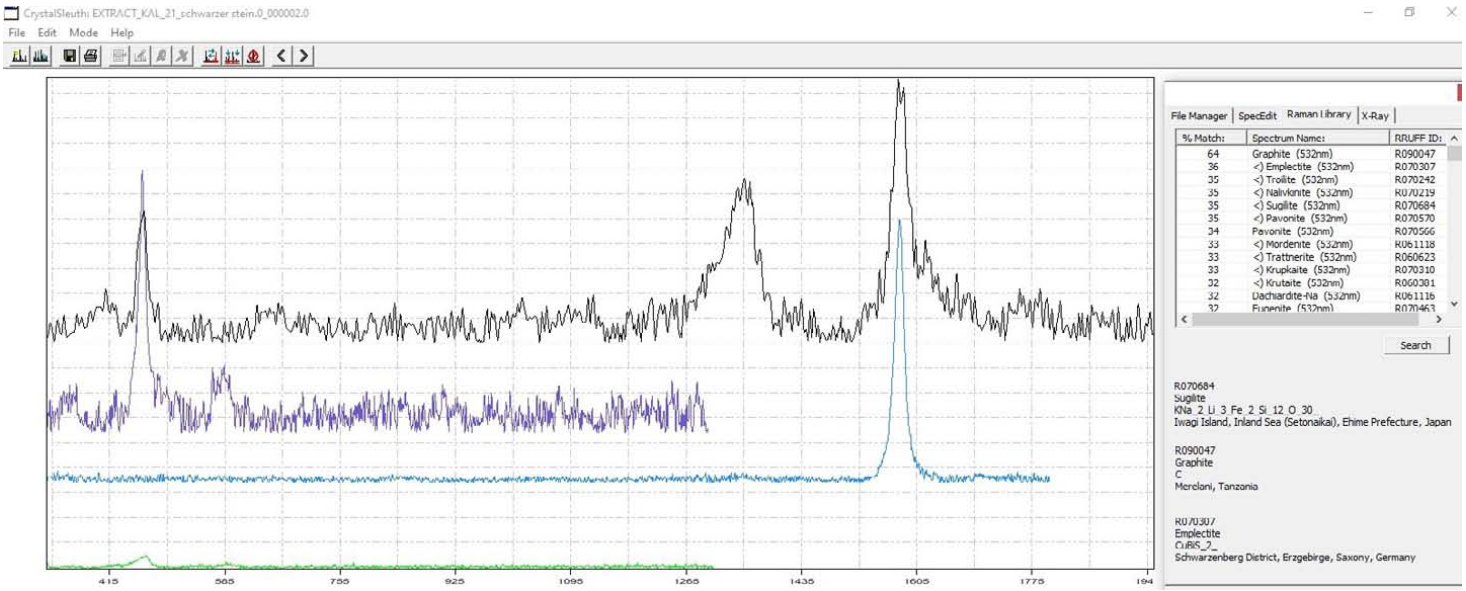
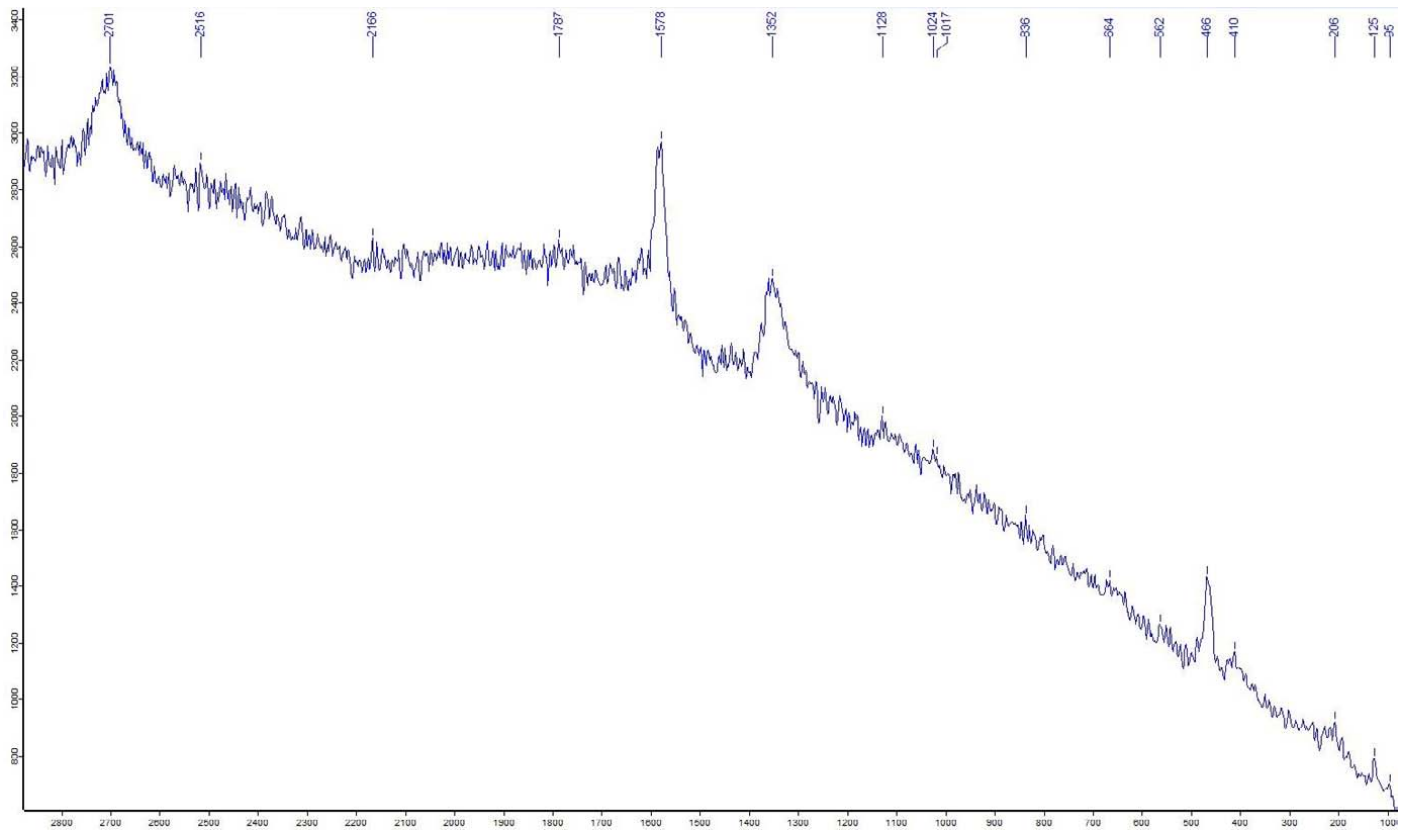
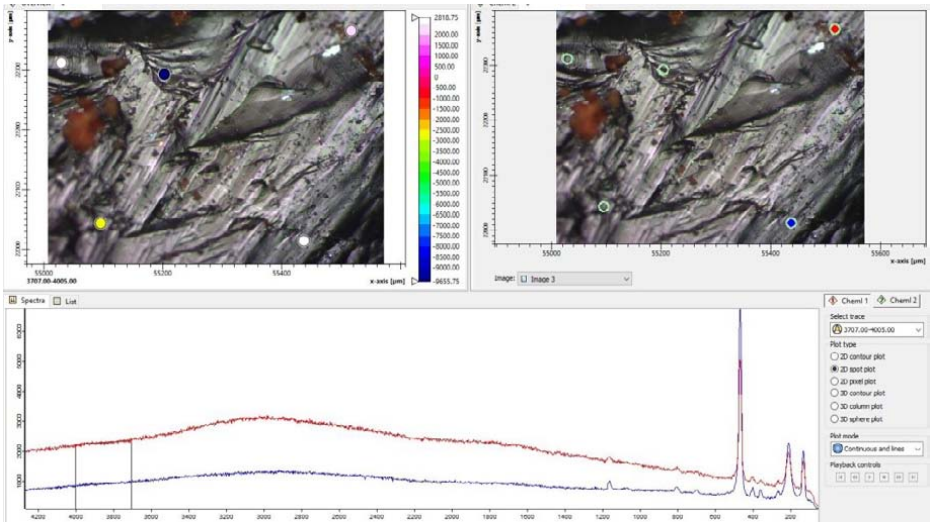
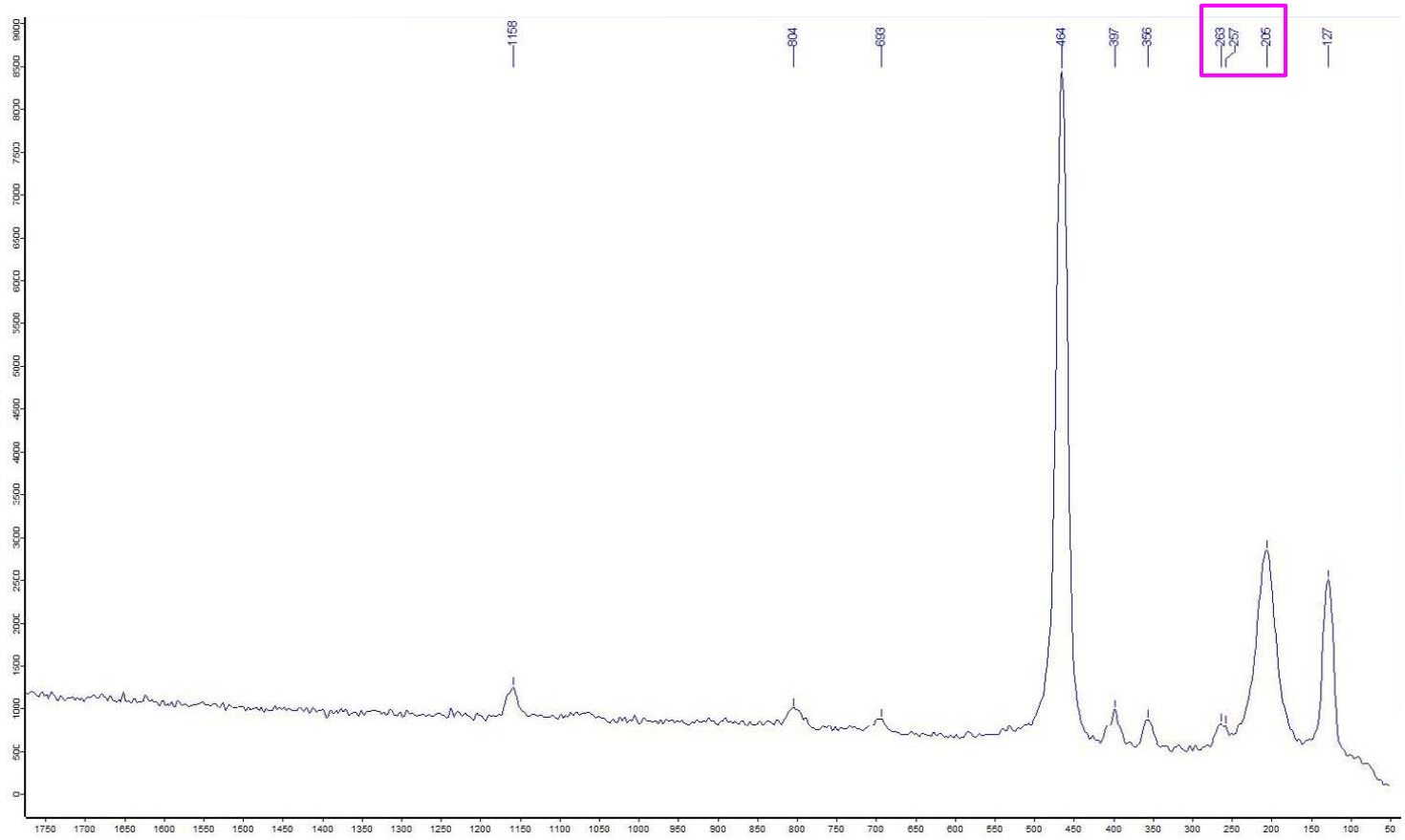




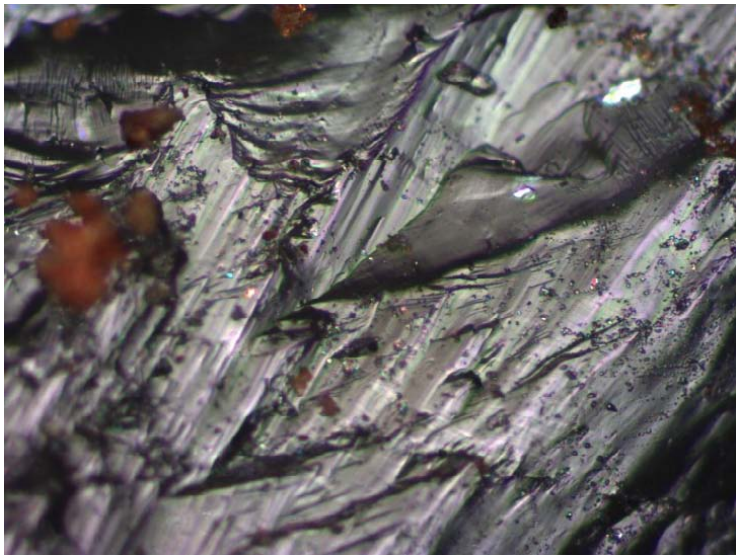
Sample Site 21 : Stone 2_spectra 1 indicates : Quartz



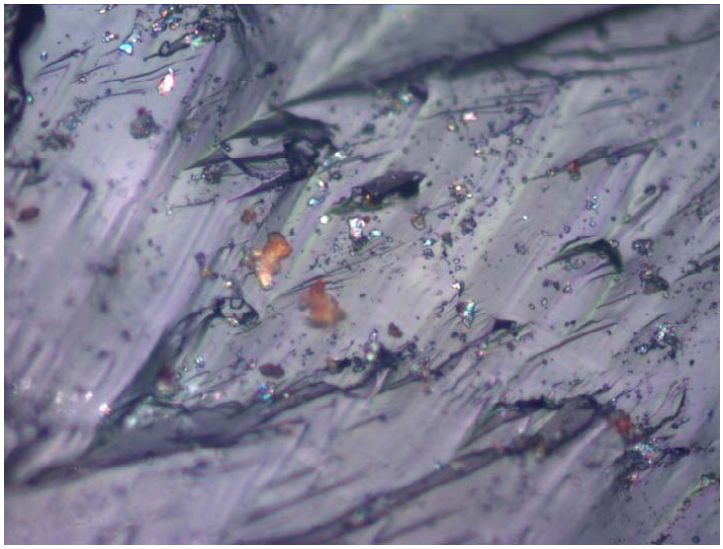
Sample :



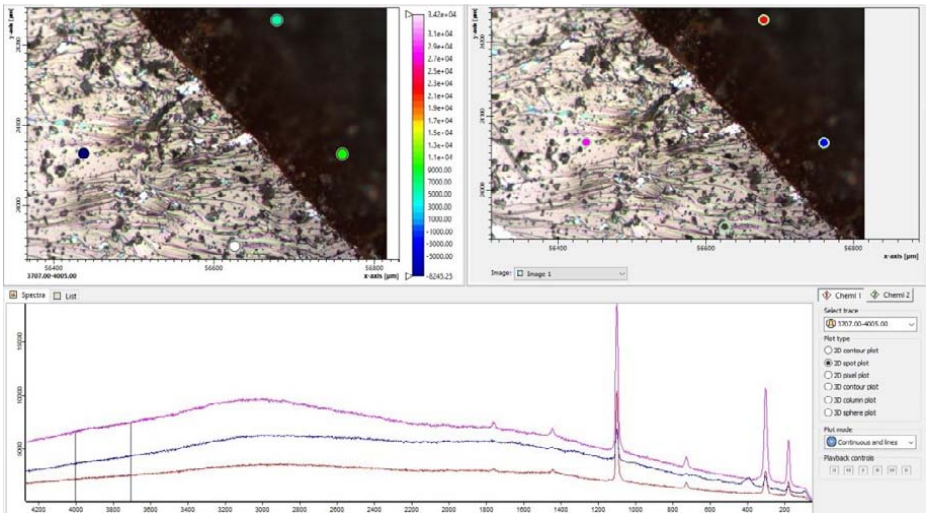
Detail : Image size : ~ 500 x 400 µm



Detail : Image size : ~ 250 x 200 µm



Sample Site 28 : Stone 1_spectra 1 indicates : Dolomite, Sahamalite-(CE)



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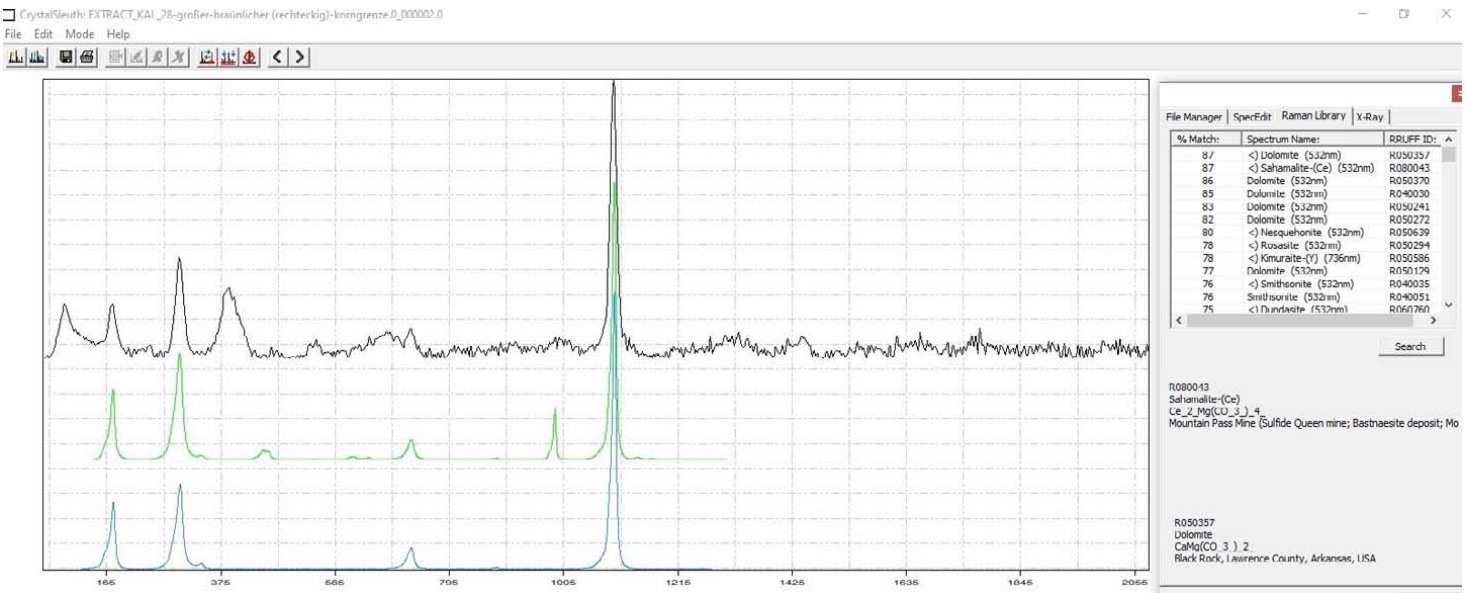
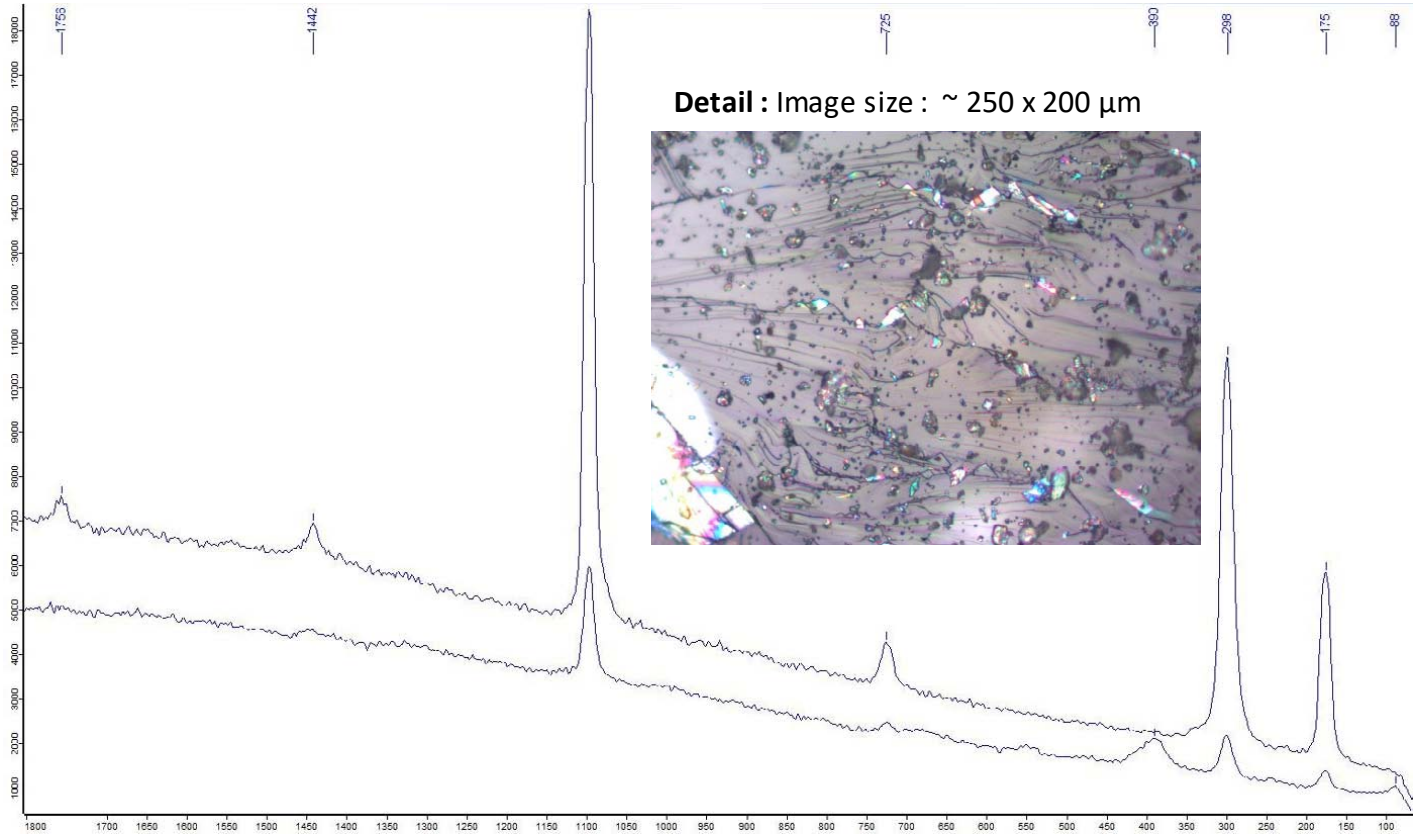




Detail : Image size : ~ 250 x 200 µm

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

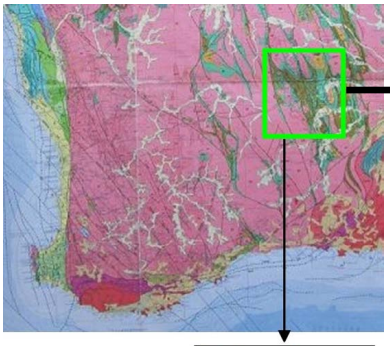
➔ See next page !

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

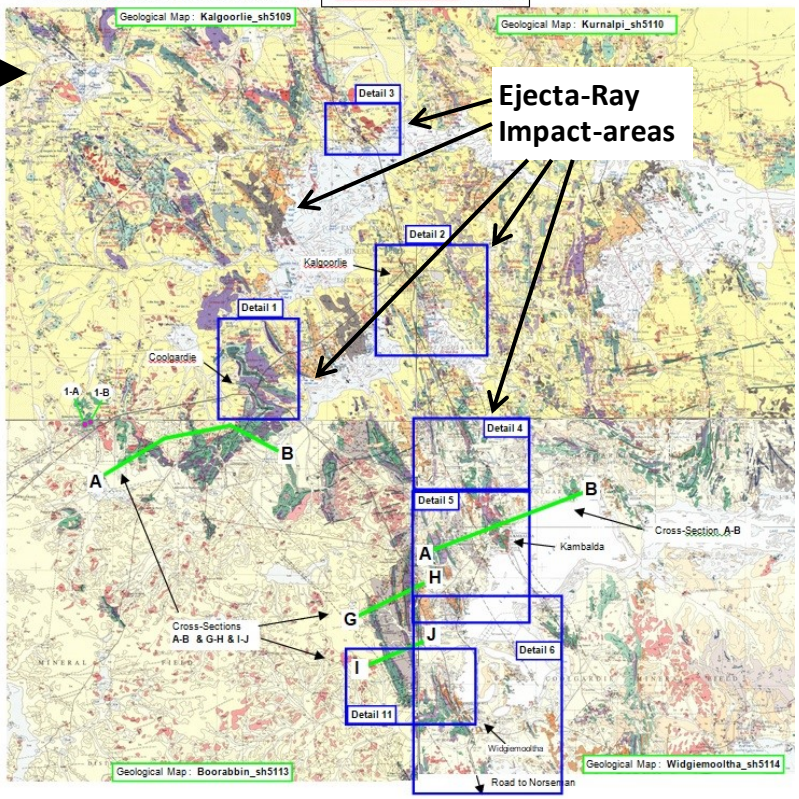
➔ Samples of the Kalgoorlie Area or here : Kalgoorlie Area

Geological Map of SW-Australia

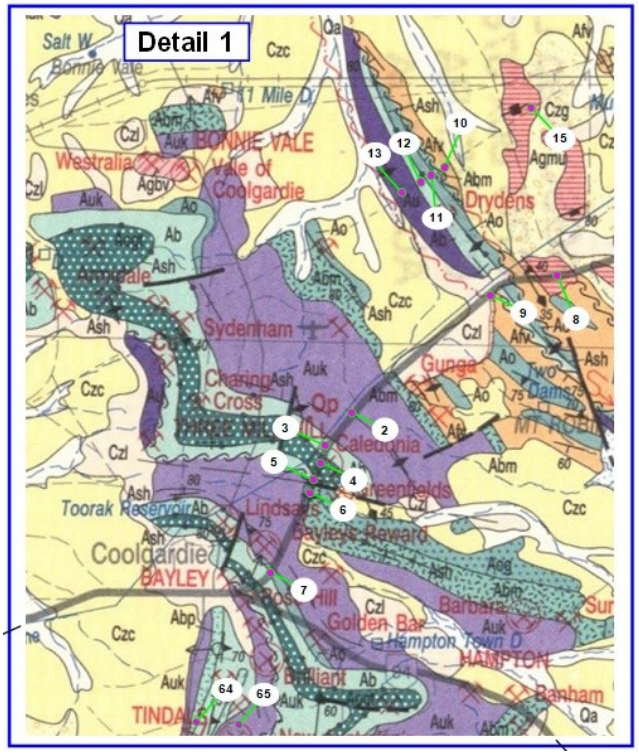
Location where samples were collected :

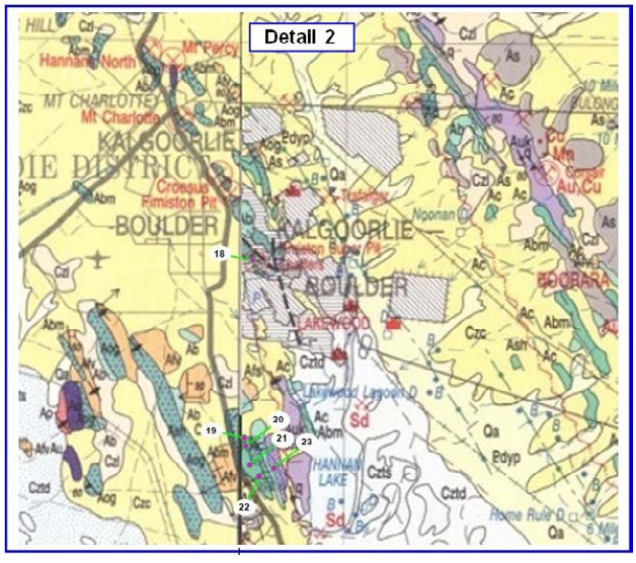


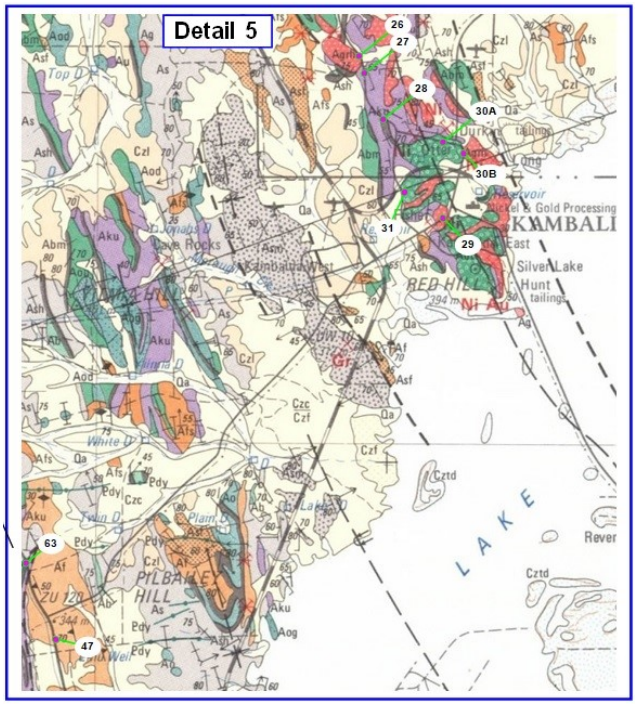
➔ 4 Geological Maps joined together : **Kalgoorlie area**



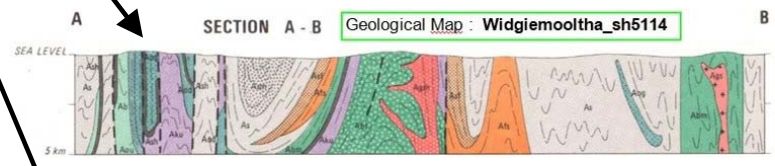
➔ **Geological Maps can be downloaded here :**
http://www.geoscience.gov.au/
Then go to "Geology**" – 1:250K Geological Maps**
and search for the required map

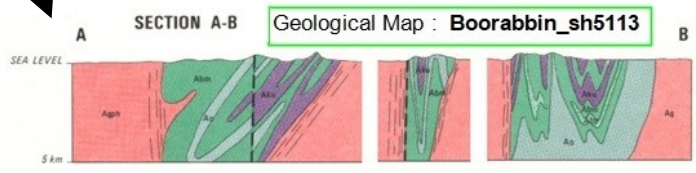






The sections of the ejectarays of the Port Hedland Crater (the nearly linear multi-colored structures) have penetrated the Yilgarn Craton down to a **depth of around 5 to 6 km** !





Sample site 2

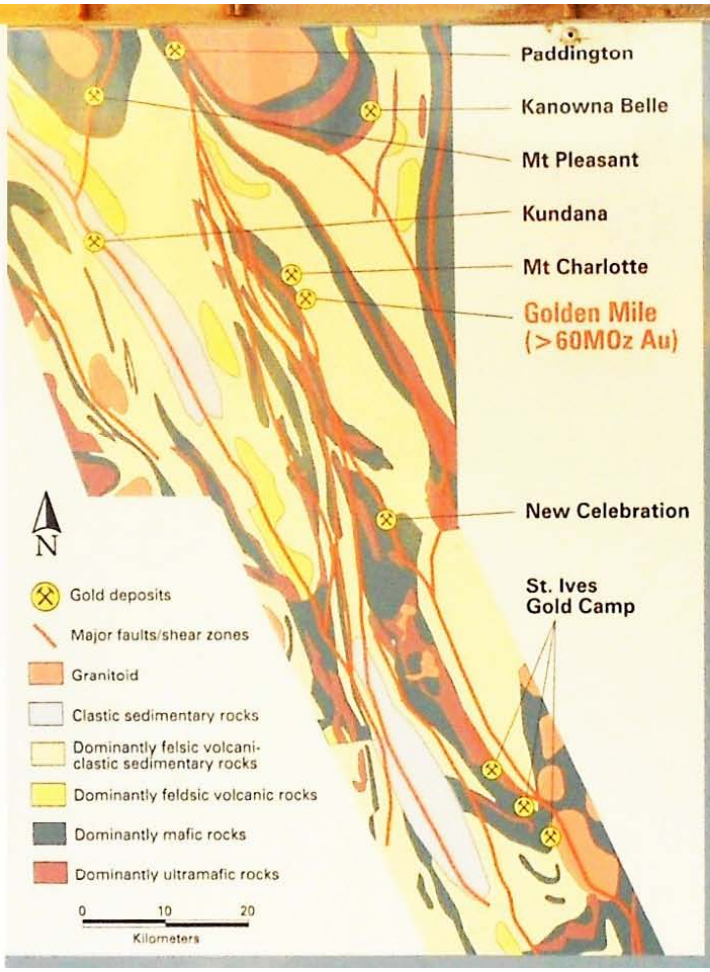
Sample site 5


13
13 30° 52,004 S 121° 13,039 E 11 m West-Australia (SW)_Kalgoorlie area


samples from the Super-Pit Mine
18
18 30° 47,322 S 121° 30,106 E 15 m West-Australia (SW)_Kalgoorlie area

Sample site 18 – The Super-Pit Gold Mine (Kalgoorlie)

geology

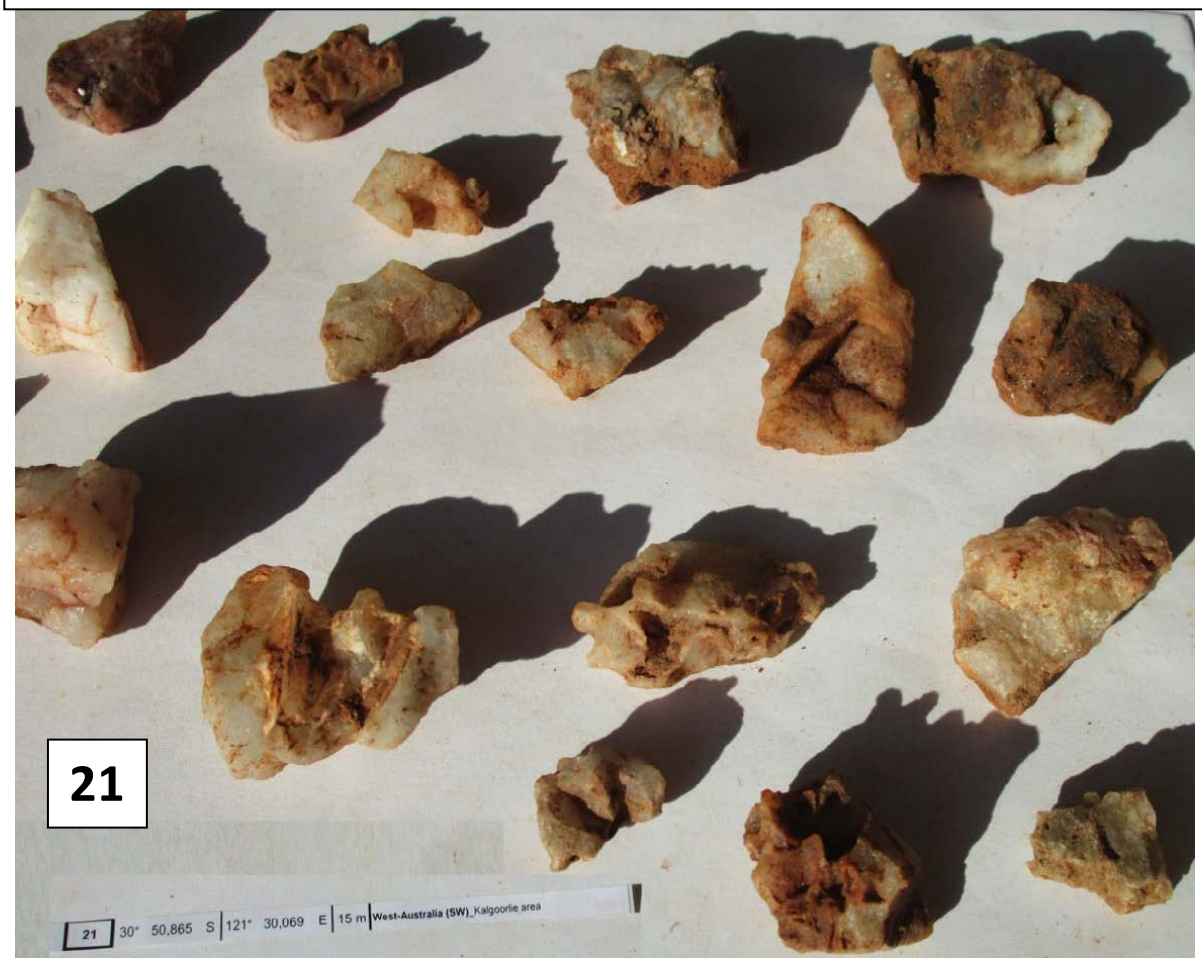


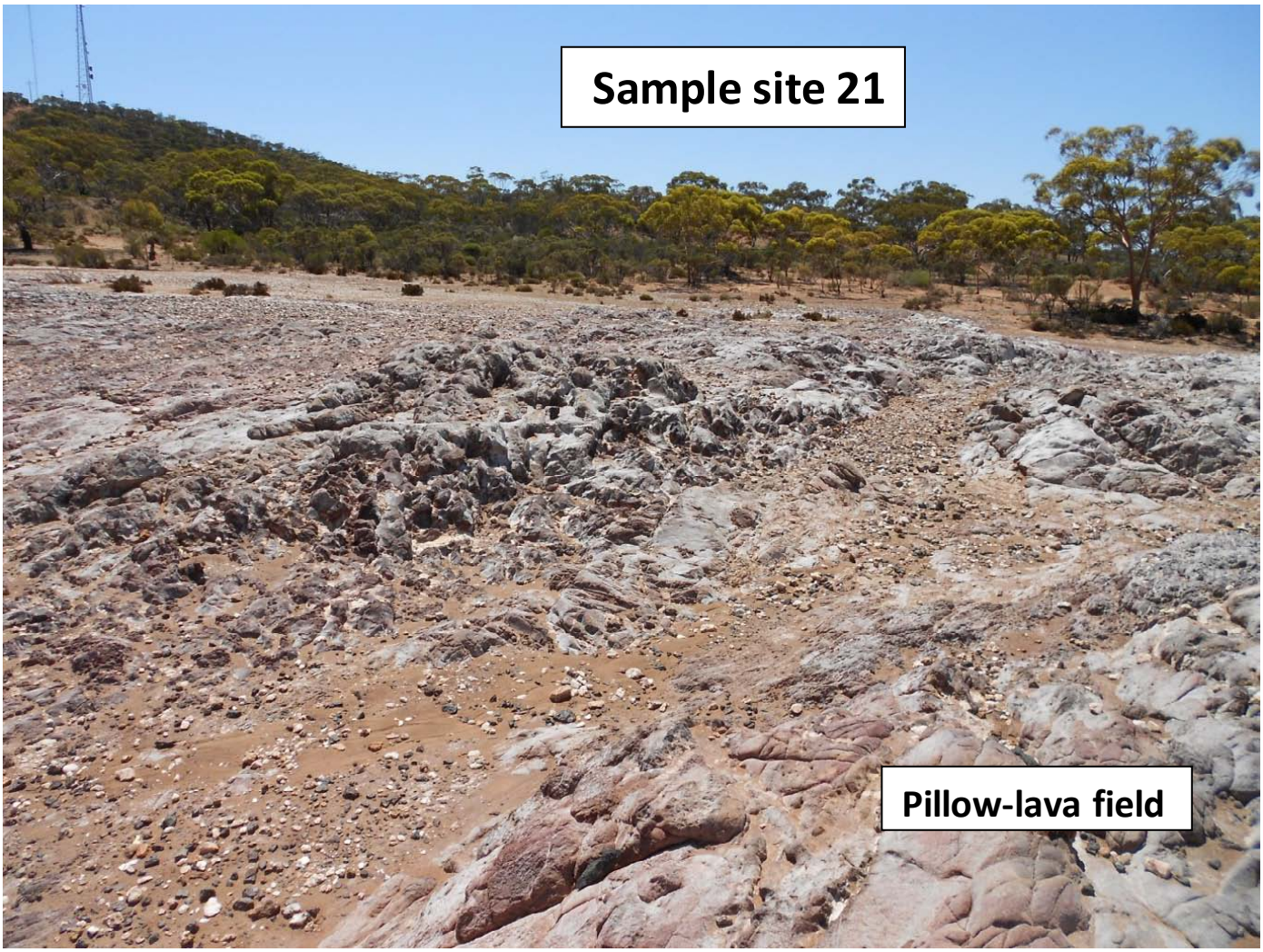
The Kalgoorlie gold[illegible]ie within the Norseman-Wiluna Belt, in the Eastern Goldfields. This is a greenstone belt, consisting of volcanic and sedimentary rocks, intruded by a number of doleritic sills. The greenstones are surrounded by extensive granite. These rocks all belong to the Archaean period of the Earth's history and are between 2.9 and 2.6 billion years old. The main host rock for the ores is the Golden Mile Dolerite, the largest of the intrusive sills in the district.

The Kalgoorlie-Boulder ores occur in two very distinctive forms, the Golden Mile lodes and the younger quartz vein network at Mt Charlotte. This quartz vein style of mineralisation is present in a few other smaller deposits in the district. The Golden Mile Dolerite (GMD) contains approximately 80% of the contained gold with the remainder within the underlying Paringa Basalt (PB).

Structurally, the goldfield is characterised by early thrust faulting, folding and late strike-slip faulting. Golden Mile mineralisation is associated with fracturing and shearing during this latter phase of deformation. A final period of faulting is closely associated with the Mt Charlotte-style quartz veining. Intensive fluid flow through the faults and fractures were integral aspects of both episodes of mineralisation. The invading fluids altered the original minerals in the host rocks and formed suites of new minerals that vary with proximity to the centre of the mineralisation. These fluids precipitated pyrite, and also carried gold.

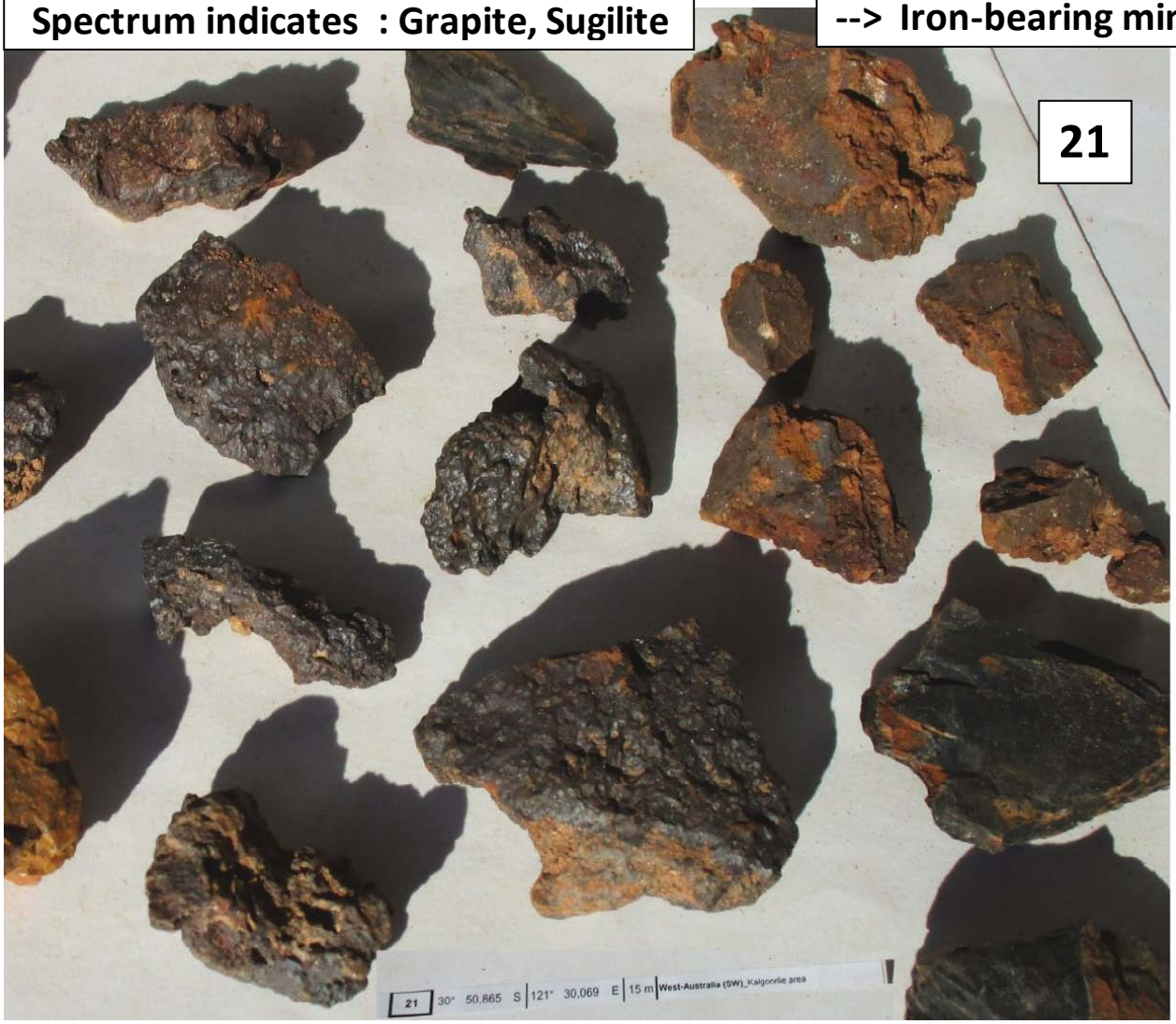
Spectrum indicates : shocked Quartz → note the deformed quartz stones !

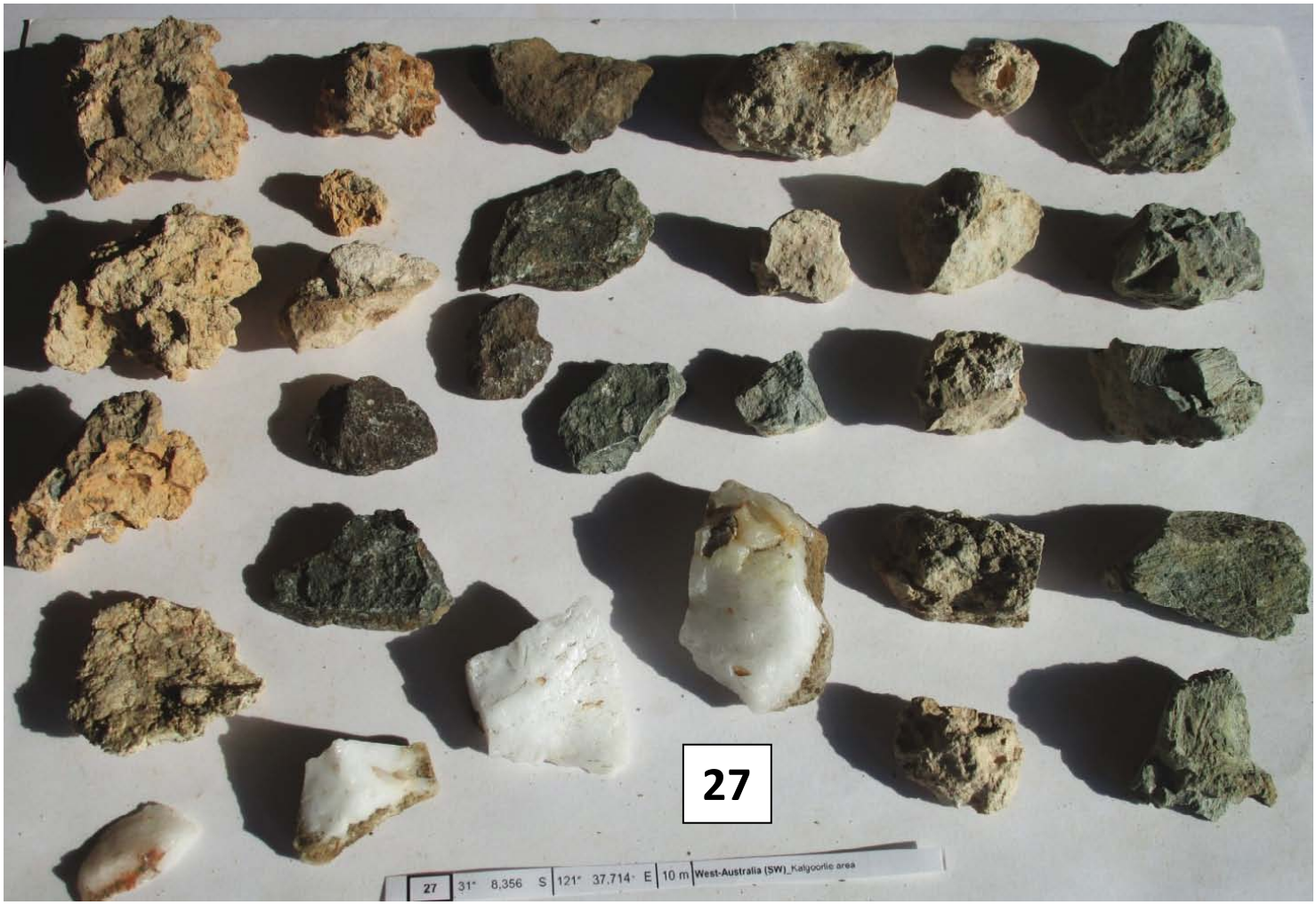


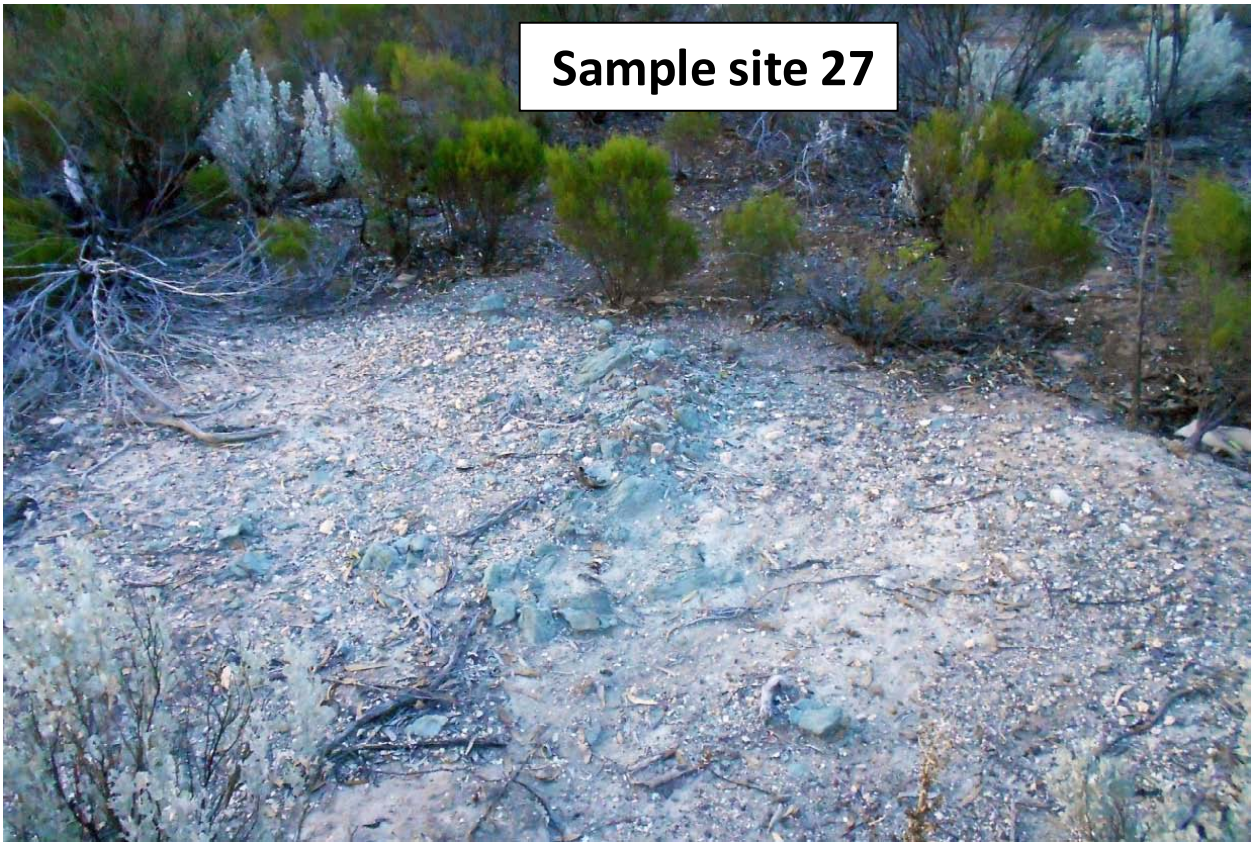


Spectrum indicates : Grapite, Sugilite

--> Iron-bearing mineral




27
27 31° 8,356 S 121° 37,714 E 10 m West-Australia (SW)_Kalgoorlie area


Sample site 27

Sample site 28

Sample site 31

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

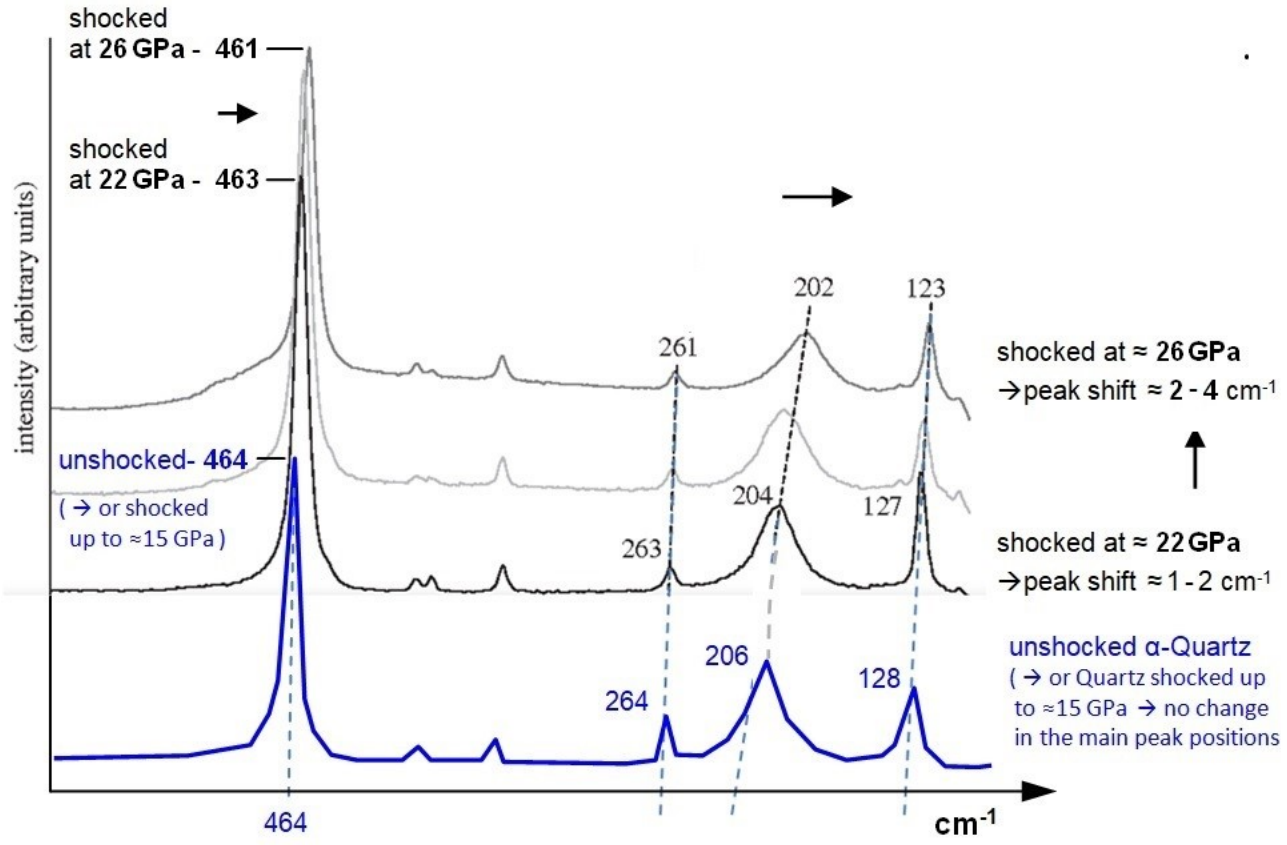
In order to verify a sample site as an impact site or impact structure, shock-metamorphic effects must be discovered in the rocks of the sample site. This can be done by different methods.

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.

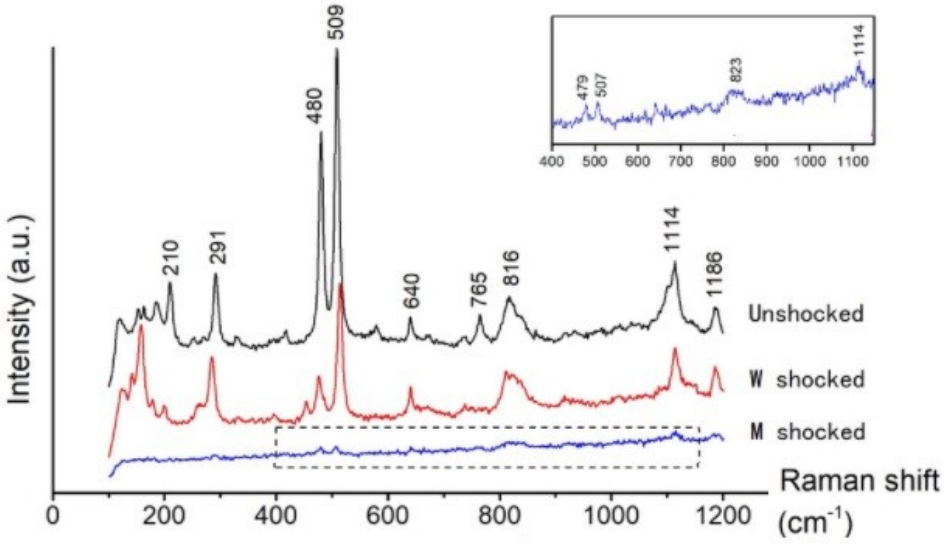
Mc Millan et al. (1992) and others have shown that the main RAMAN-peaks of Quartz shift towards lower frequencies if the Quartz was exposed the a shock-pressure > 15 GPa. → see diagram below

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 of the Kalgoorlie Area or here : Kalgoorlie 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 & 24-28 of Part 3 (P3) & page 33 of Part 2 (P2) of my hypothesis (→ weblinks below !)

Also read my Raman-analyses to rock samples from the Geraldton area ; Southern-Cross-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

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
https://asu.pure.elsevier.com/en/publications/a-raman-spectroscopic-study-of-shocked-single-crystalline-quartz
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
https://www.academia.edu/8003100/Raman_spectroscopy_of_natural_silica_in_Chicxulub_impactite_Mexico
alternative : https://www.sciencedirect.com/science/article/pii/S1631071302017005

Shock-induced irreversible transition from α-quartz to CaCl2-like silica - Journal of Applied Physics: Vol 96, No 8
https://aip.scitation.org/doi/10.1063/1.1783609

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, …
https://www.researchgate.net/publication/44655699_Raman_Spectroscopic_Study_of_a_Fulgurite
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
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
https://onlinelibrary.wiley.com/doi/pdf/10.1111/maps.12495

Shock Effects in feldspar : an overview - by A. E. Pickersgill
https://www.hou.usra.edu/meetings/lmi2019/pdf/5086.pdf

ExoMars Raman Laser Spectrometer RLS, a tool for the potential recognition of wet target craters on Mars
https://www.researchgate.net/publication/348675414_ExoMars_Raman_Laser_Spectrometer_RLS_a_tool_for_the_potential_recognition_of_wet_target_craters_on_Mars