Impact-area of an ejecta-ray from the Port Hedland Crater or from the VLC , located near Geraldton (Western Australia)

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

Summary :

The visited area is located near the town Geraldton / Western Australia. The Gravity Anomaly Map indicates that **Ejecta-material either from the assumed Ø 400 x 350 km Port Hedland Crater or from the Victoria Lake Crater (E-Africa) 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 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 that have strong similarities to structures caused by ejecta-blankets which were produced by an impact (→ see explanation in **Part 3** (**P3**) on pages 24-28). These structures consist of rock types that are different to the rock types of the surrounding plains of the Yilgarn Craton. The nearly linear ejecta-ray structures seem to have penetrated the Yilgarn Craton approximately up to a depth of around 10 km (→ see geologic cross-section B-C on the geological map "Perenjori-sh6006).

I have collected some rock-samples from these nearly linear structures in the Geraldton 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 is the case !

The Raman-spectra of quartz from the Sample Sites 11, 12 and 17 provide first evidence for an impact event as the probable cause of the linear ray-structure in the visited area (→ map Detail 2). Indication for an impact shock event comes also from the sites 23 and 24. **The clear shifts of the main Raman peaks, of the analysed quartz samples, to the lower frequencies 461 and 126 cm^{-1} (Site 11, stone 2), to 463, 262/268 and 125 cm^{-1} (Site 17, stone 1), to 463 and 125 cm^{-1} (Site 11, stone 1), to 260/265, 125 cm^{-1} (Site 17, stone 2) and to 261 and 126 cm^{-1} (Site 12) provide first proof for an Impact Event as the cause of the ray-structure visible on a gravity-anomaly- and on a geological map !** (→ see explanation in **Appendix 1** at **page 15** : Overview : The Raman bands (peaks) of shocked Quartz)

The shifts of one main Raman peak, of analysed quartz grains from the sites 23 & 24, to the lower frequency 124 cm^{-1} (Site 23) and to 261/263 cm^{-1} (Site 24) may also indicate an impact shock event.

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 3 to 14**)

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

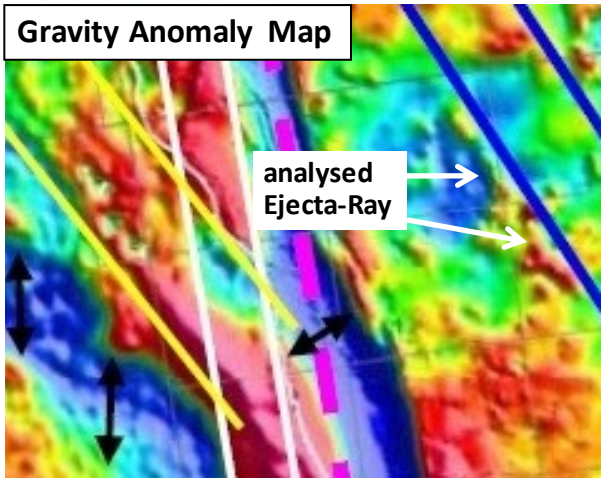
→ Images of the analysed rock samples and photos of the sample sites are in the Appendix at **page 21**.

→ More images of all sample sites are available on www.permiantriassic.de or www.permiantriassic.at

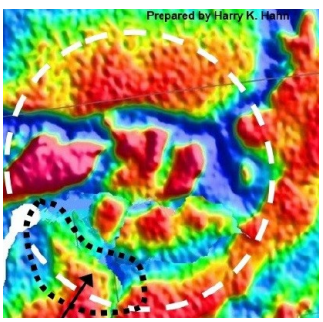
→ **References : see page 22** / and pages 14-16, 20-21 and 24-28 of **Part 3** (**P3**) of my hypothesis.

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.

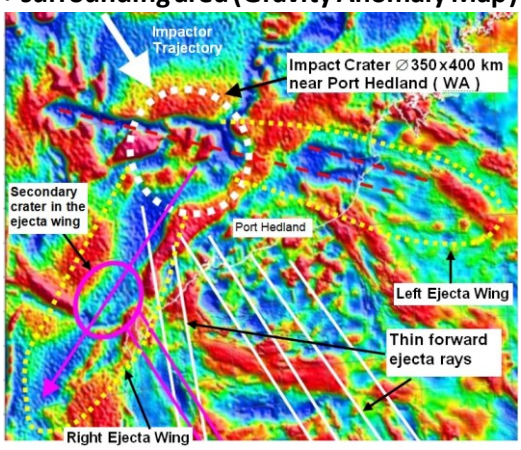
Gravity Anomaly Map



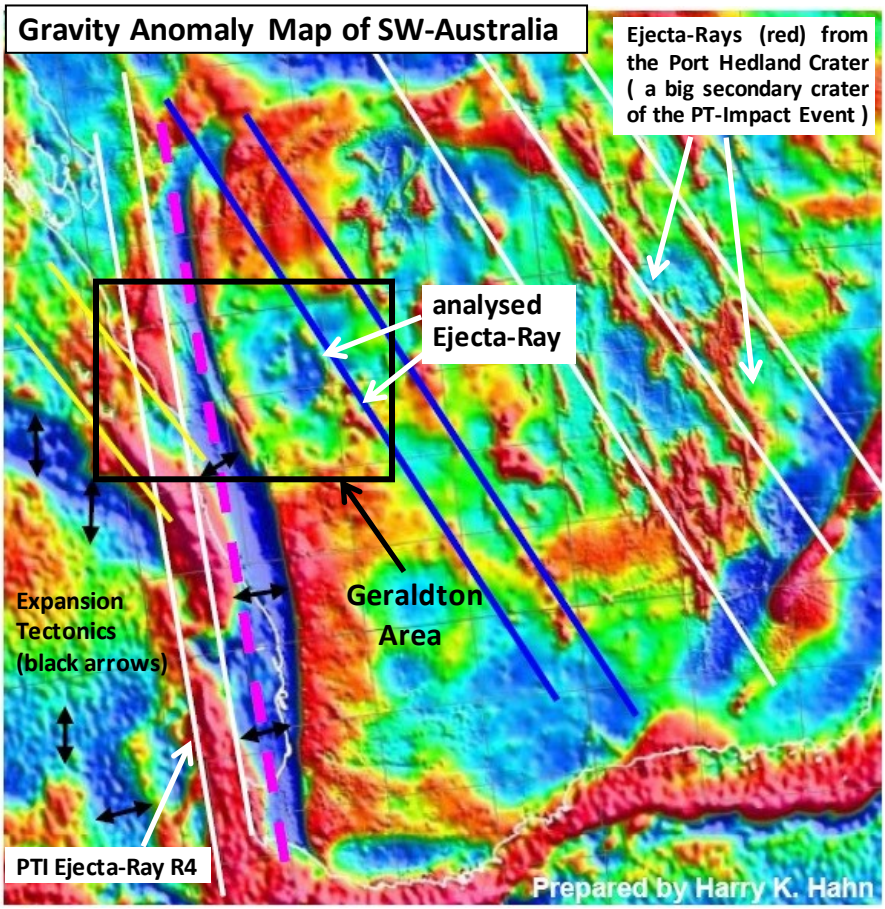
Ø 400 x 350 km Port Hedland Crater



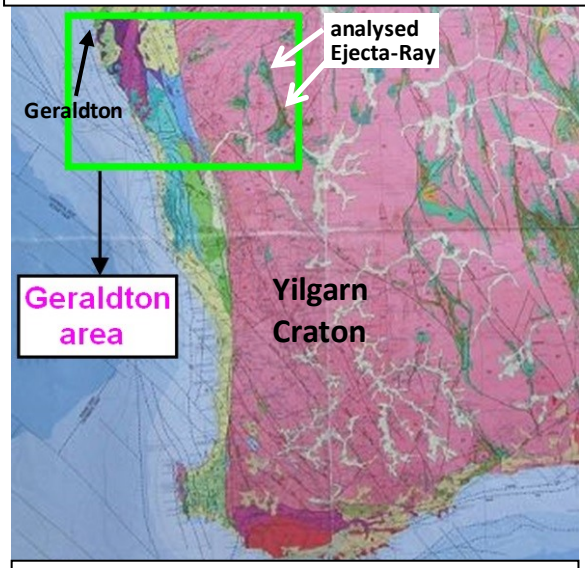
Port Hedland Crater (= Bengal Bay Crater) + surrounding area (Gravity Anomaly Map)



Gravity Anomaly Map of SW-Australia



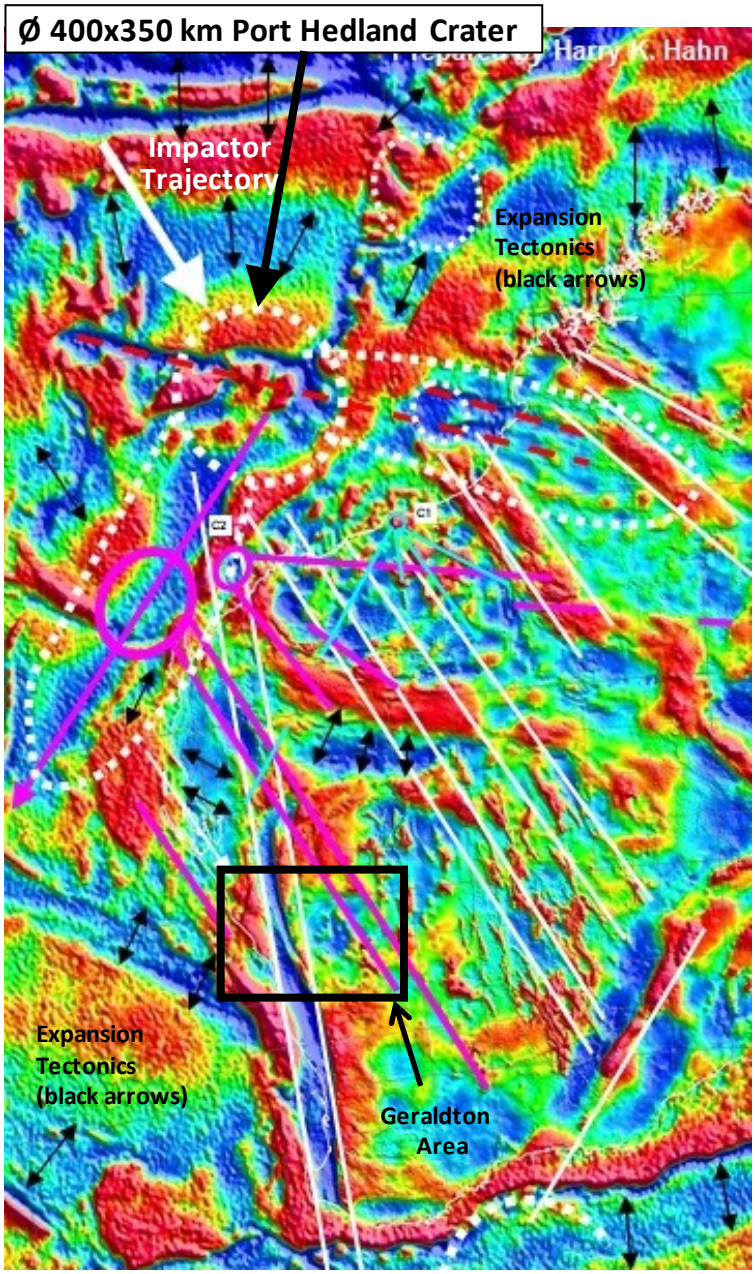
Geological Map of South-West-Australia
→ with sample site area marked on the map

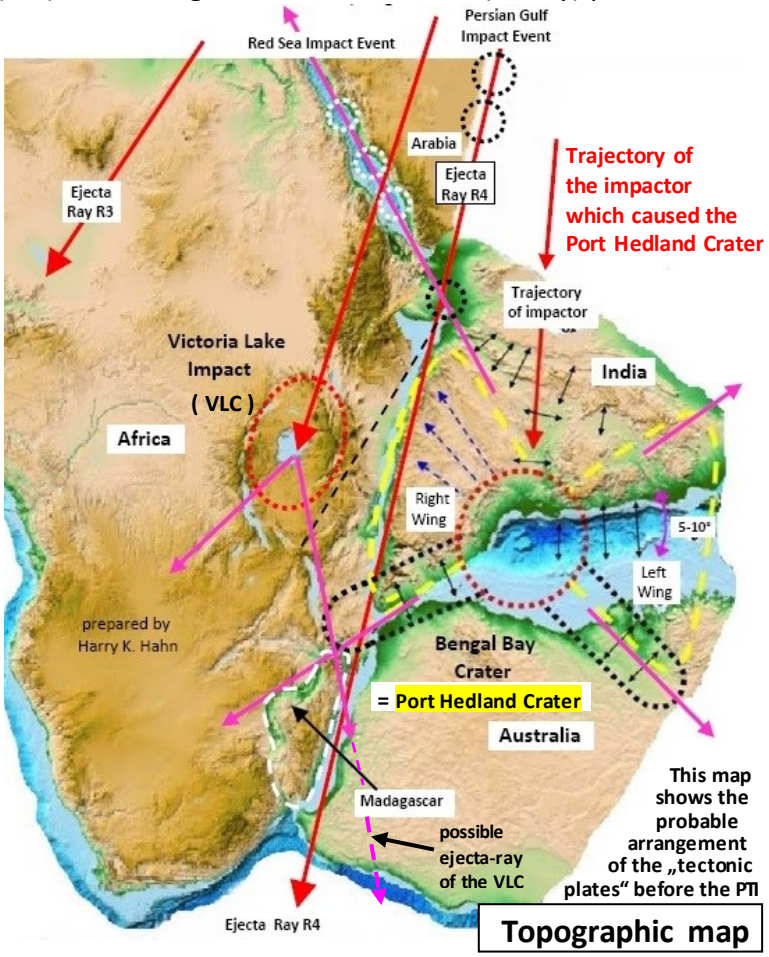


The Ejecta-Ray area near the town Geraldton is marked in green on the Geological Map above

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

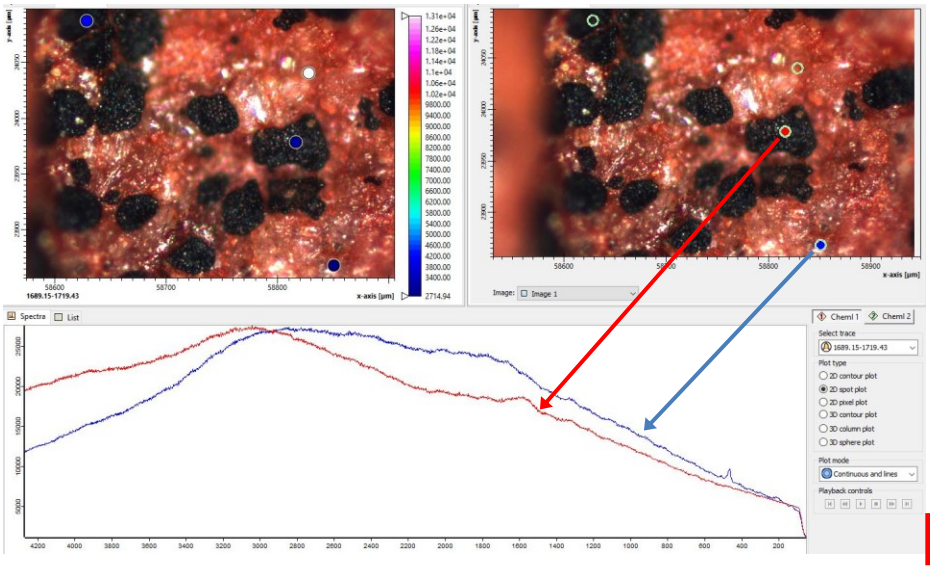
Ø 400x350 km Port Hedland Crater





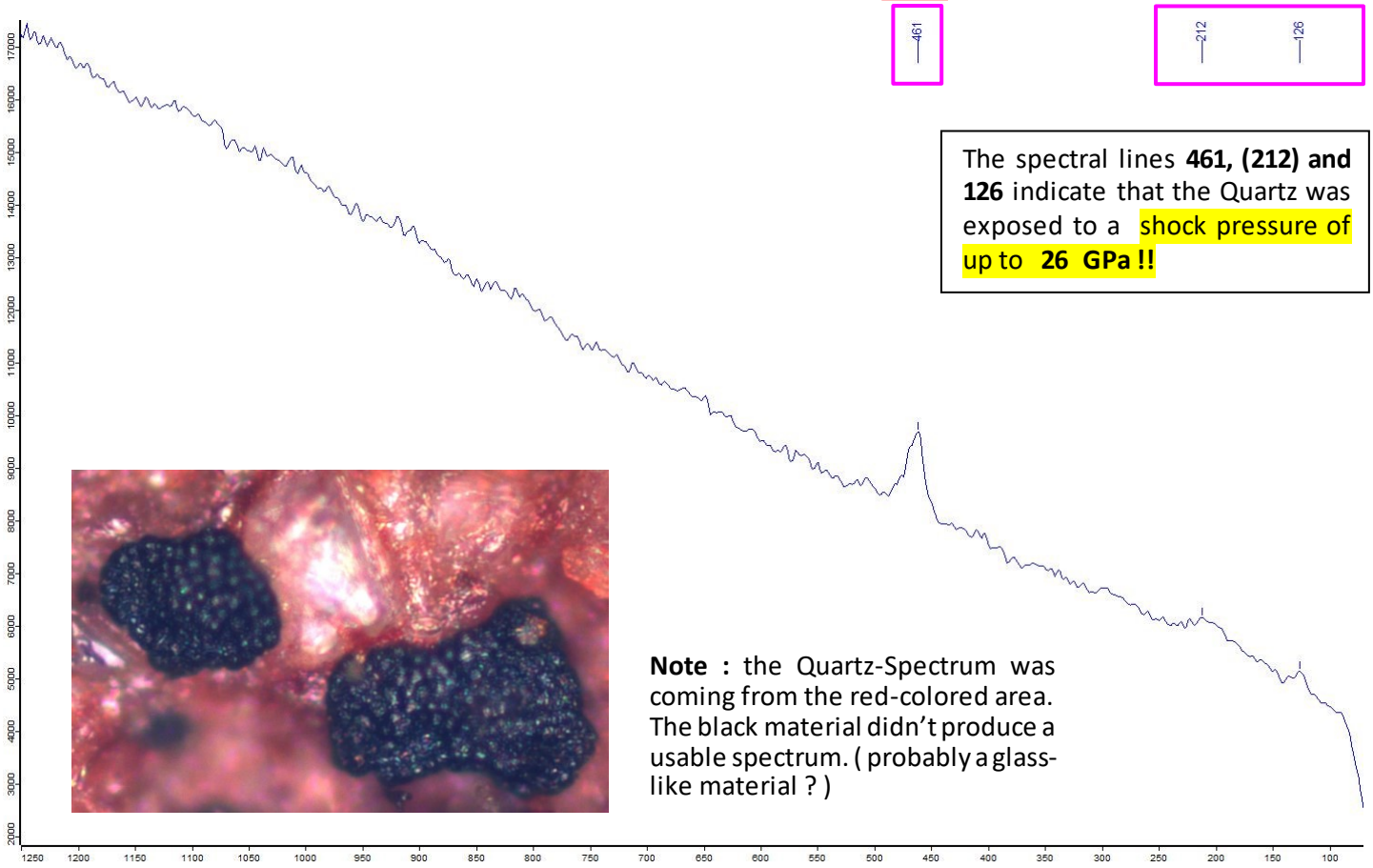
Topographic map

Sample Site 12 : Stone 1_spectra 1 indicates : Quartz



Note : Sample very similar to sample No : 11 (stone 2) from the Southern-Cross-area : see Link 1 or Link 2

Sample :

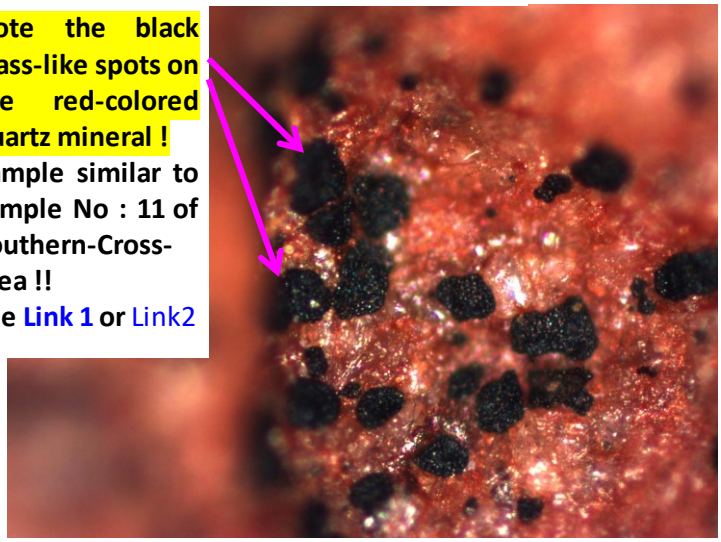


The spectral lines **461, (212) and 126** indicate that the Quartz was exposed to a shock pressure of up to **26 GPa !!**

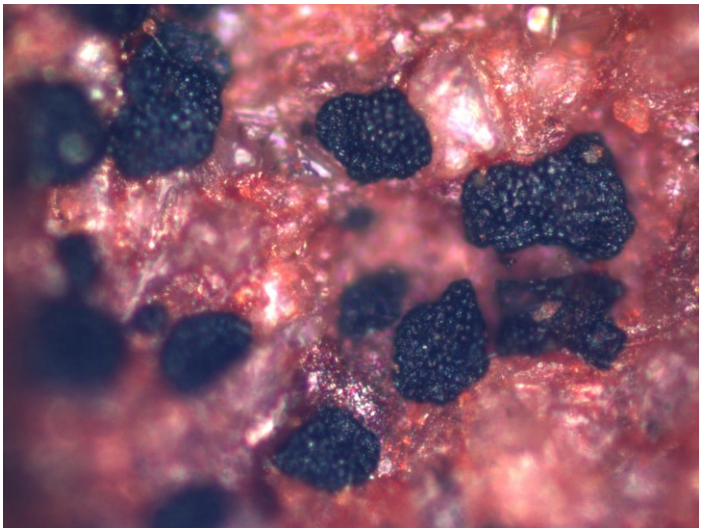
Note : the Quartz-Spectrum was coming from the red-colored area. The black material didn't produce a usable spectrum. (probably a glass-like material ?)

Detail : Image size : ~ 500 x 400 µm

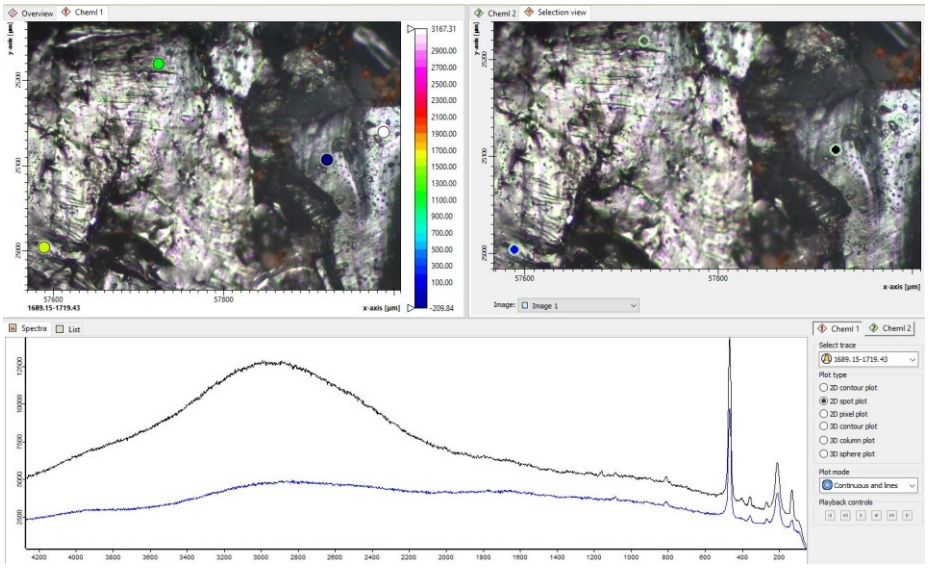
Note the black glass-like spots on the red-colored quartz mineral !
Sample similar to sample No : 11 of Southern-Cross-area !!
see Link 1 or Link2



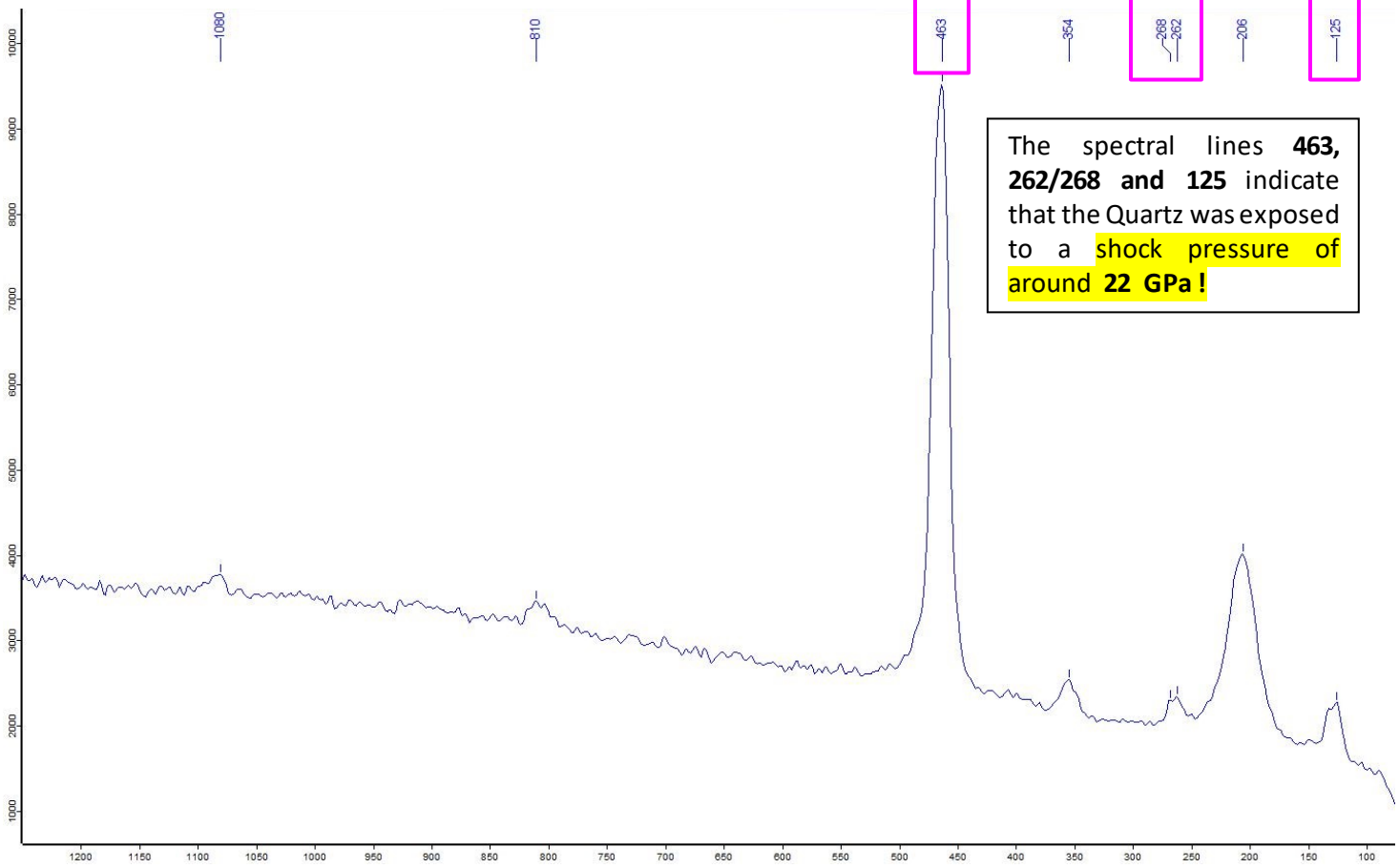
Detail : Image size : ~ 250 x 200 µm



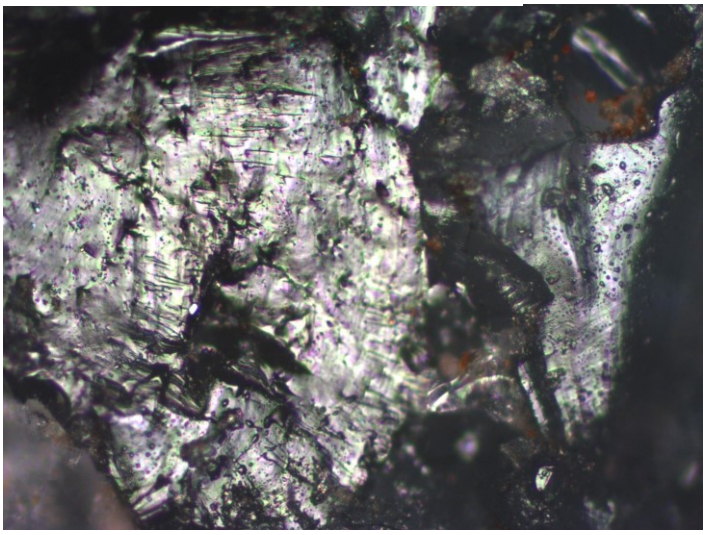
Sample Site 17 : Stone 1_spectra 1 indicates : Quartz



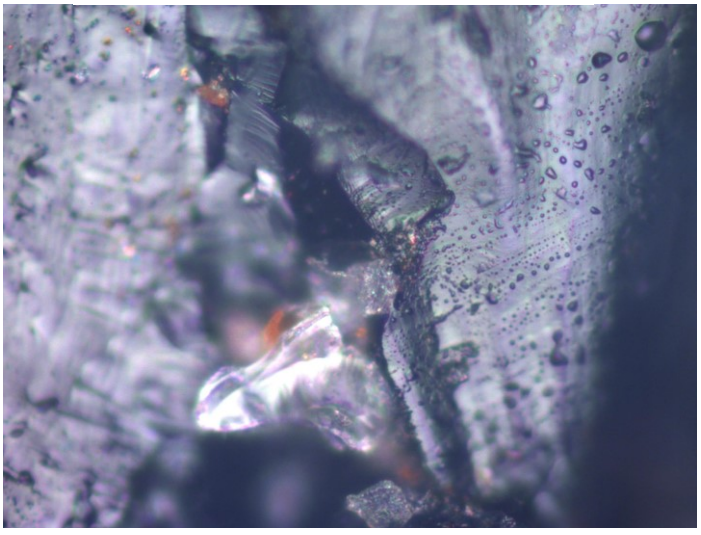
Sample :



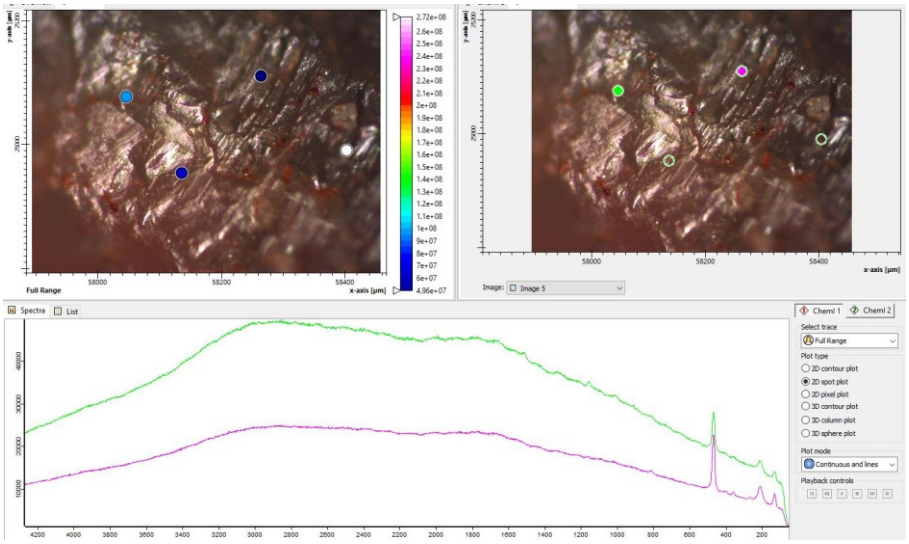
Detail : Image size : ~ 500 x 400 µm



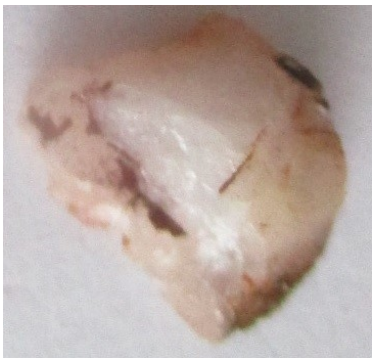
Detail : Image size : ~ 250 x 200 µm

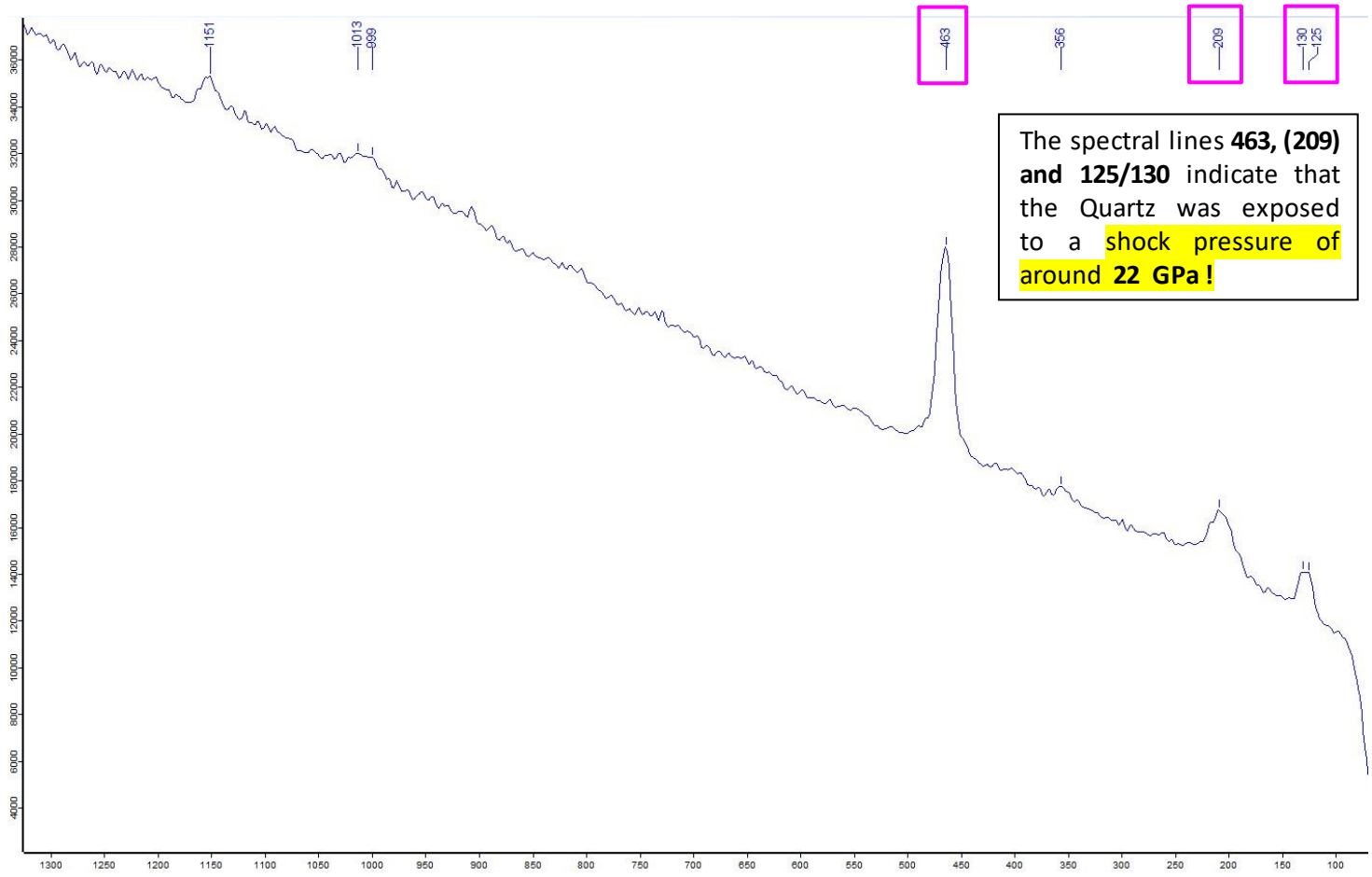


Sample Site 11 : Stone 1_spectra 1 indicates : Quartz



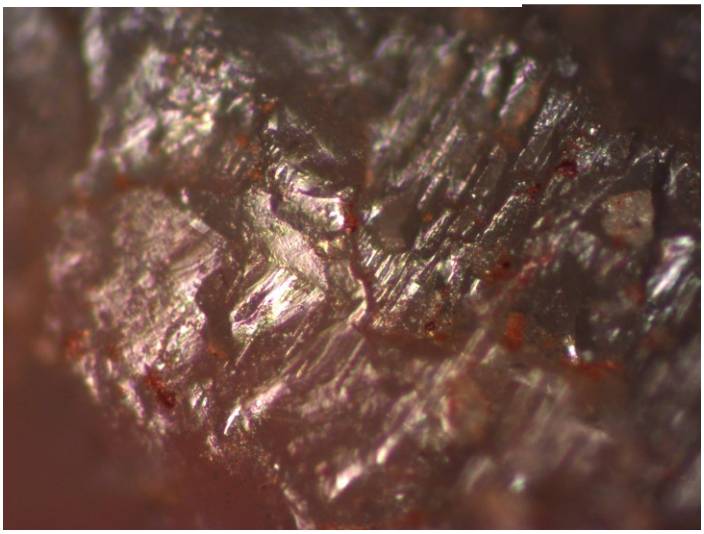
Sample :



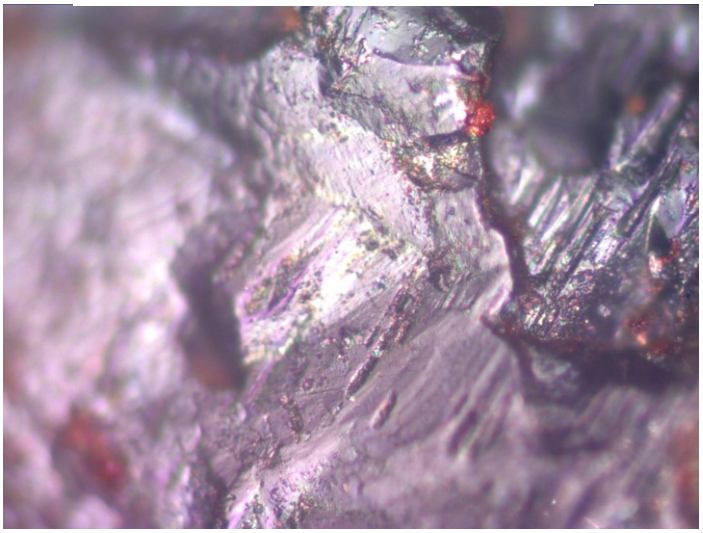


The spectral lines **463, (209) and 125/130** indicate that the Quartz was exposed to a shock pressure of around **22 GPa !**

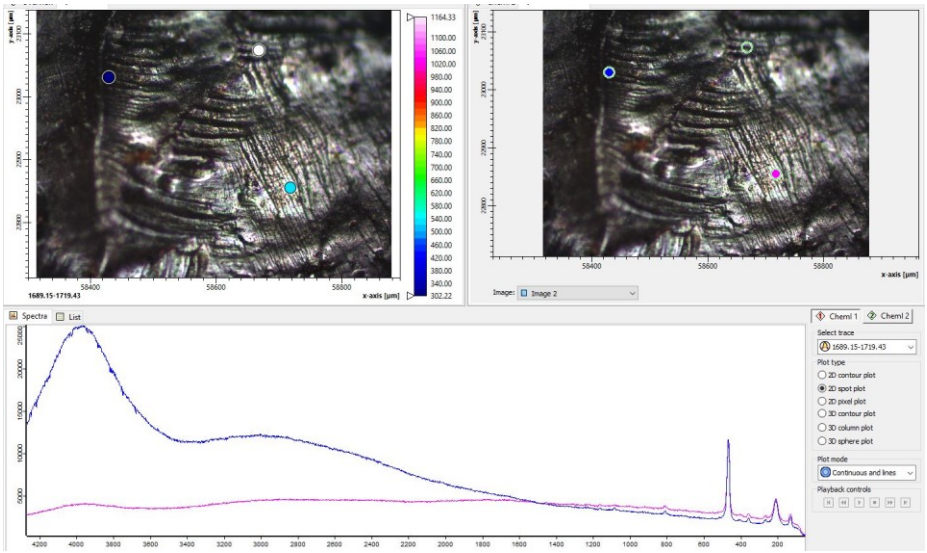
Detail : Image size : ~ 500 x 400 µm



Detail : Image size : ~ 250 x 200 µm



Sample Site 17 : Stone 2_spectra 1 indicates : Quartz



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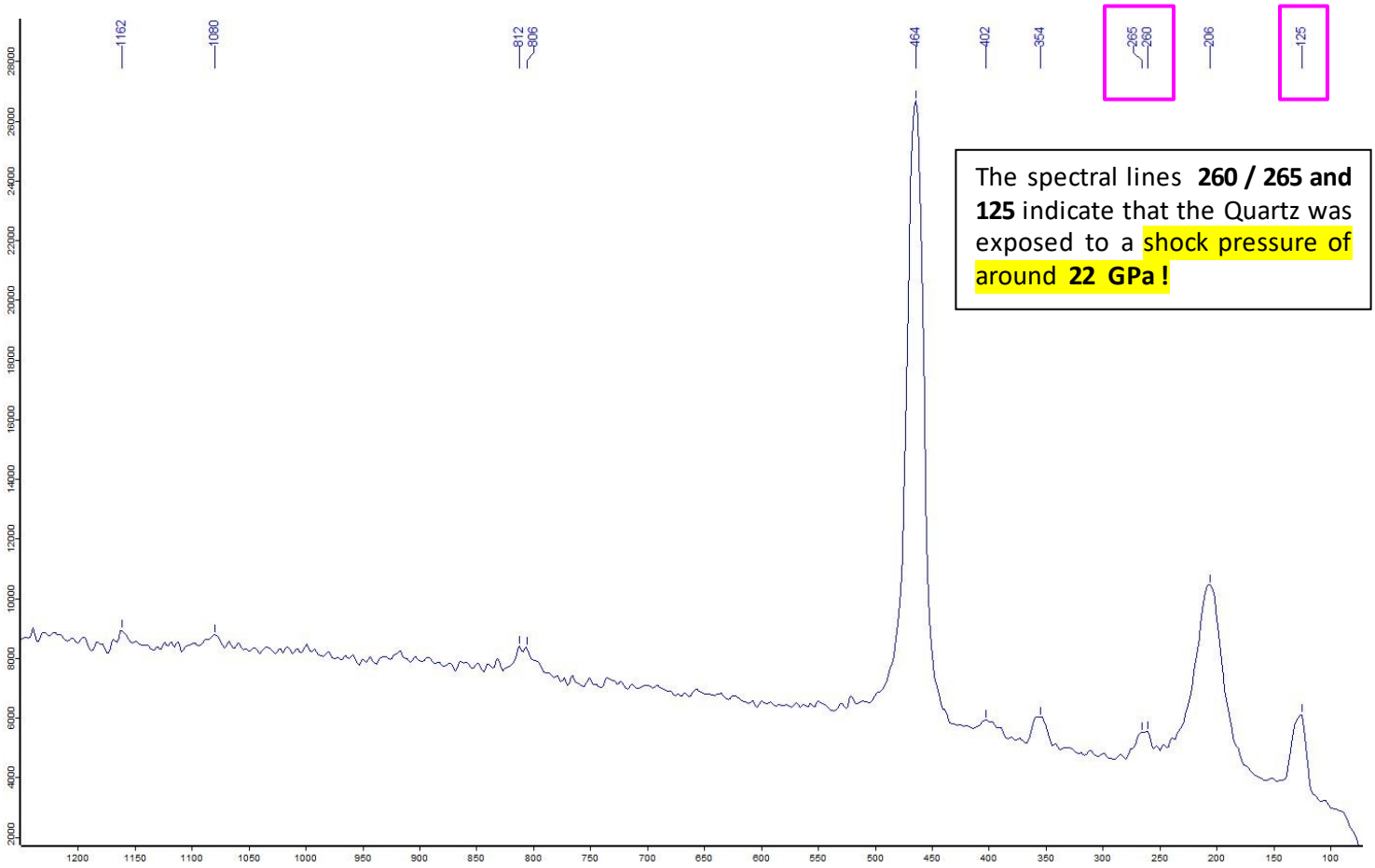
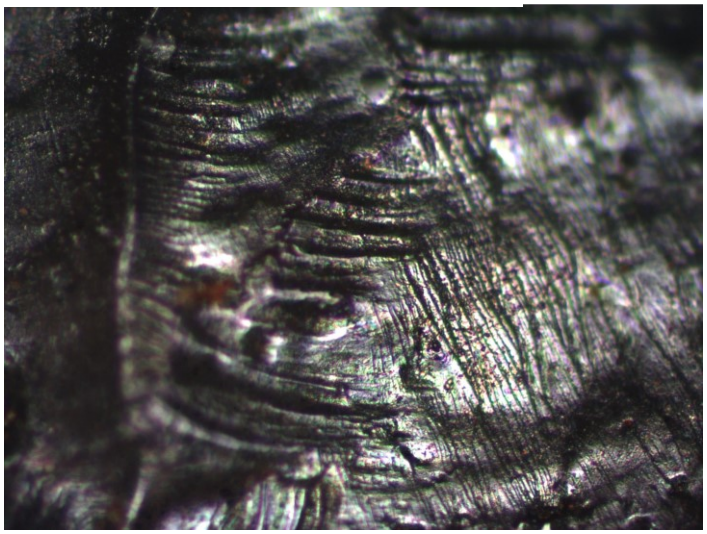
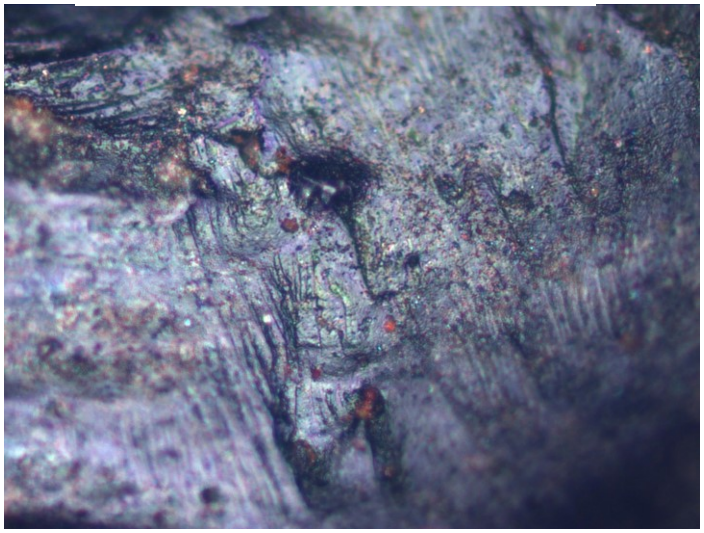


The spectral lines **260 / 265 and 125** indicate that the Quartz was exposed to a shock pressure of around **22 GPa !**

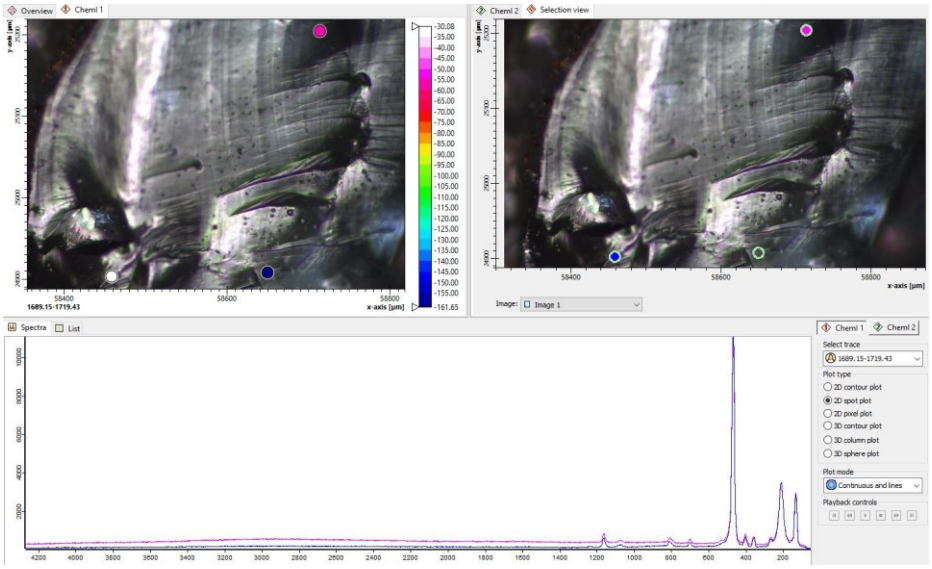
Detail : Image size : ~ 500 x 400 µm



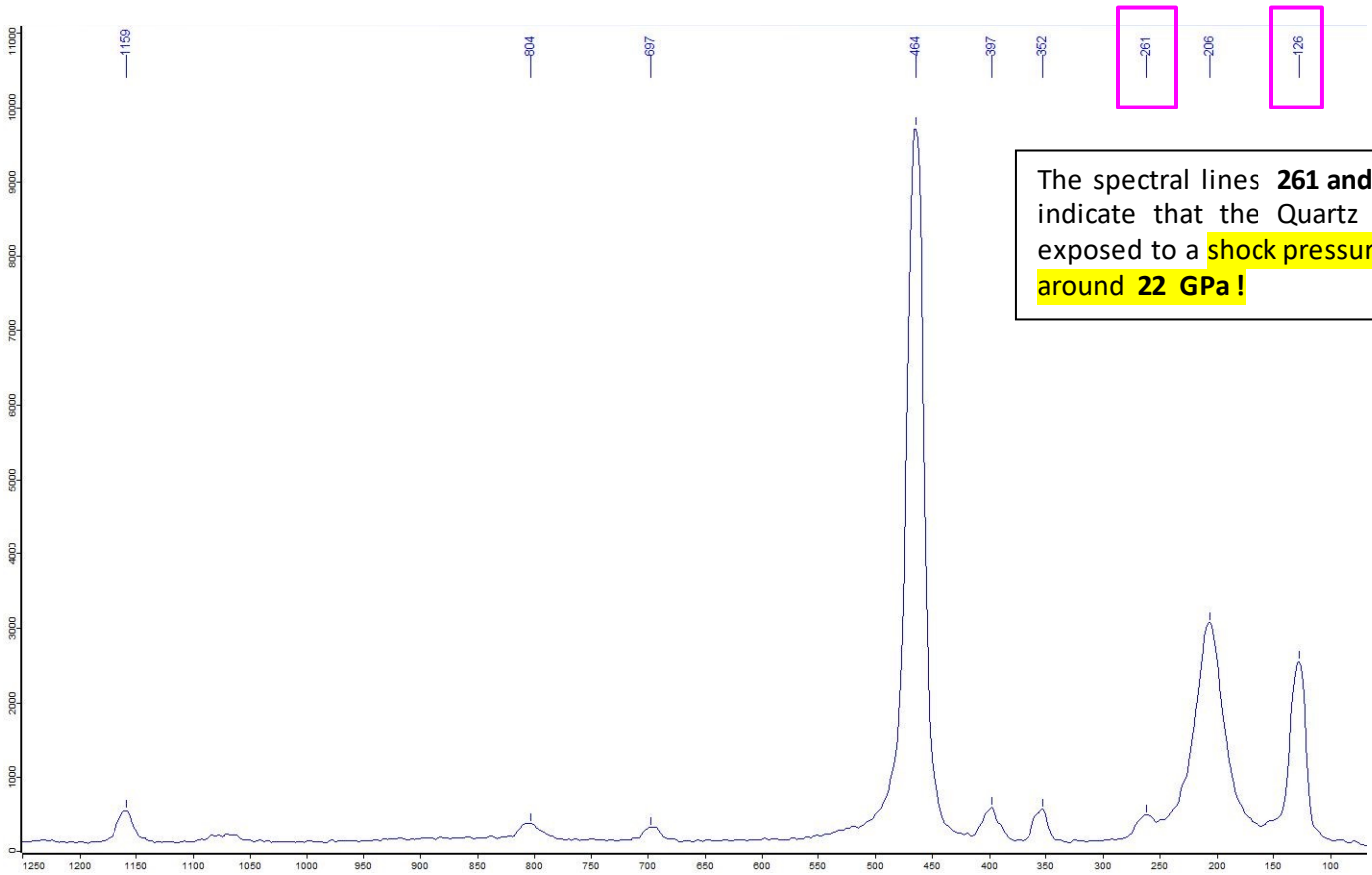
Detail : Image size : ~ 250 x 200 µm



Sample Site 12 : Stone 2_spectra 1 indicates : Quartz

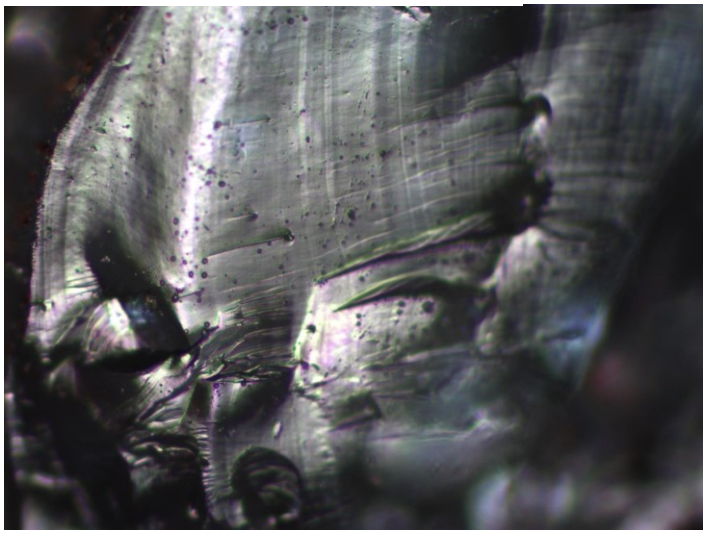


Sample :

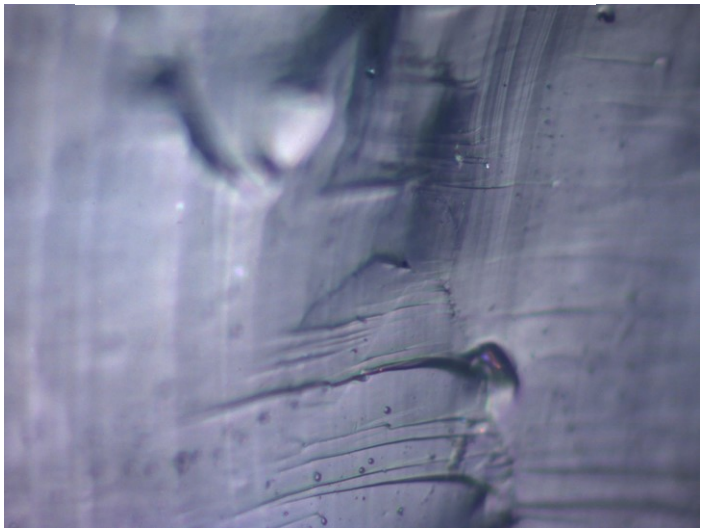


The spectral lines **261 and 126** indicate that the Quartz was exposed to a shock pressure of around **22 GPa !**

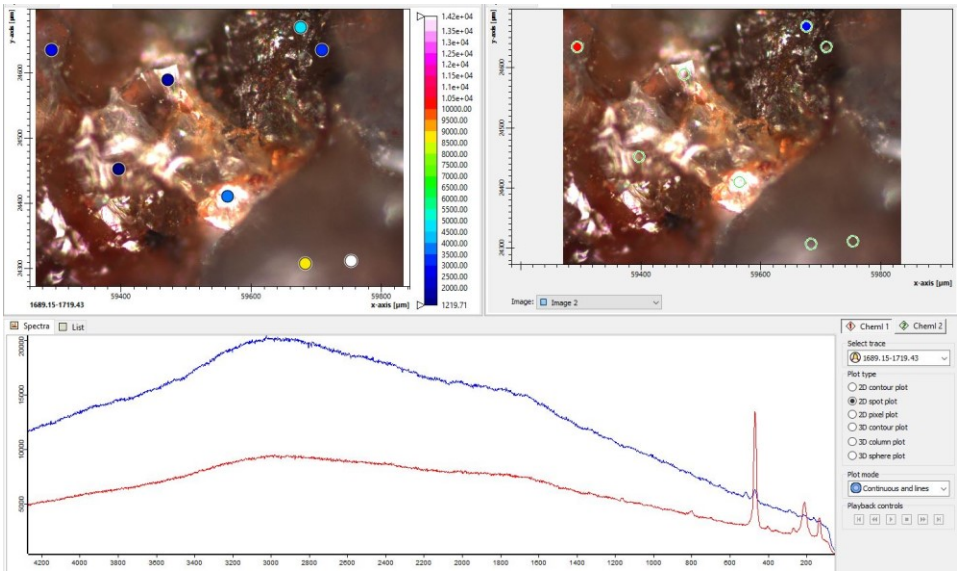
Detail : Image size : ~ 500 x 400 µm



Detail : Image size : ~ 250 x 200 µm



Sample Site 23 : Stone 1_spectra 1 indicates : Quartz + (Orthoclase)



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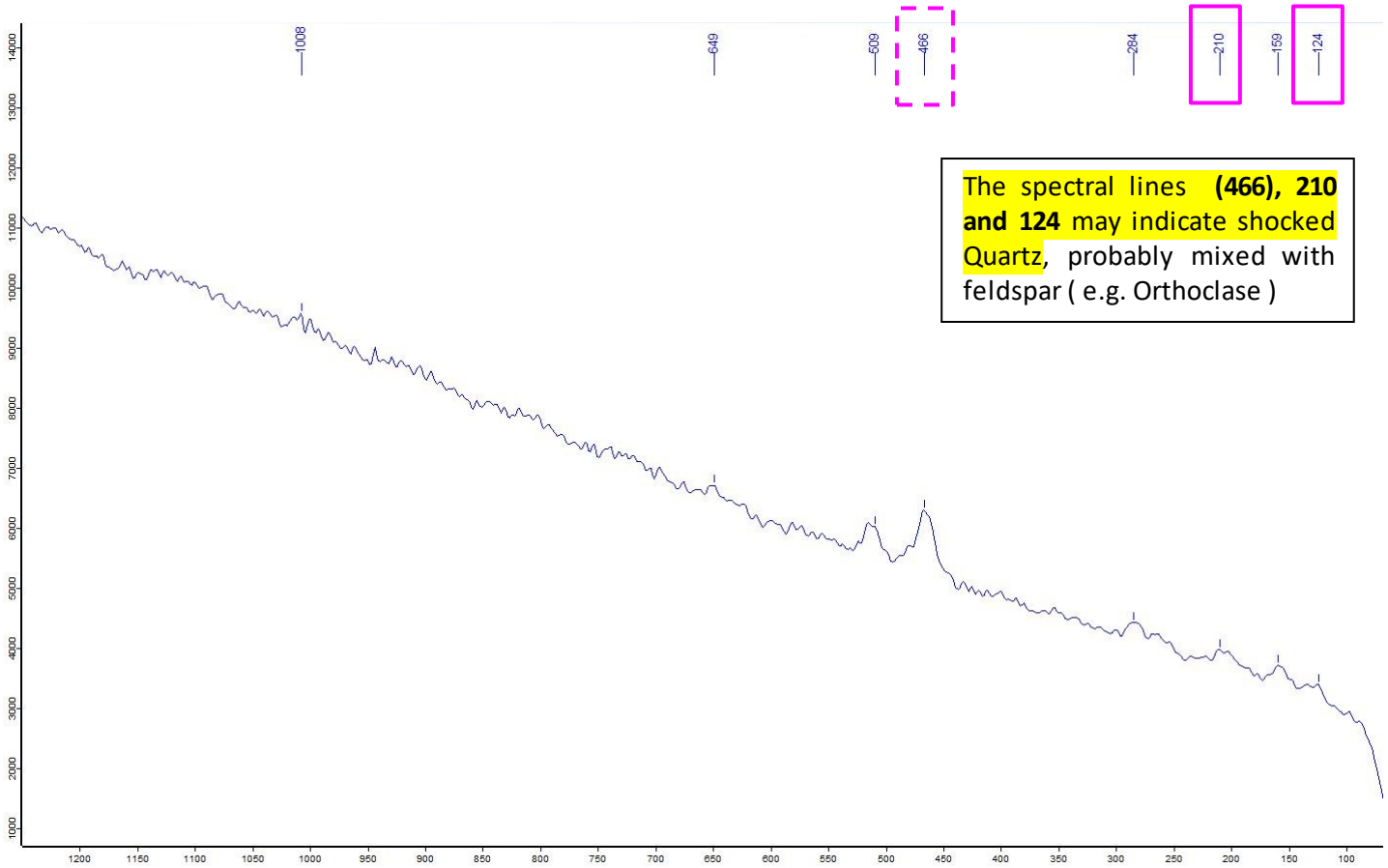
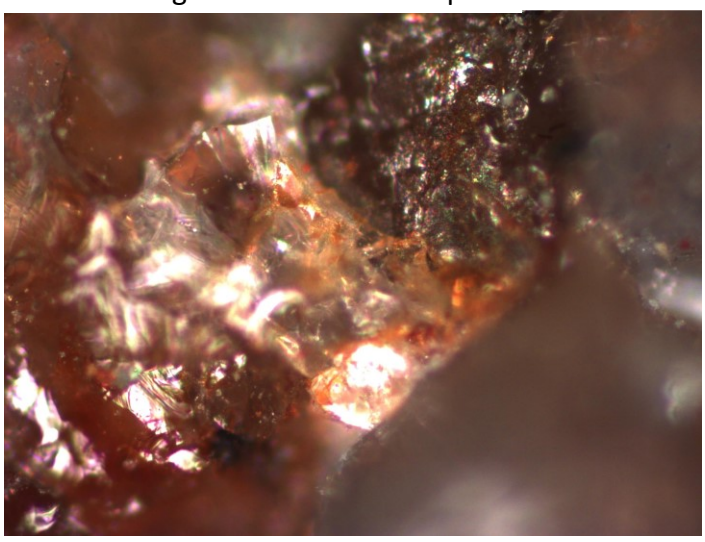
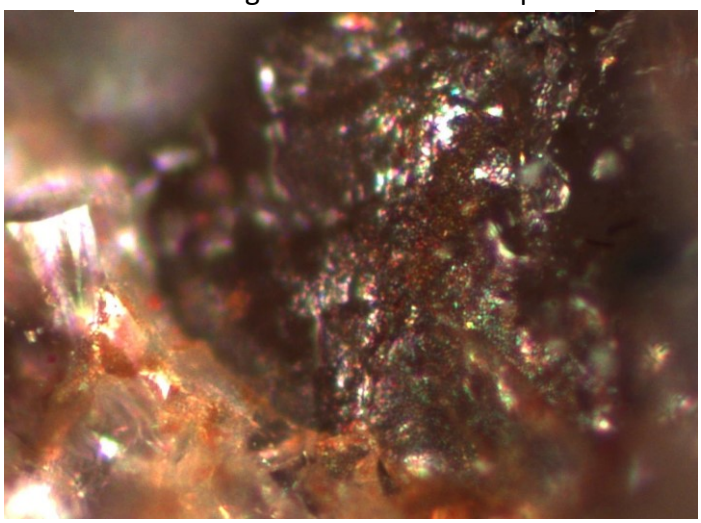


The spectral lines **(466), 210 and 124** may indicate shocked Quartz, probably mixed with feldspar (e.g. Orthoclase)

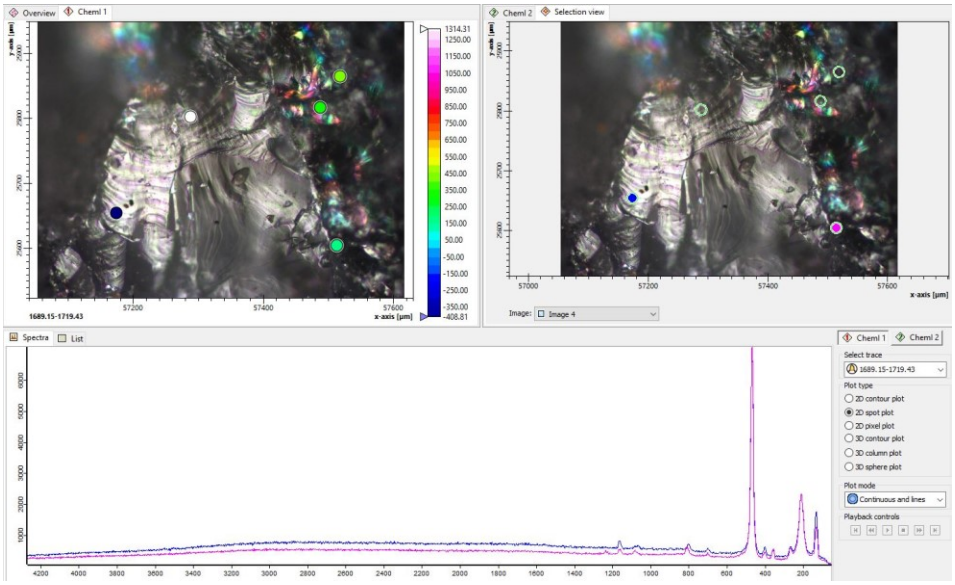
Detail : Image size : ~ 500 x 400 µm



Detail : Image size : ~ 250 x 200 µm



Sample Site 24 : Stone 1_spectra 1 indicates : Quartz



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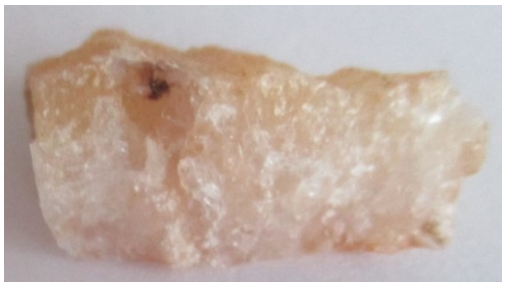
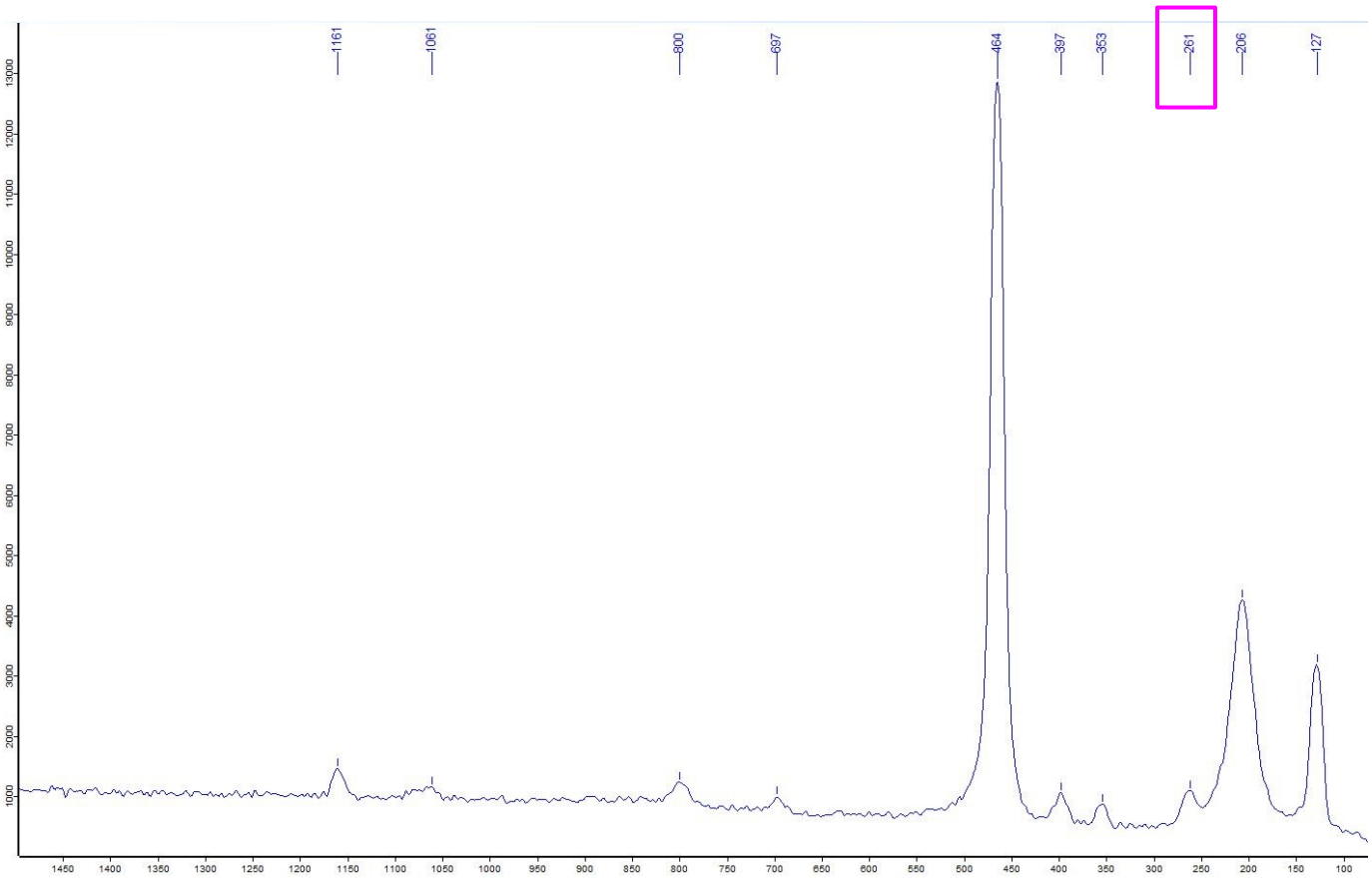
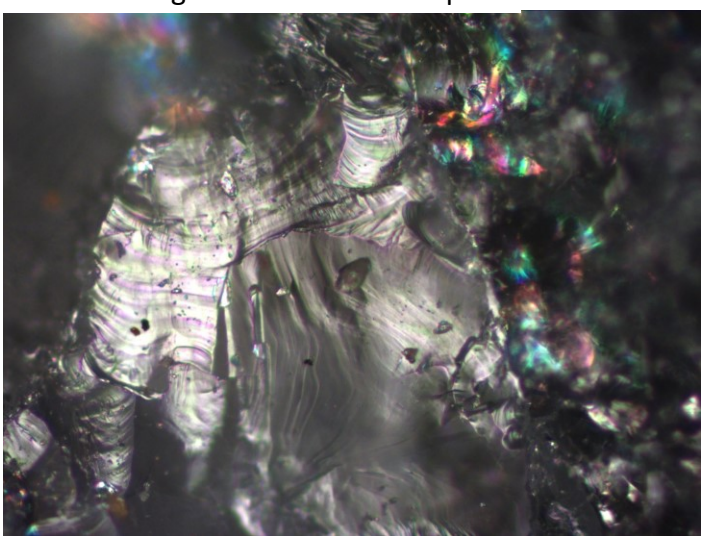




Detail : Image size : ~ 500 x 400 µm



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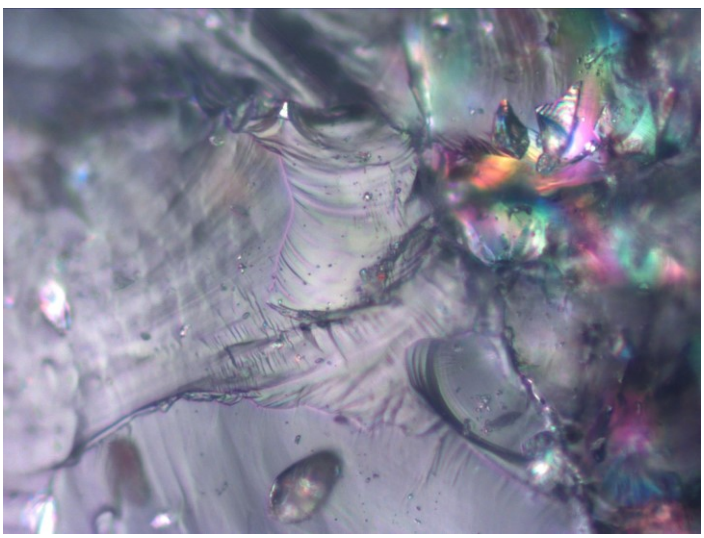
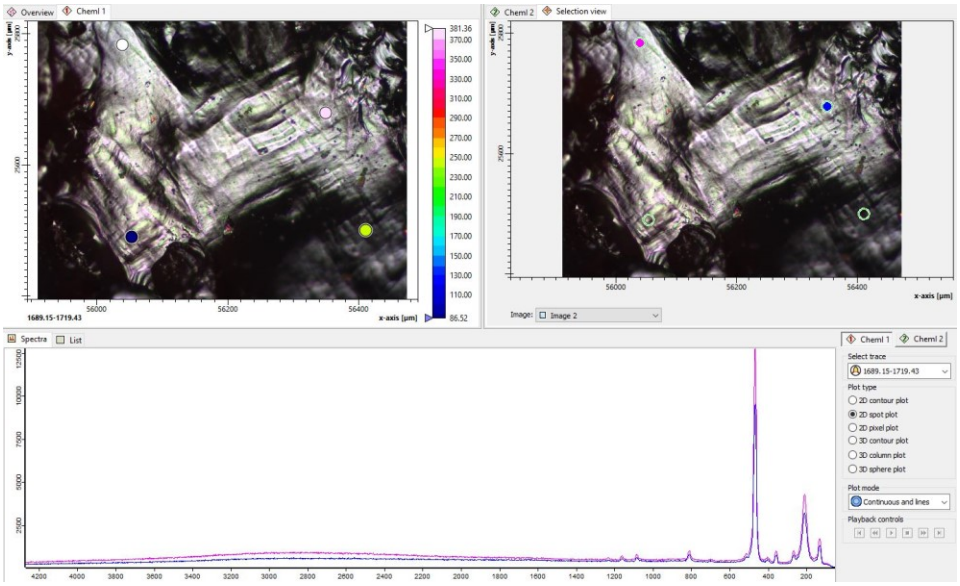


Sample Site 24 : Stone 2_spectra 1 indicates : Quartz



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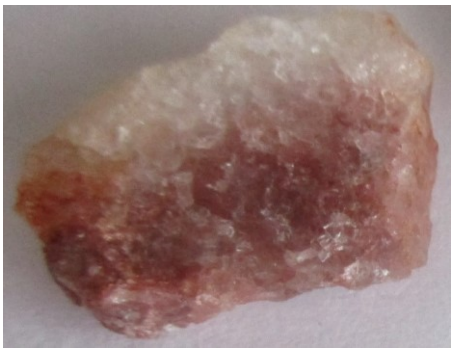

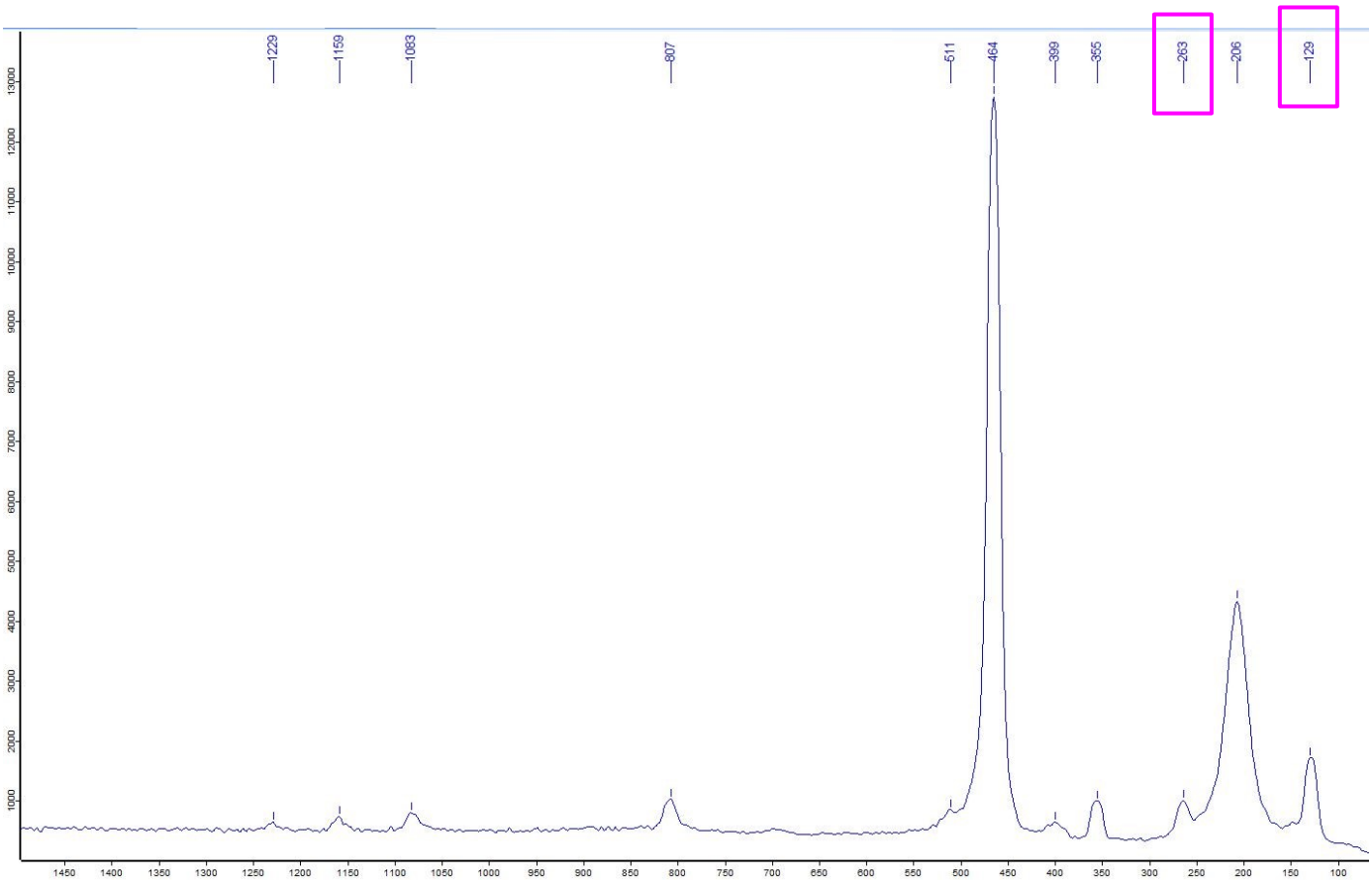

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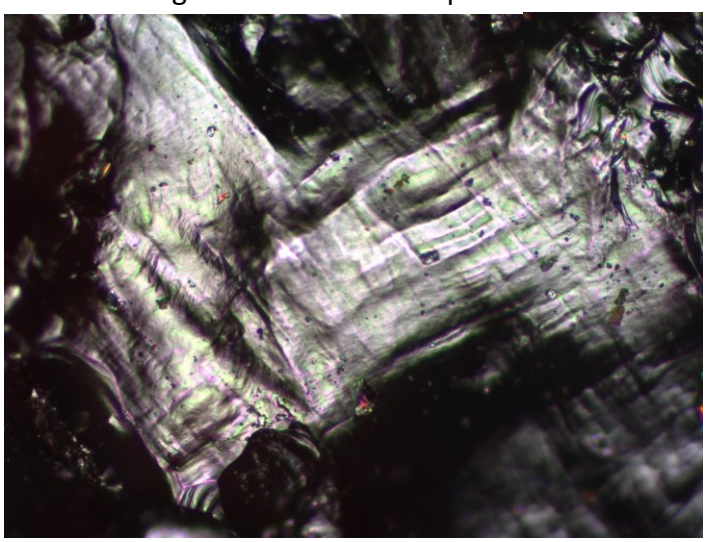
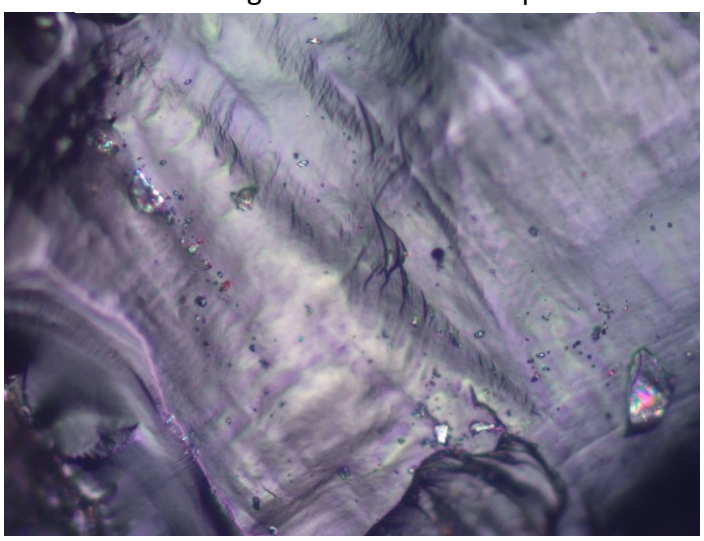
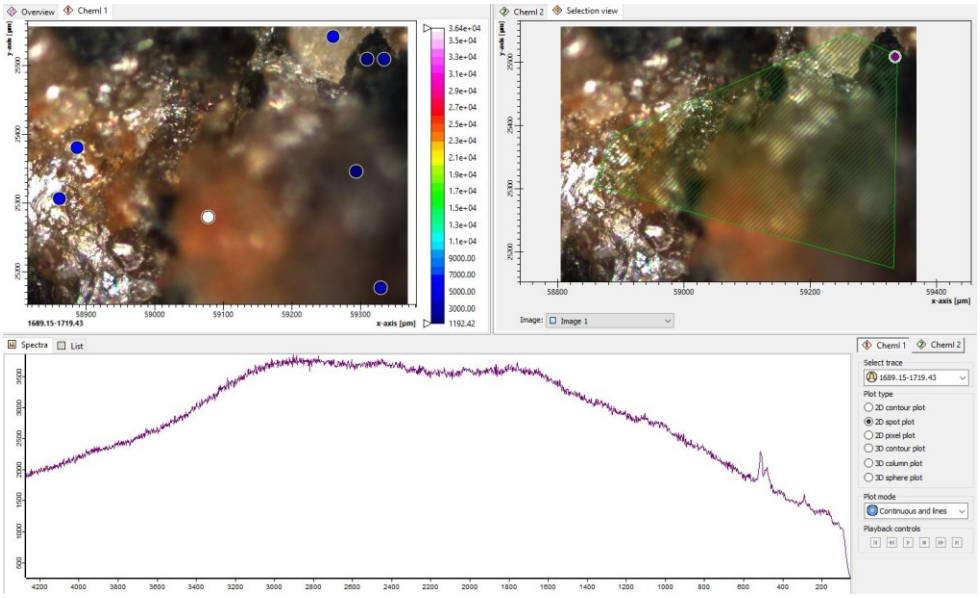


Detail : Image size : ~ 250 x 200 µm



Sample Site 23 : Stone 2_spectra 1 indicates : Tengerite-(Y), Labradorite



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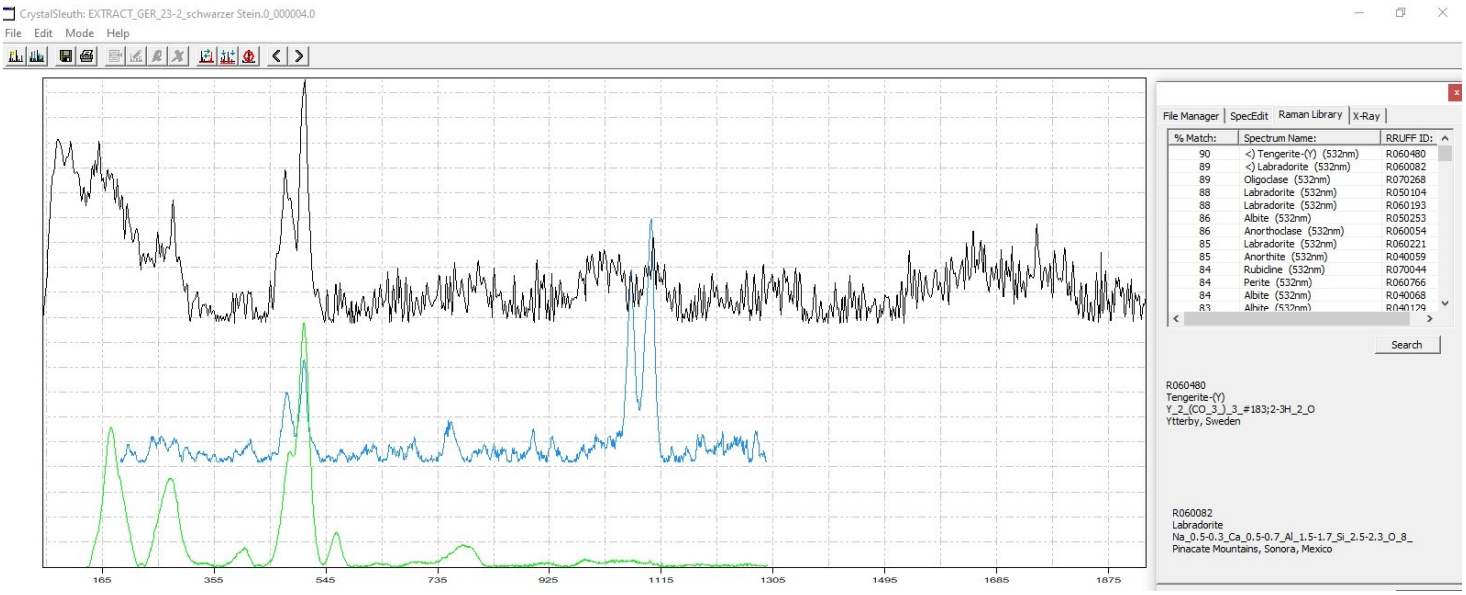
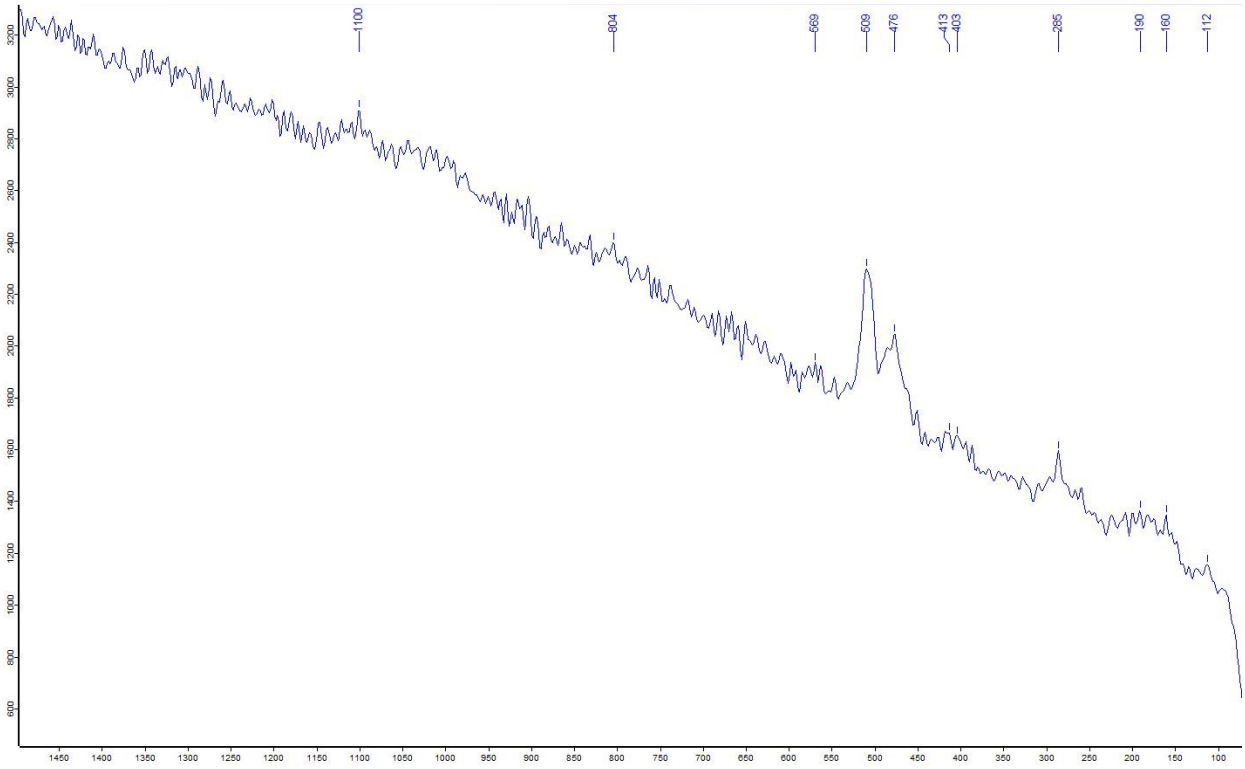
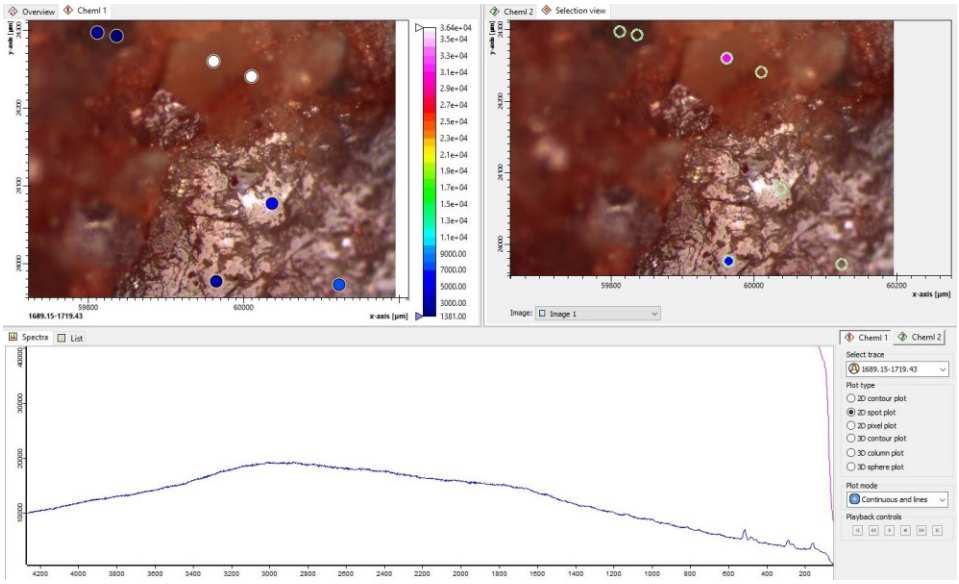




Sample Site 23 : Stone 3_spectra 1 indicates : Microcline



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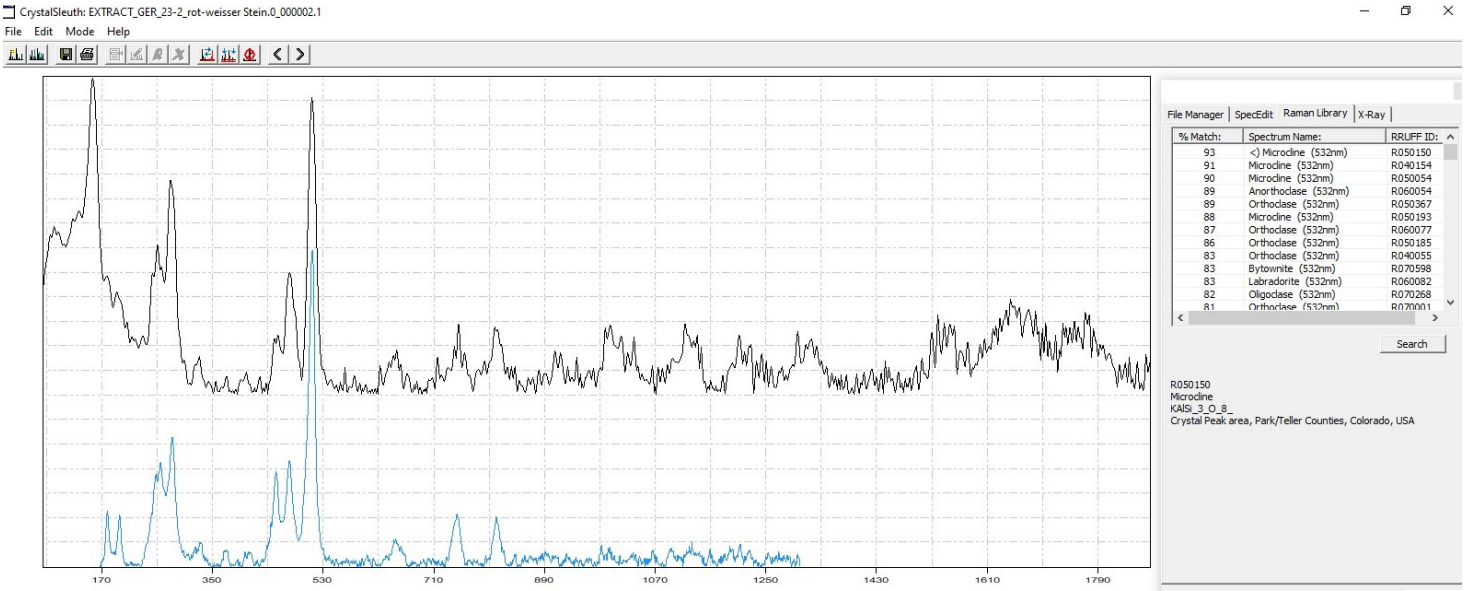
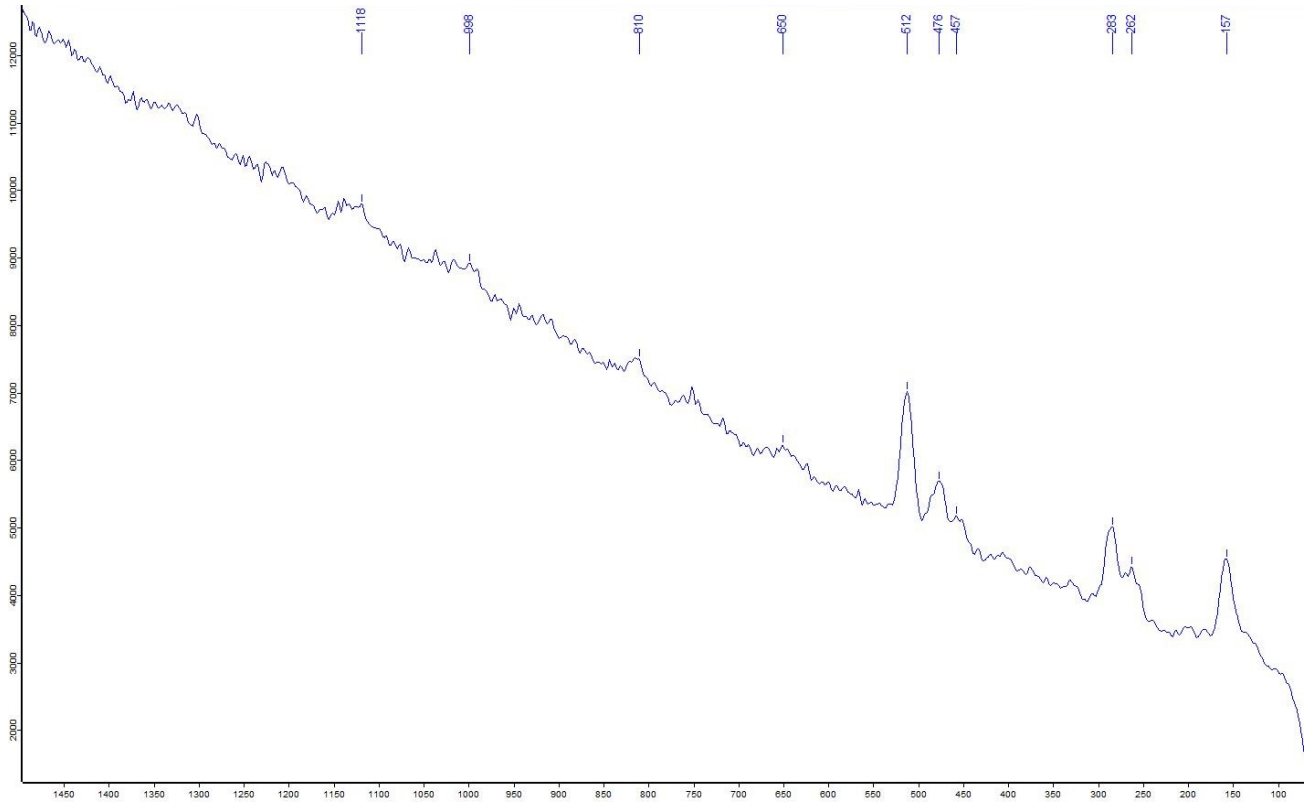
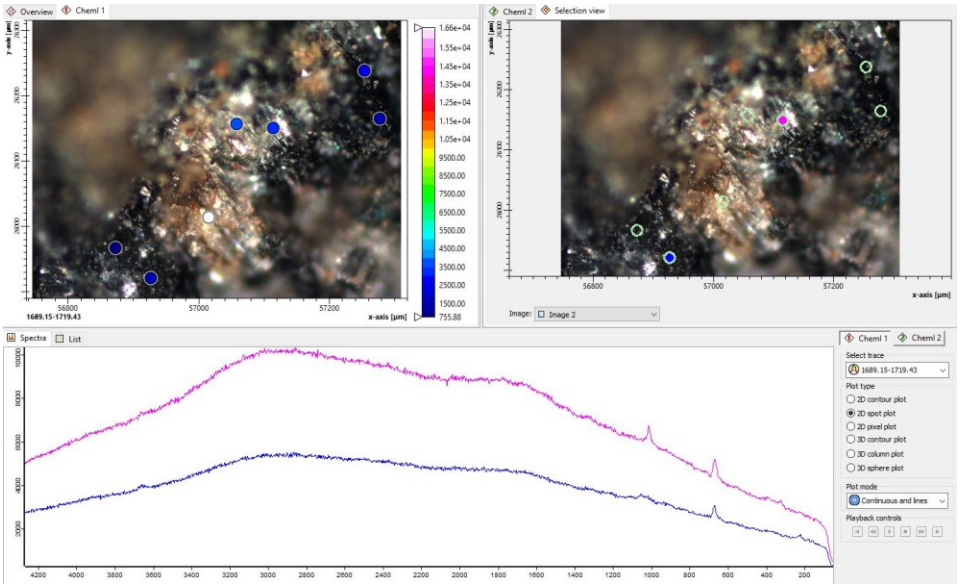
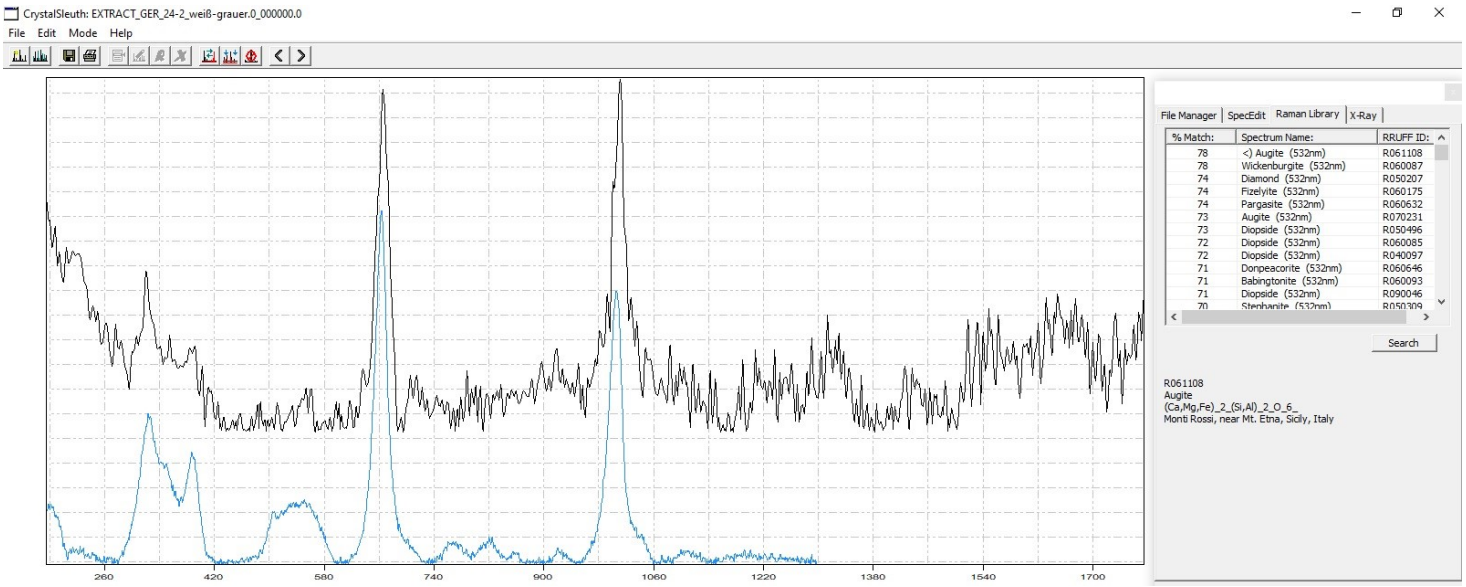


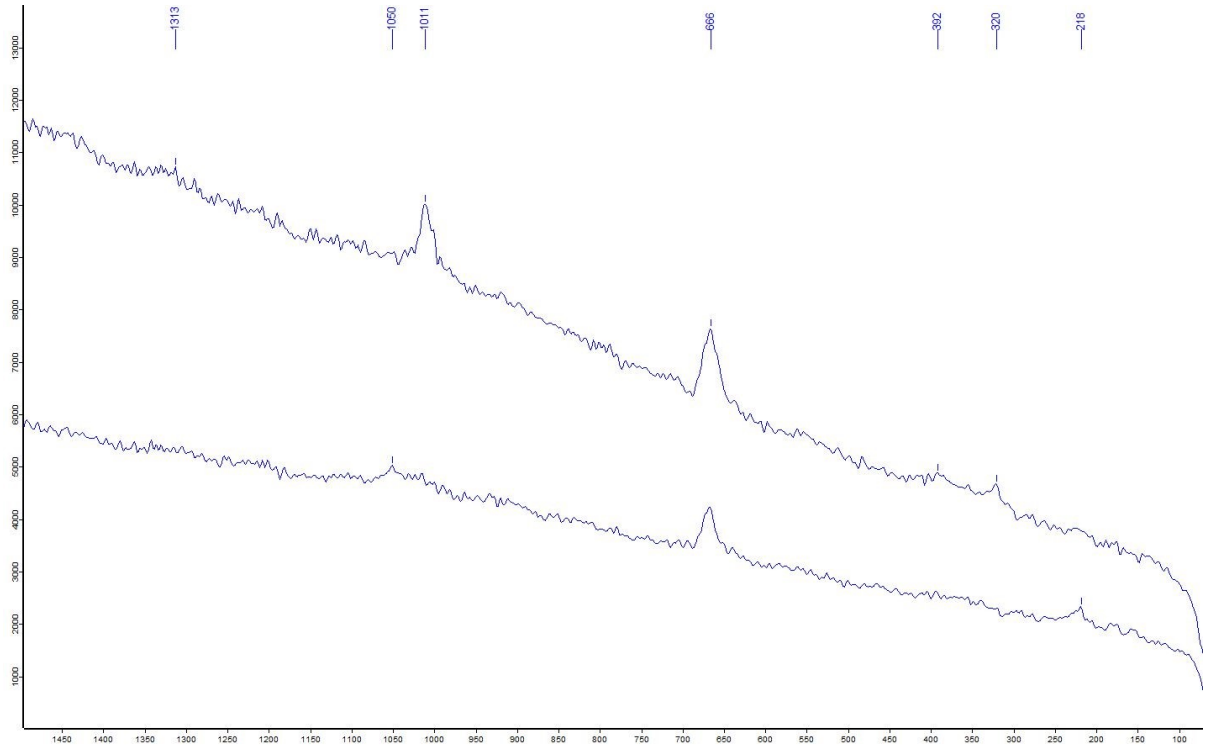


Sample Site 24 : Stone 3_spectra 1 indicates : Augite



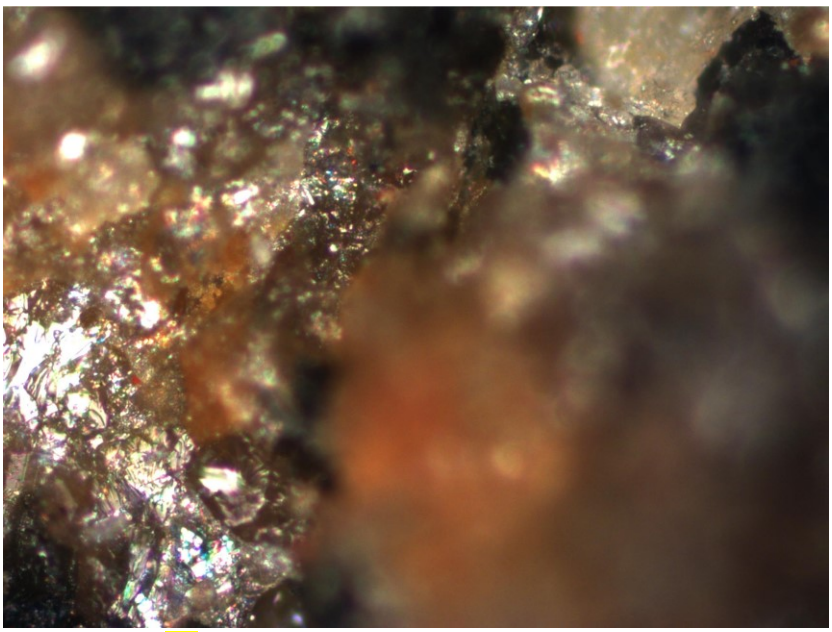
Sample :



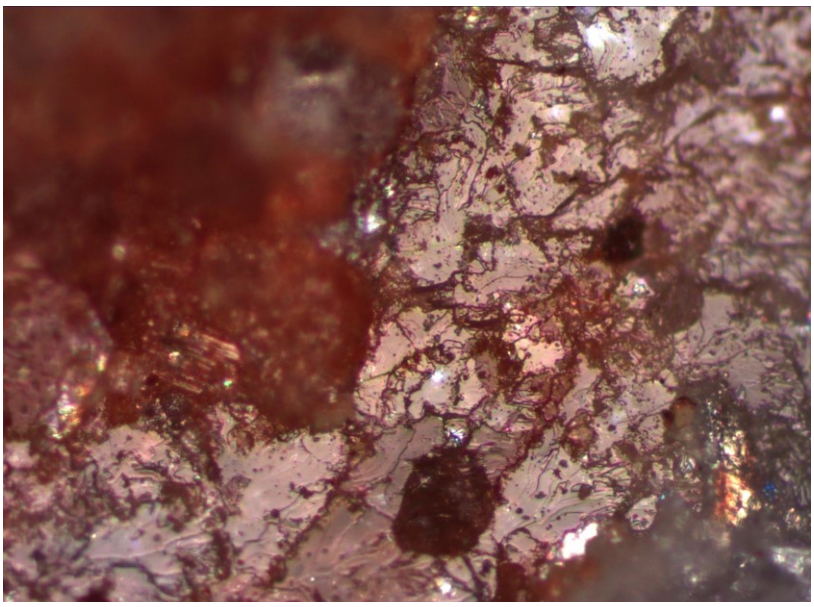


Microscopic Images : Sample from Site 23 and 24 → original state (no preparation for analysis)

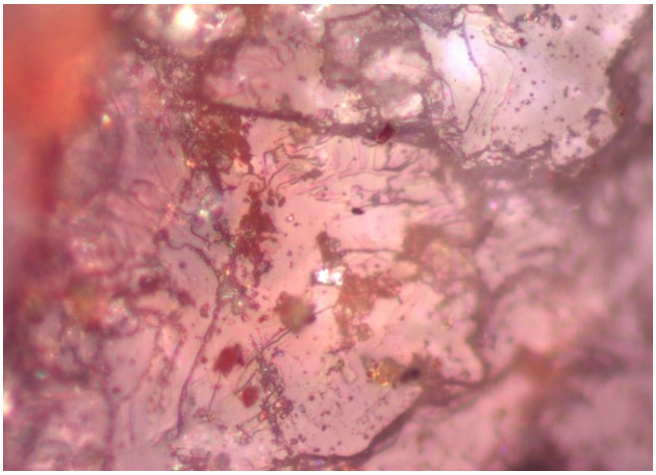
Sample Site 23 : Stone 2_spectra 1 indicates : Tengerite-(Y), Labradorite (Image ~ 500 x 400 µm)



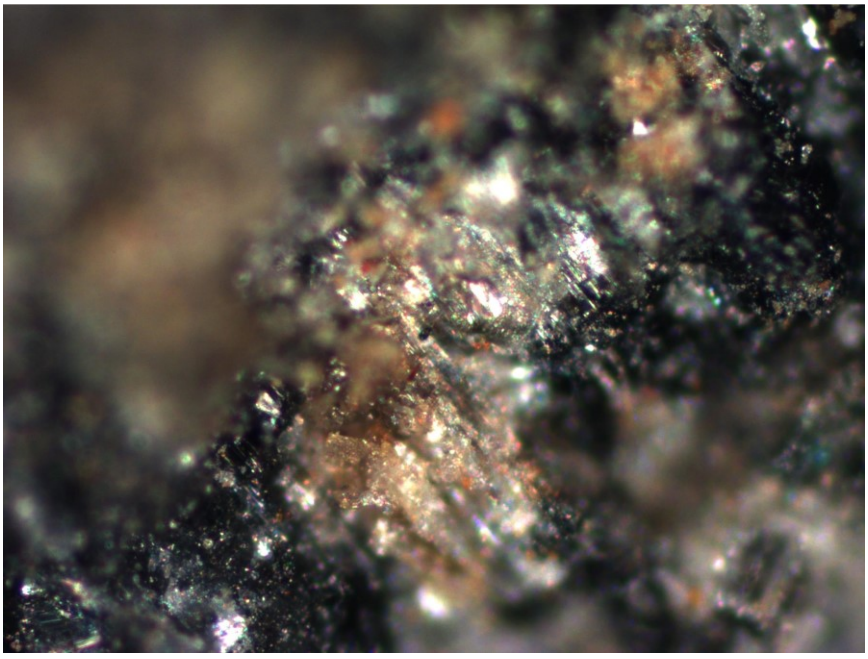
Sample Site 23 : Stone 3_spectra 1 indicates : Microcline (Image ~ 500 x 400 µm)



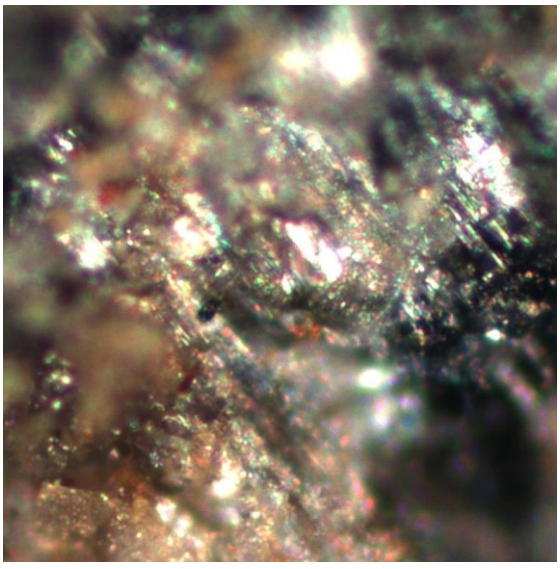
Detail : Image size : ~ 170 x 130 µm



Sample Site 24 : Stone 3_spectra 1 indicates : Augite (Image: ~ 500 x 400 µm)



Detail : Image size : ~ 200 x 200 µm



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

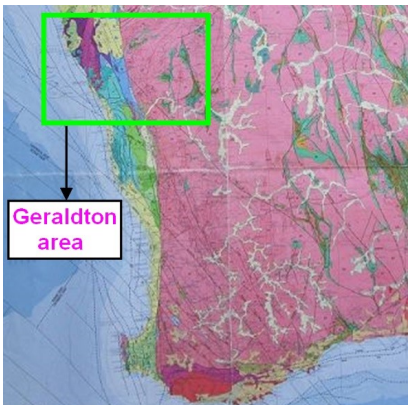
→ See next page !

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

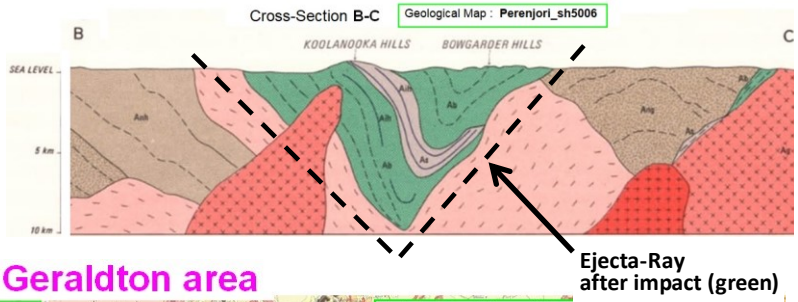
→ Samples of the Geraldton Area or here : Geraldton Area

Geological Map of SW-Australia

Location where samples were collected :

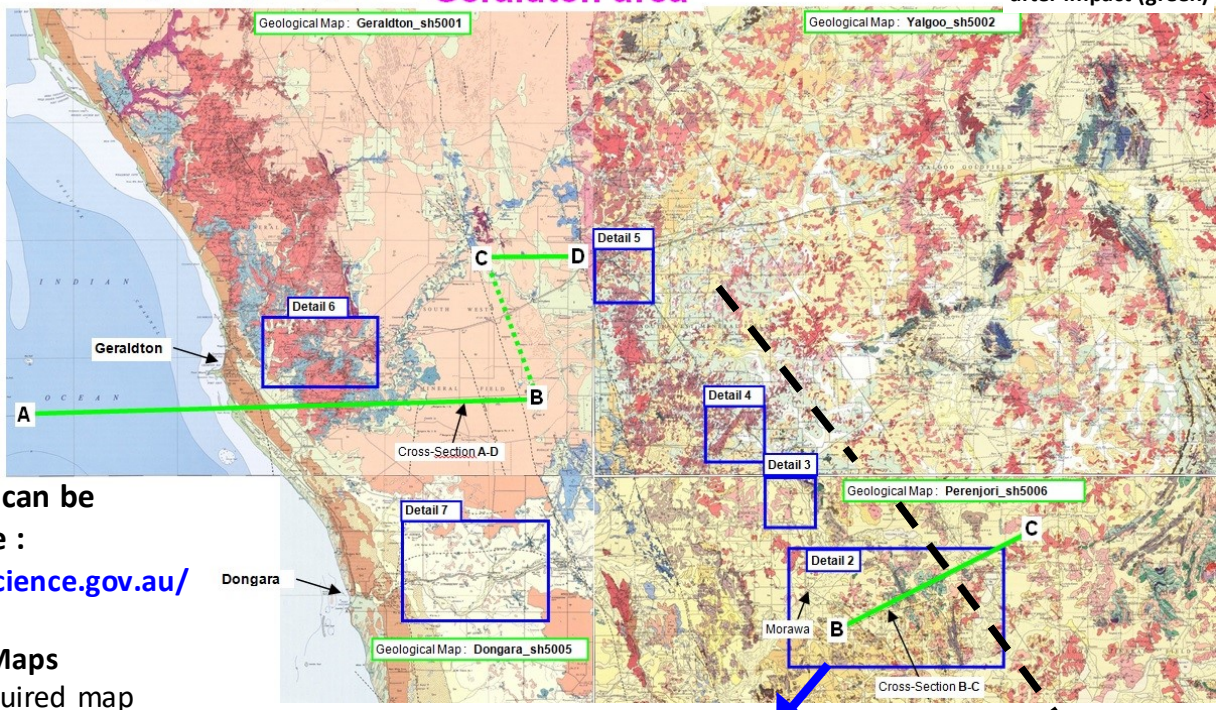


The section of an ejecta-ray of the Port Hedland Crater (or VLC) → the nearly linear green-colored structures) seem to have penetrated the Yilgarn Craton down to a **depth of around 10 km** !



→ 4 Geological Maps joined together :

Geraldton area



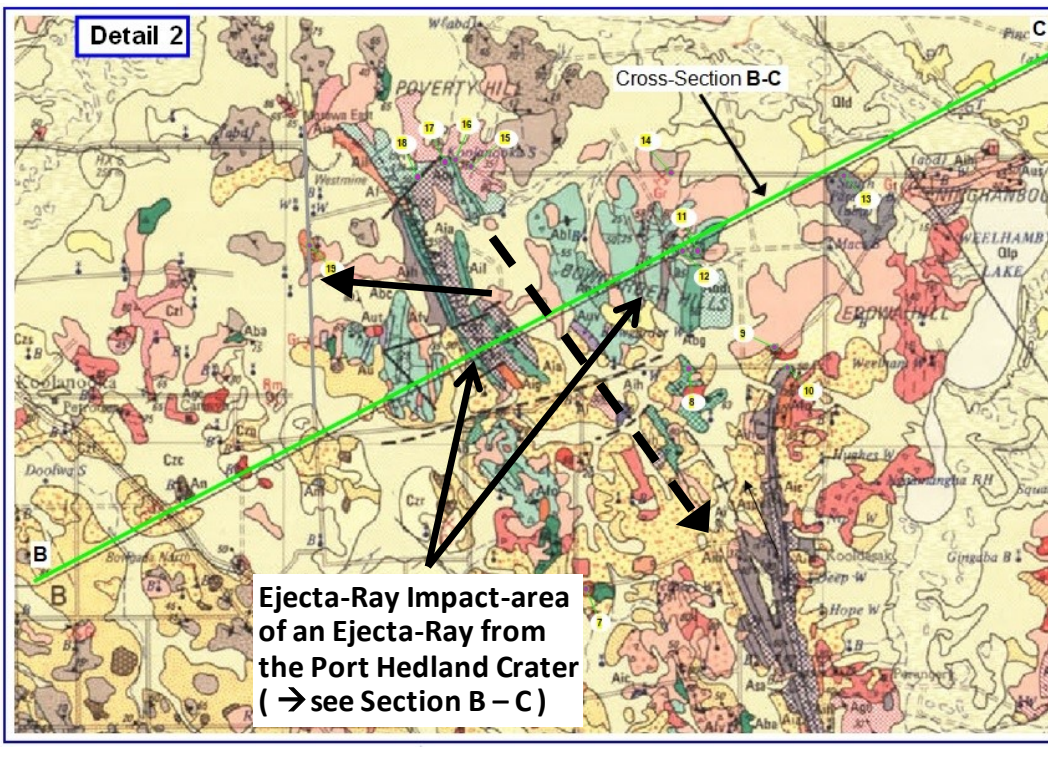
→ **Geological Maps can be downloaded here :**

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

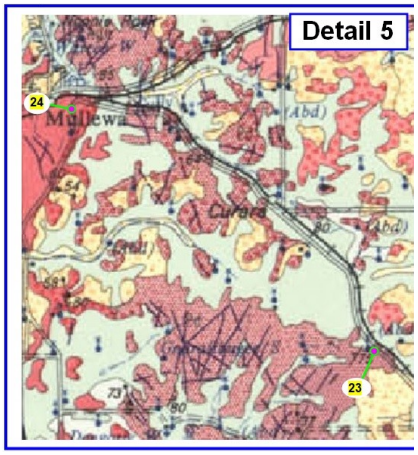
Then go to "Geology"

– 1:250K Geological Maps

and search for the required map



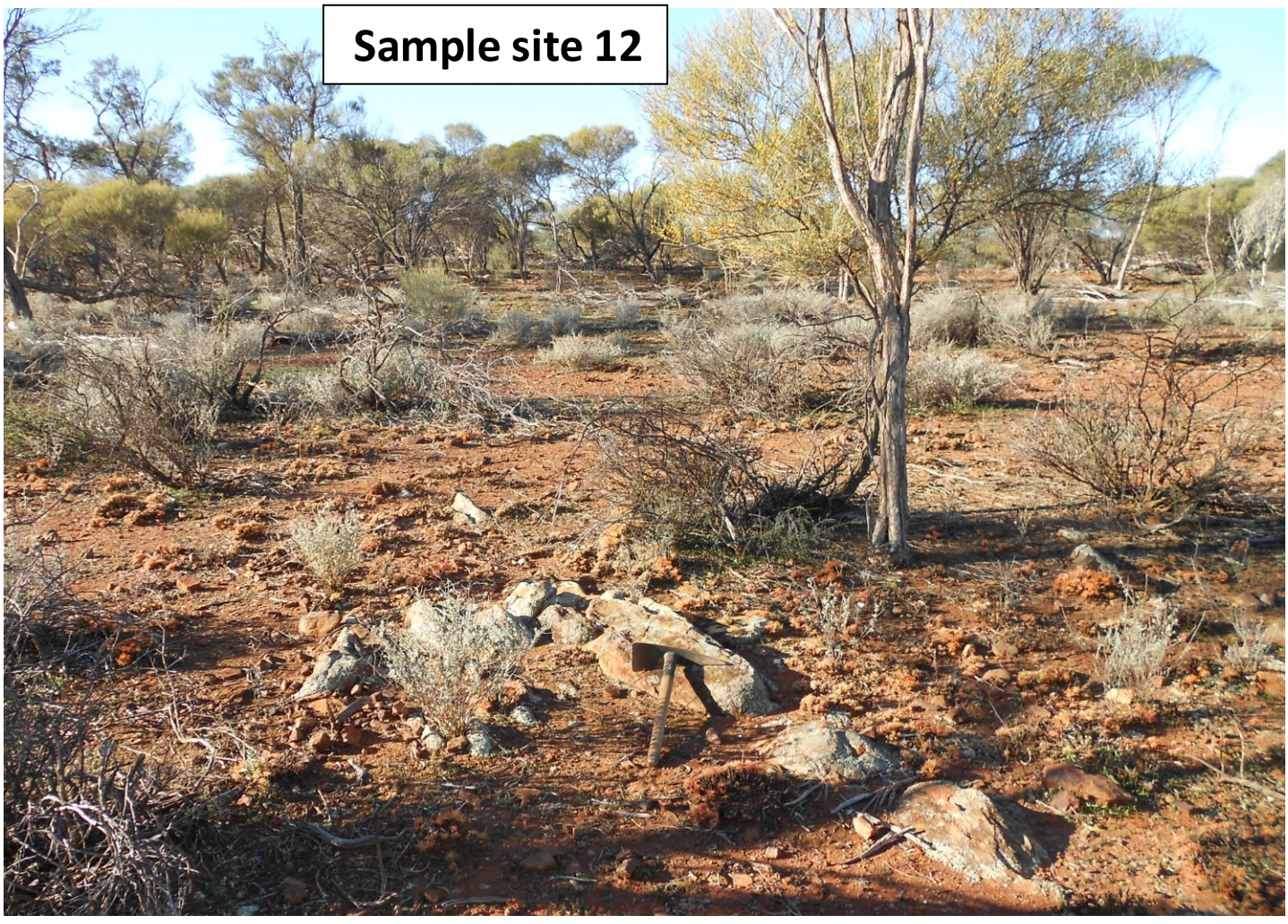
Ejecta-Ray Trajectory




11
11 29° 13,227 S 116° 20,477 E 20 m West-Australia (SW)_Geraldton

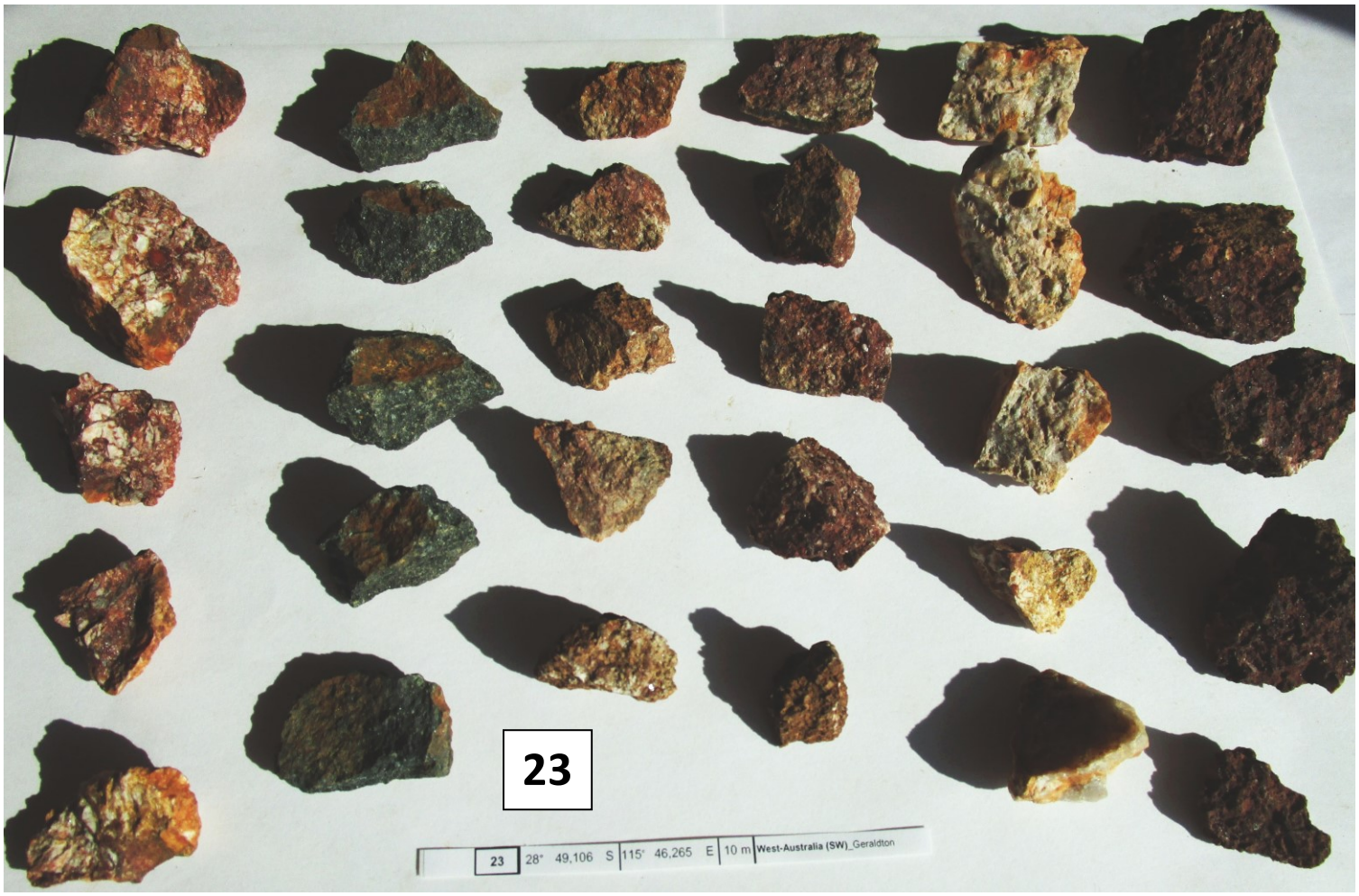

Sample site 11

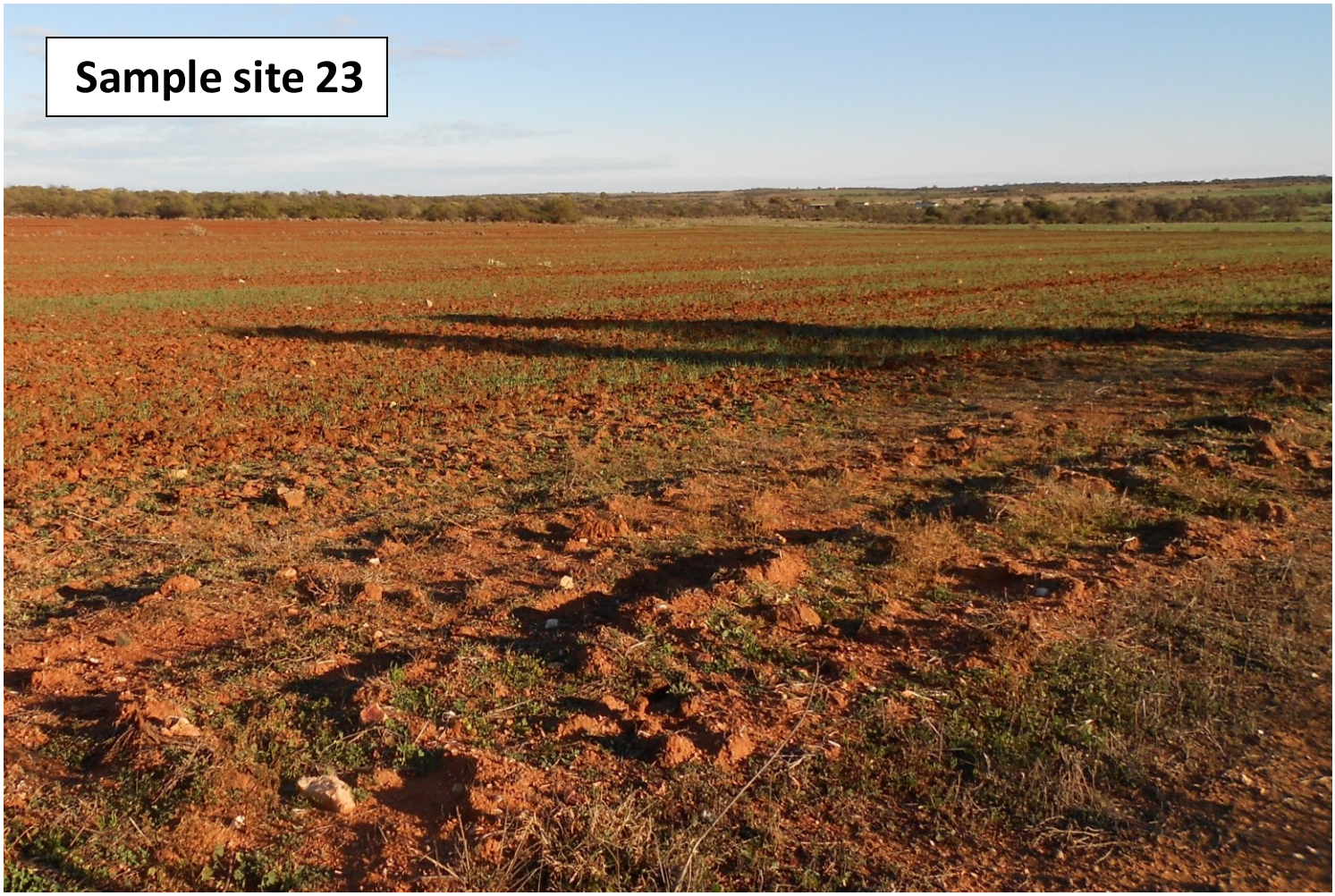

12
12 29° 13.253 S 116° 19.932 E 9 m West-Australia (SW)_Geraldton


Sample site 12

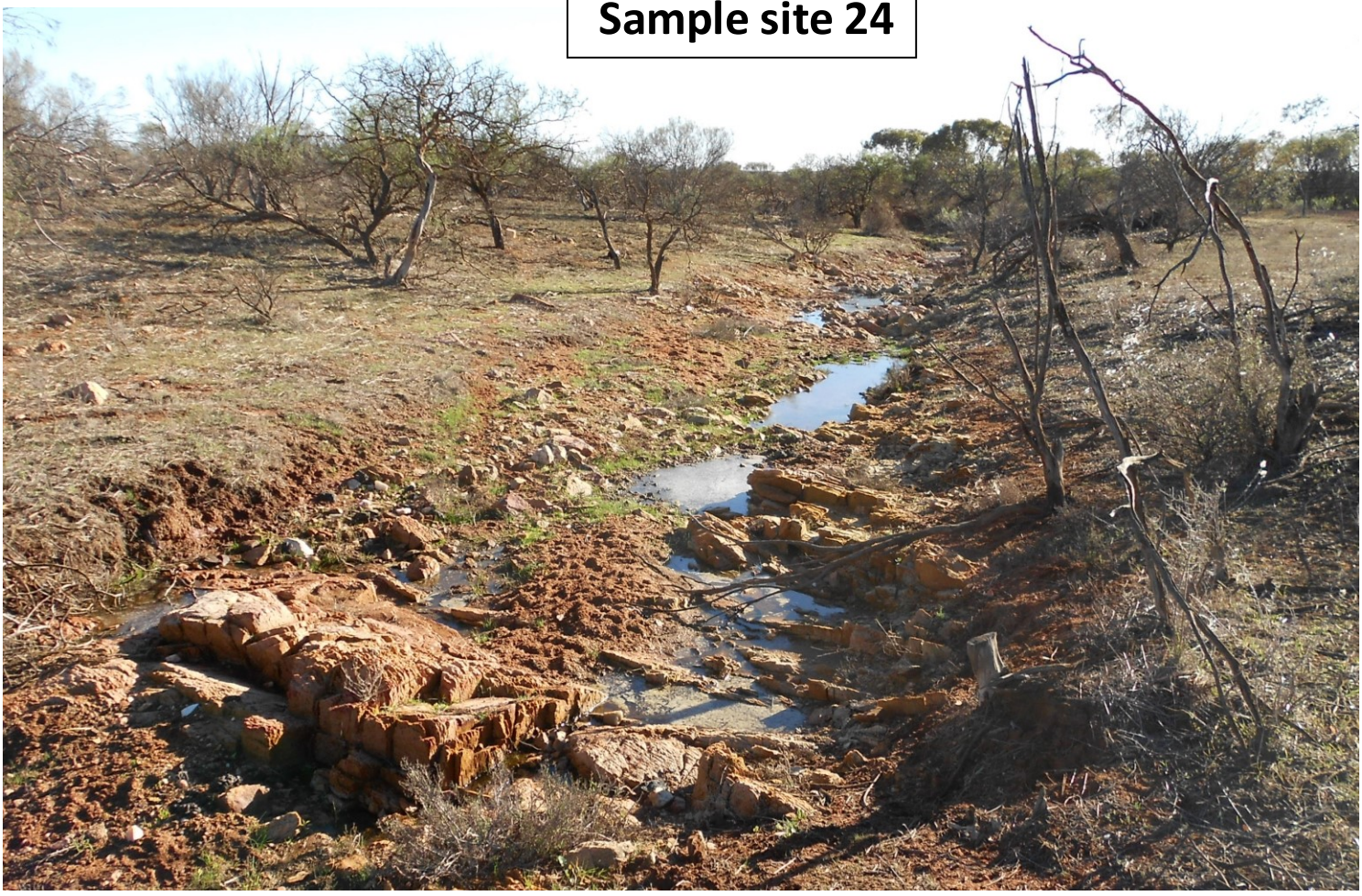

17
17 29° 11,412 S 116° 14,237 E 20 m West-Australia (SW)_Geraldton


Sample site 17


23
23 28° 49,106 S 115° 46,265 E 10 m West-Australia (SW)_Geraldton


Sample site 23

Sample site 24



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

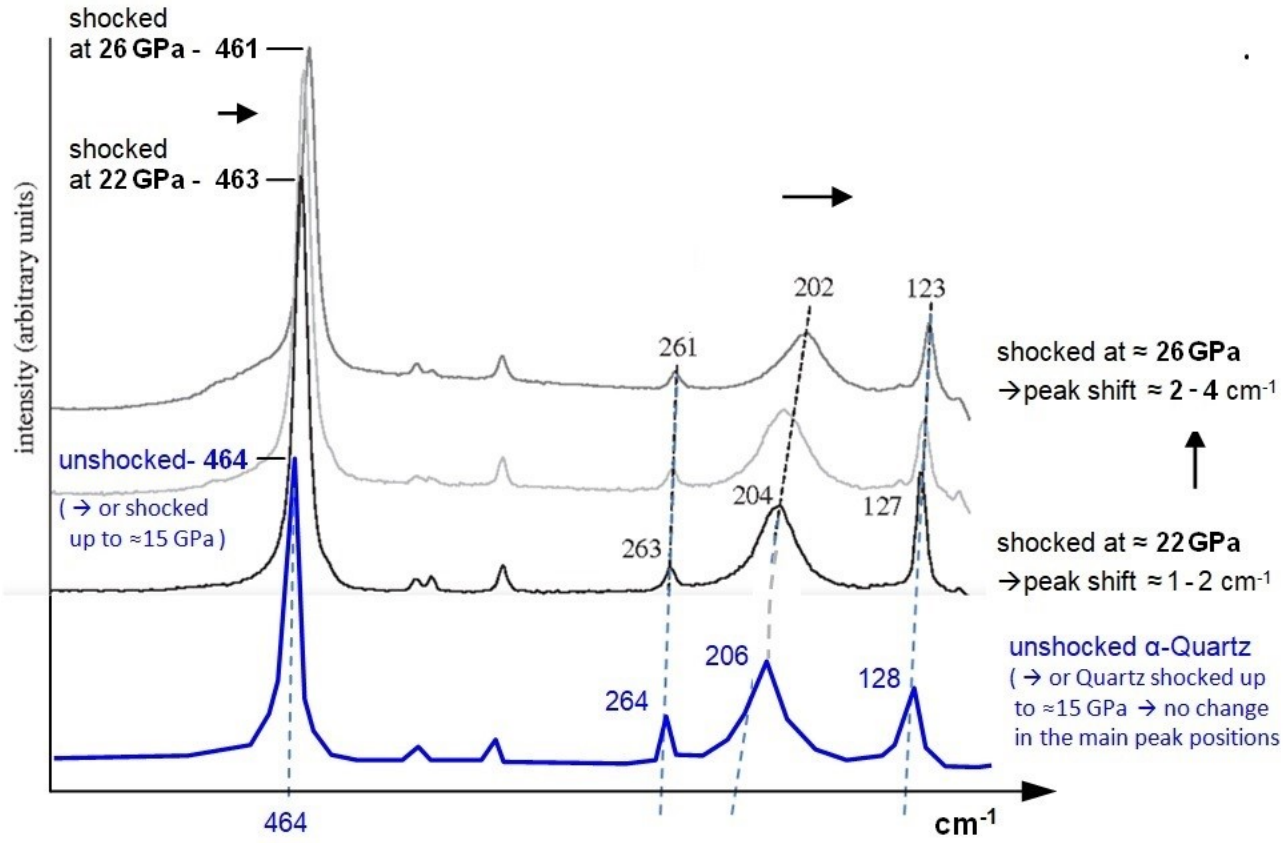
In order to verify a sample site as an impact site or impact structure, shock-metamorphic effects must be discovered in the rocks of the sample site. This can be done by different methods.

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.

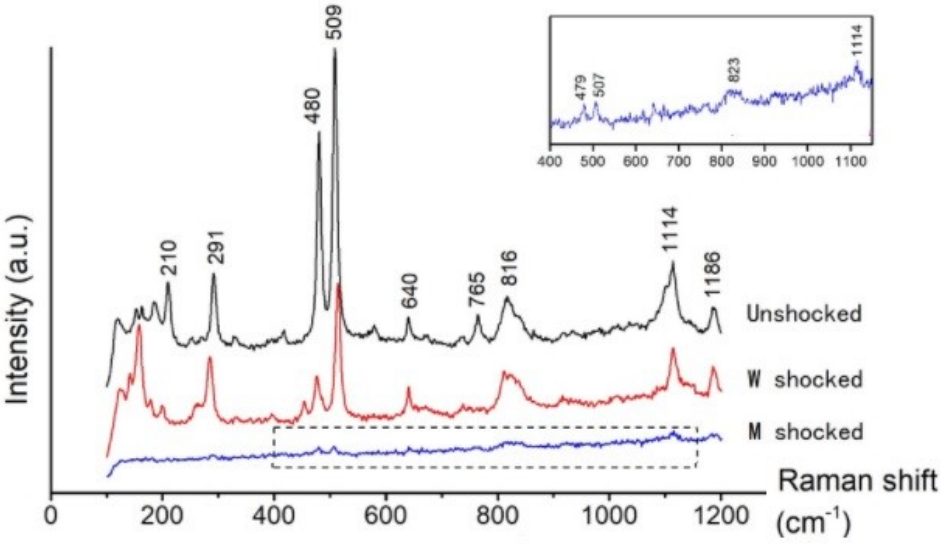
Mc Millan et al. (1992) and others have shown that the main RAMAN-peaks of Quartz shift towards lower frequencies if the Quartz was exposed the a shock-pressure > 15 GPa. → see diagram below

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 Geraldton Area or here : Geraldton 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 Kalgoorlie 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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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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https://www.researchgate.net/publication/234026075_Shock_experiments_on_quartz_targets_pre-cooled_to_77_K

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Shock-Related Deformation of Feldspars from the Tenoumer Impact Crater, Mauritania - by Steven J. Jaret
https://trace.tennessee.edu/cgi/viewcontent.cgi?article=1002&context=pursuit

A Study of Shock-Metamorphic Features of Feldspars from the Xiuyan Impact Crater - by Feng Yin, Dequi Dai
https://www.researchgate.net/publication/339672303_A_Study_of_Shock-Metamorphic_Features_of_Feldspars_from_the_Xiuyan_Impact_Crater

Shock effects in plagioclase feldspar from the Mistastin Lake impact structure, Canada – A. E. Pickersgill – 2015
https://onlinelibrary.wiley.com/doi/pdf/10.1111/maps.12495

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https://www.hou.usra.edu/meetings/lmi2019/pdf/5086.pdf

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