The Ø 12 x 9 km Tinajo Crater on Lanzarote (Canary Islands)

- RAMAN Spectra of selected Rock Samples -

by Harry K. Hahn / Germany - 16.3.2022

Summary :

Here a summary of the Raman-spectroscopic analysis a of rock-samples which I have collected near the **Ø 12 x 9 km "Tinajo Impact Crater"** on Lanzarote, and on other interesting sites on the Island.

The Gravity Anomaly Map of the Canarian Islands indicates a large scale Impact Event. This impact event probably was the result of Ejecta from the PTI (Permian Triassic Impact) which formed a large secondary crater, the hypothetical **Ø 430 x 290 km Gibraltar Crater (GIC).** (see gravity anomaly map on the next page). The smaller oblique (ellipitical) impact craters indicated on this Gravity Anomaly map, offshore of the Islands Lanzarote, Fuerteventura and Teneriffa, belong to this impact event and are located along the hypothetical crater-wall (-rim) of the **GIC**. A magnetic anomaly map of the Atlantic Ocean-floor south-west of Spain provides indication for this Ø 430 x 290 km Gibraltar Crater.

(→ see the explanation on **pages 28** & **29** of my **PT Impact Hypothesis:** **Part 2** (or alternative here: **P2**))

The hot spots which caused the Canary Islands originally were impact sites of large ejecta fragments, which were ejected from the Permian Triassic Impact Crater in the Arctic Sea. I am sure that these impact sites (hot spots) were produced by the same large-scale secondary impact event (caused by the PTI), that also has formed the **Bay of Lyon Crater** (or **BLC**) and **other impact structures in Spain**.(or **L2**)

In all collected rock samples no quartz was found. This makes it difficult to provide evidence for the secondary impacts of the PTI which probably have caused the hotspots of the Canarian Islands.

A feldspar-sample collected on the sample site 65, that is close to the center of the hypothetical impact crater, may show a Raman-spectra which indicates (W) weakly-shocked feldspar.
(an explanation to Raman spectra of shocked Alkali-Feldspar : → see at page **17** in the **Appendix 3**)

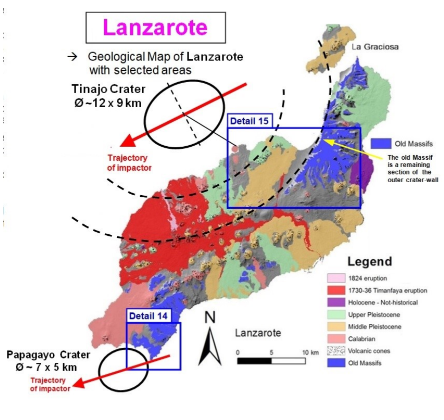
Minerals found in the analyses : Labradorite, Apatite-(Ca-F), Nepheline or Dachiardite-Ca, Forsterite, Reyerite, Dolomite or Rosasite, Kutnohorite or Calcite, Reynersonite (?)

→ Images of the analysed rock samples and photos of the sample sites are in the Appendix at page **12**

→ A general summary to all analysed samples regarding my **PTI-hypothesis** (**P1**) → in **Part 6** (**P6**)

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

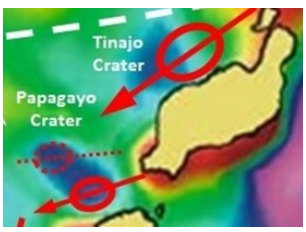
Geological Map of Lanzarote with the possible Tinajo Crater and Papagayo Crater marked on the map

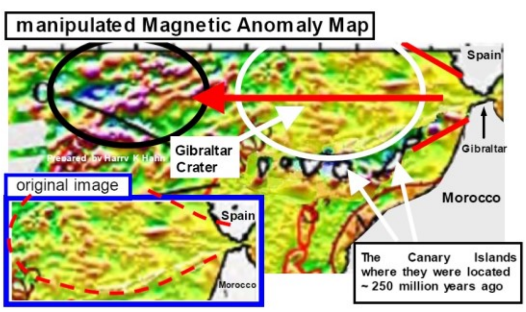


Gravity Anomaly Map of Lanzarote :

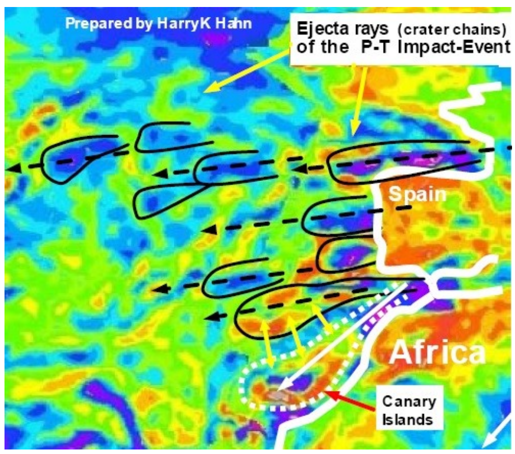
with the possible two impact Craters marked on the map. (indicated by blue color)

→ negative anomalies





Gravity Anomaly Map of the Canarian-Island-area



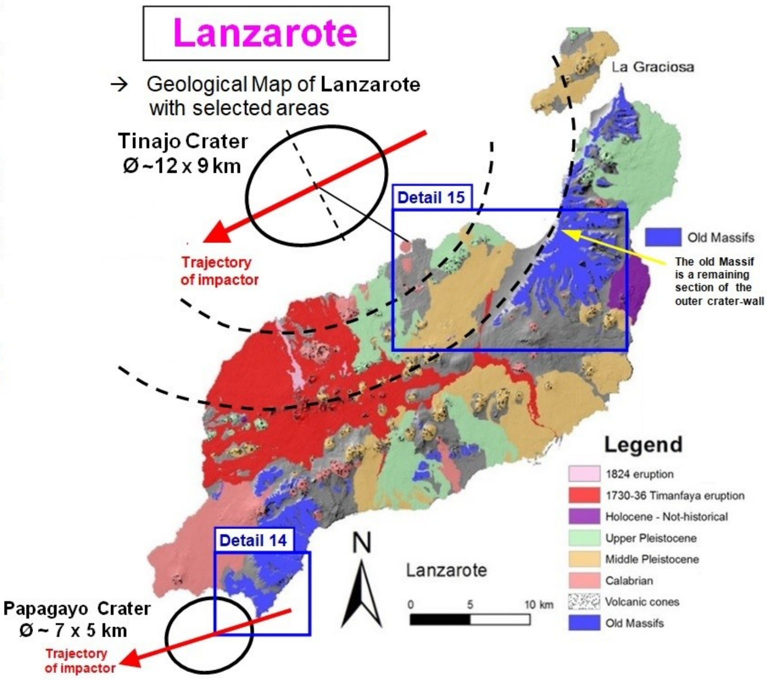
The Ø 12 x 9 km Tinajo Crater offshore of Lanzarote

The gravity anomaly map of the Island Lanzarote indicates an Impact Event. This is the hypothetical **Ø 12 x 9 km Tinajo Crater and the Ø 7 x 5 km Papagayo Crater** just noth-east and south (offshore) of Lanzarote's coast.
The elliptical **"Tinajo Crater"** and **"Papagayo Crater"** in all probability were caused by oblique Impacts (secondary impacts) caused by the Permian-Triassic Impact Event (PTI)

This secondary impact event probably caused hotspots in the area which are responsible for the volcanism on this island.

On **sample site 61** there are pyroclastic basaltic rocks visible with a streamline-shaped (blast-like) structure orientated in a nearly horizontal direction.
This could be an indication for the Ejecta that was ejected by the **Ø 7 x 5 km Papagayo Crater**

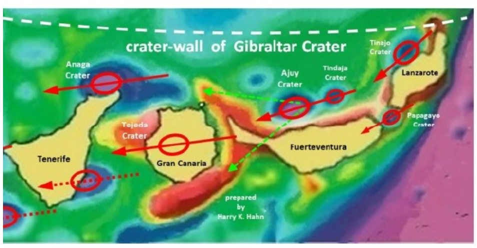
On **sample site 67** there is a massive crater-wall-shaped range which could be either the result of the hypothetical **Ø 12 x 9 km Tinajo Crater** itself, or it could be the result of a large shield volcano that grew on top of the impact crater after the impact event.
Shock-metamorphed minerals to confirm the hypothetical impact event may only be accesible with the help of drill-core sample staken from the center-areas of the negative gravity anomalies.



The old Massif on the **site 65** :

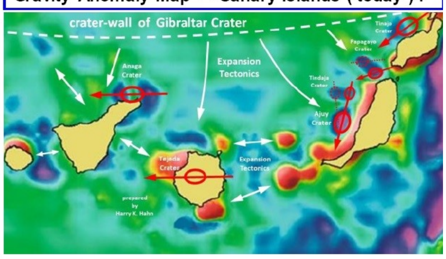
→ Islands locations **shortly after** the **PTI** - impact event :

manipulated Gravity Anomaly Map :

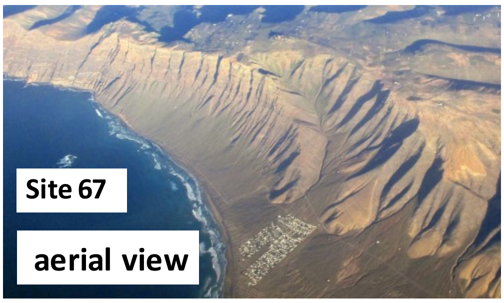


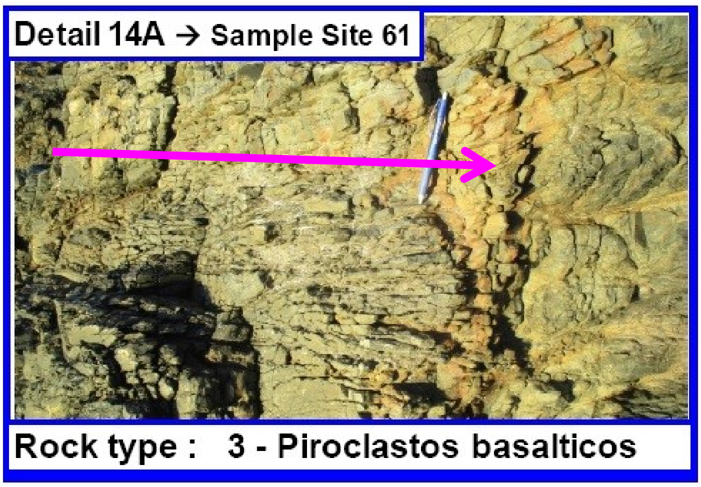
→ original Gravity Anomaly Map :

Gravity Anomaly Map – Canary Islands (today) :



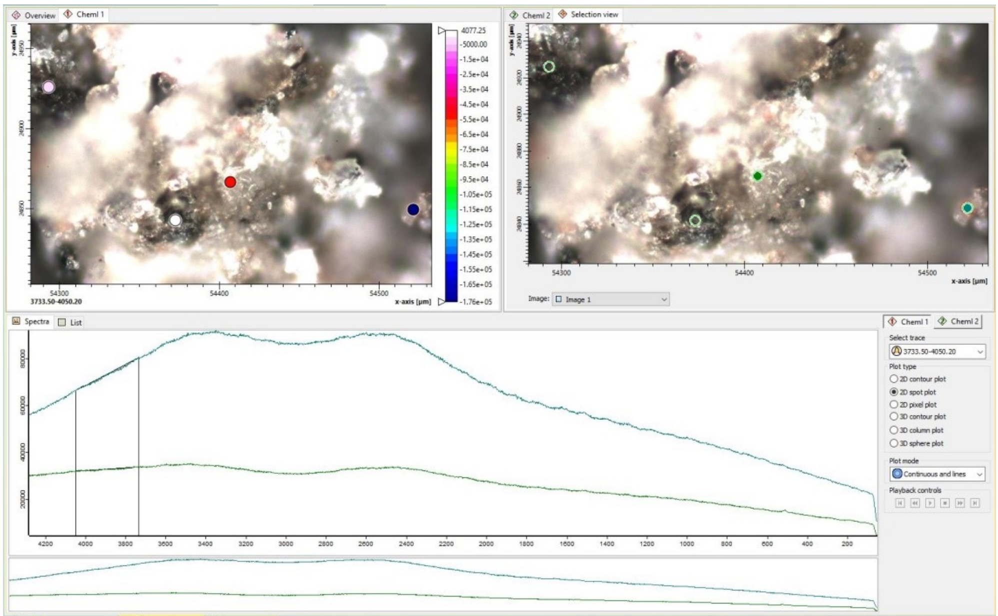
Note the structure of this range on **site 67 :** (craterwall-like structure)



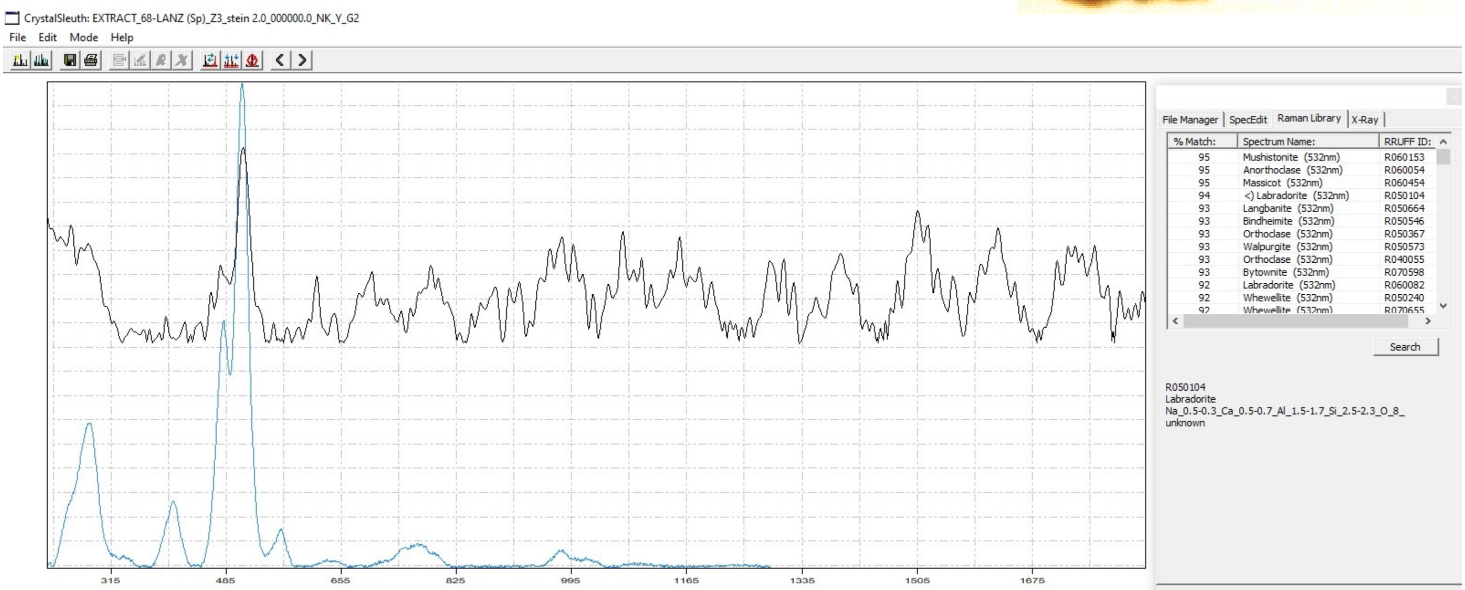


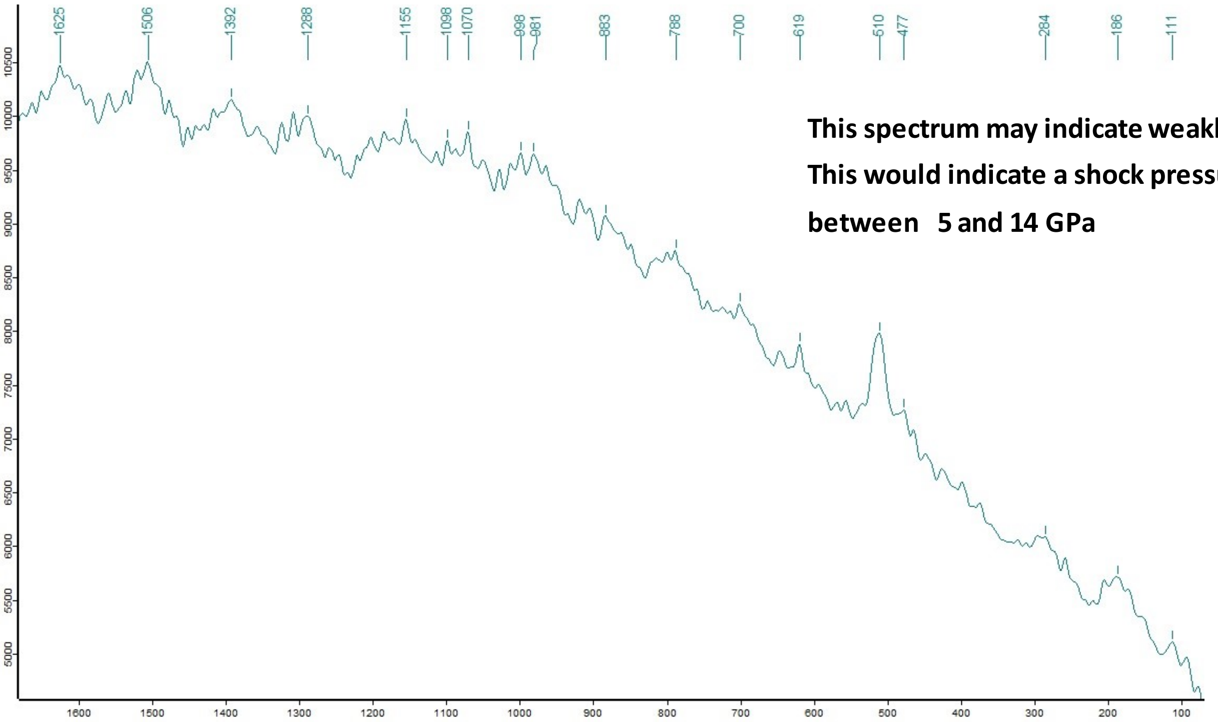
Pyroclastic basaltic rocks on **site 61**
Note the nearly horizontal orientated structure of these pyroclastic basaltic rocks

Sample Site 68 : Stone 2_spectra 1 indicates : Labradorite (→ see RRUFF_CS results)



Sample :



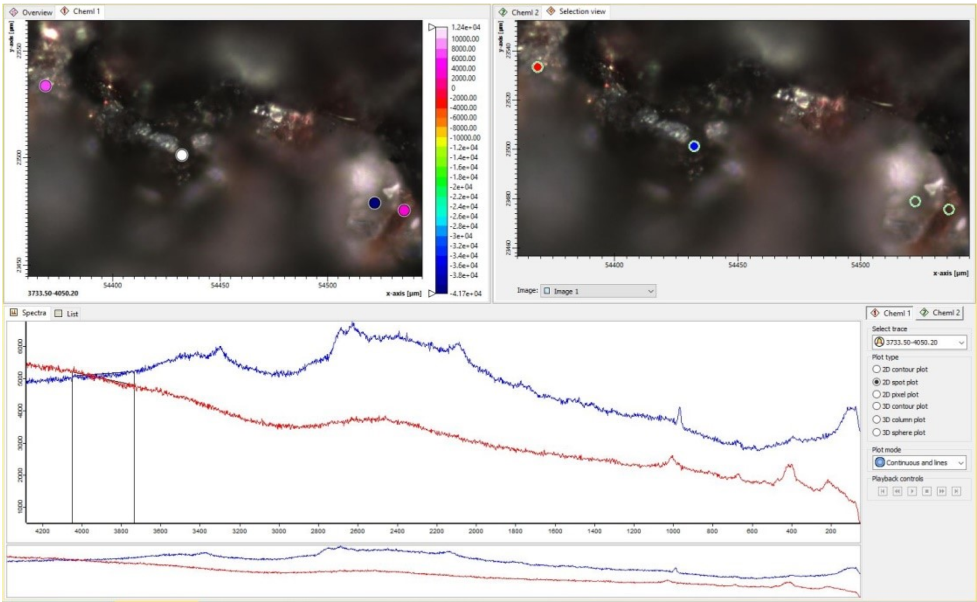


This spectrum may indicate weakly shocked feldspar

This would indicate a shock pressure

between 5 and 14 GPa

Sample Site 65 : Stone 1_spectra 1 indicates : Apatite-(CaF) (→ see RRUFF_CS results)



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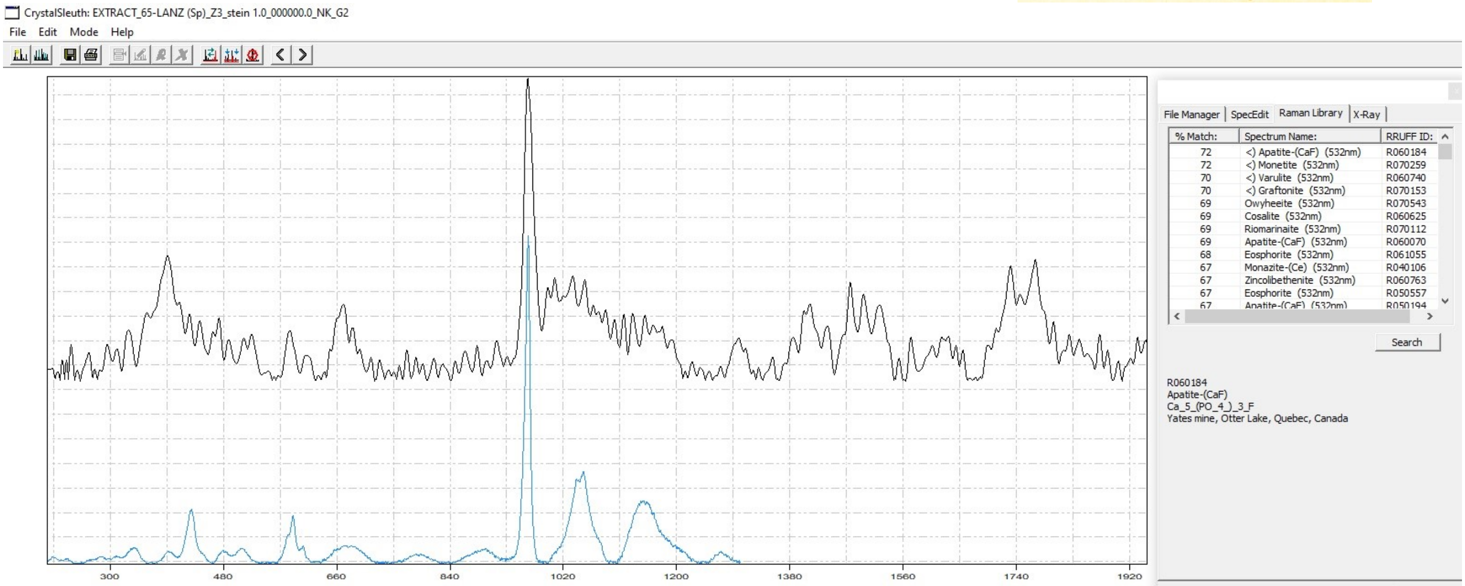
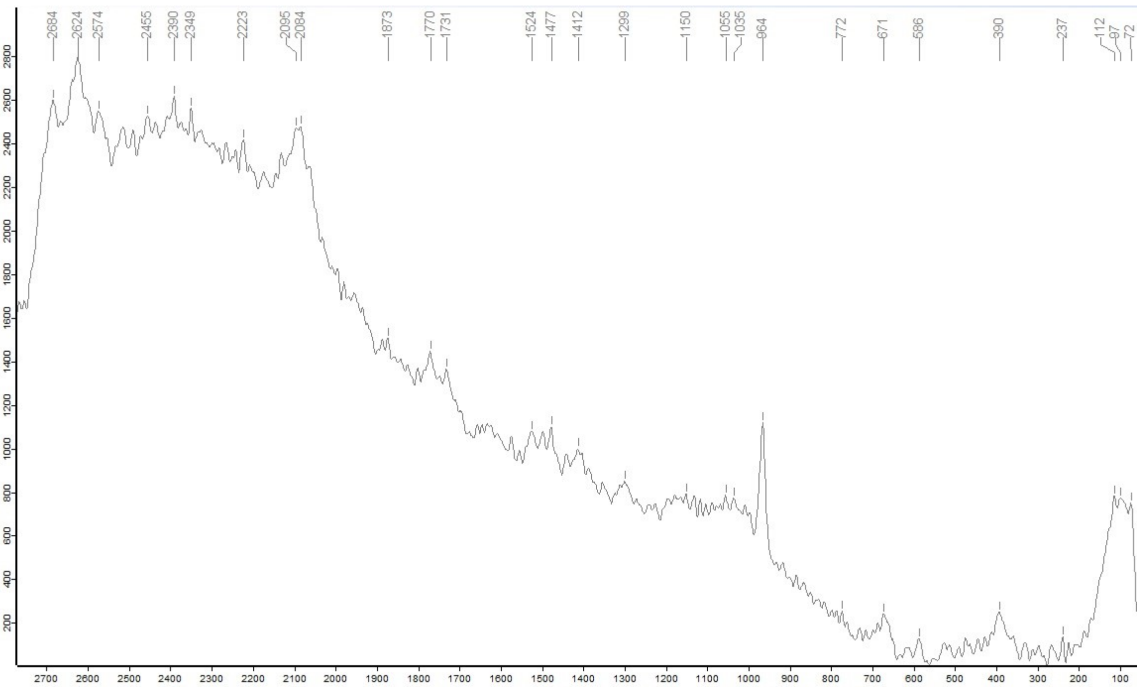
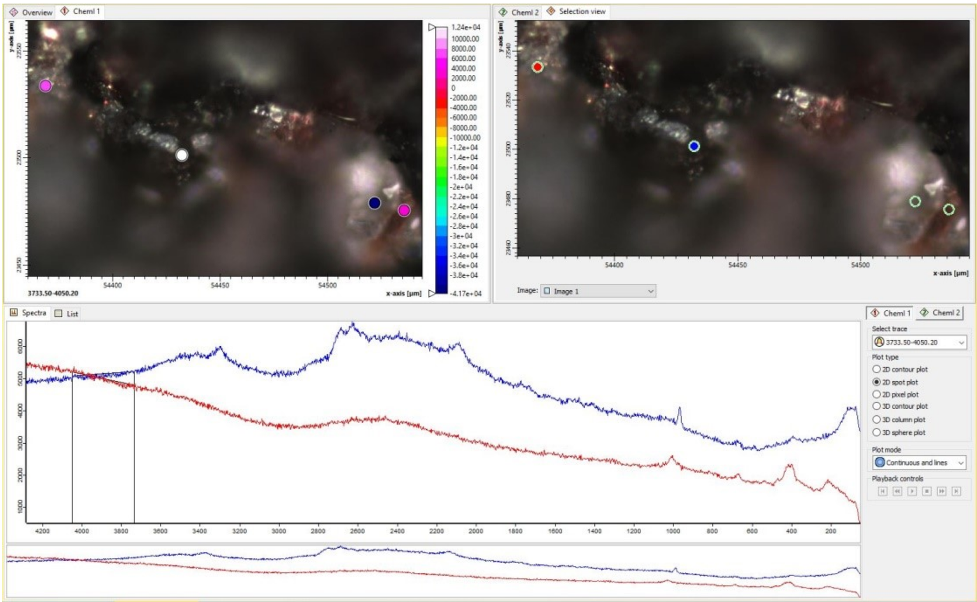
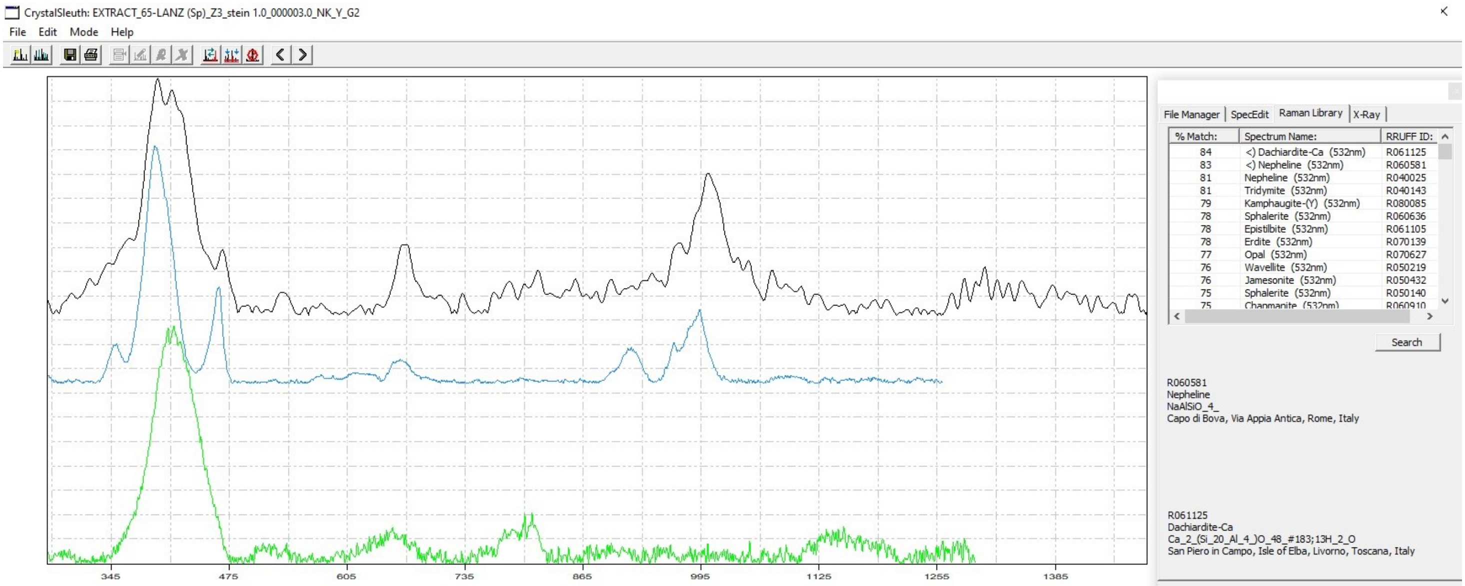


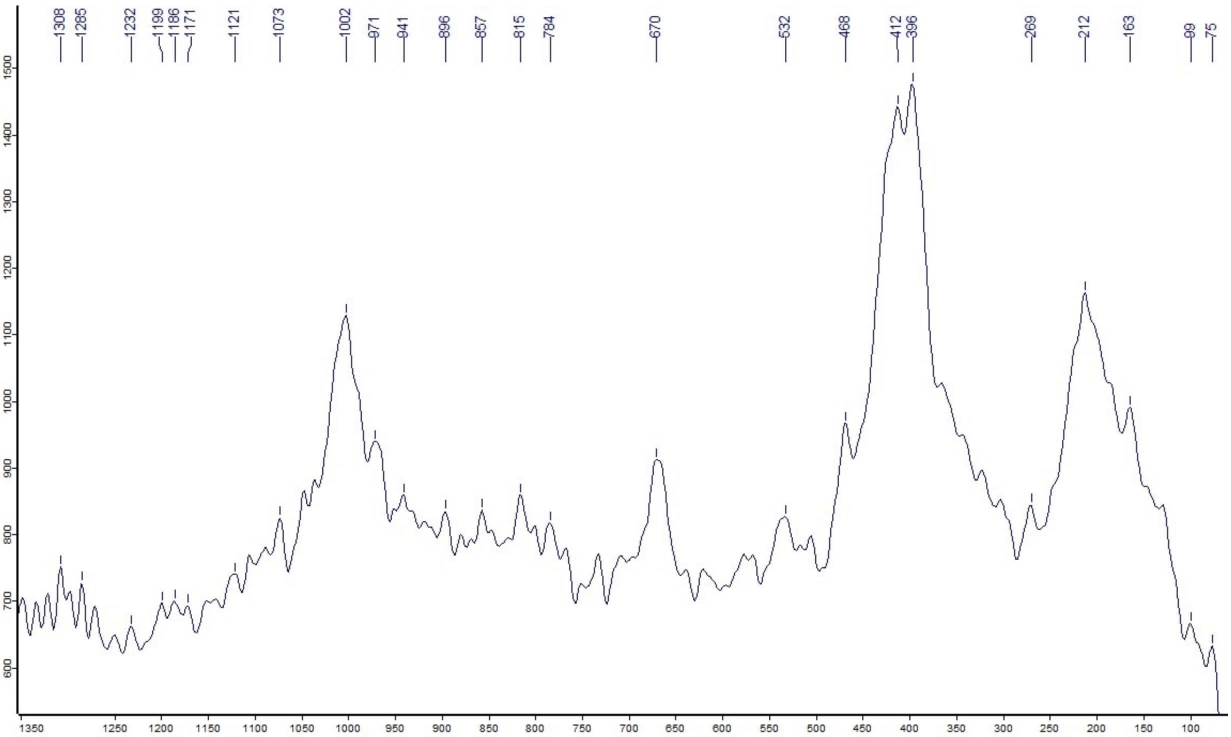


Sample Site 65 : Stone 1_spectra 2 indicates : Nepheline, Dachiardite-Ca (→ see RRUFF_CS results)

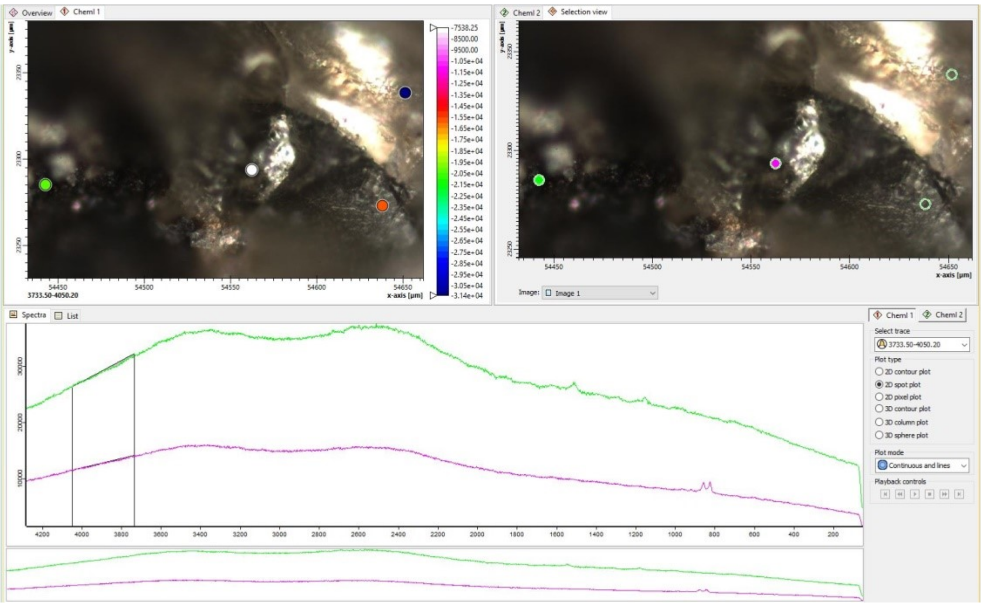


Sample :





Sample Site 65 : Stone 2_spectra 1 indicates : Forsterite (→ see RRUFF_CS results)



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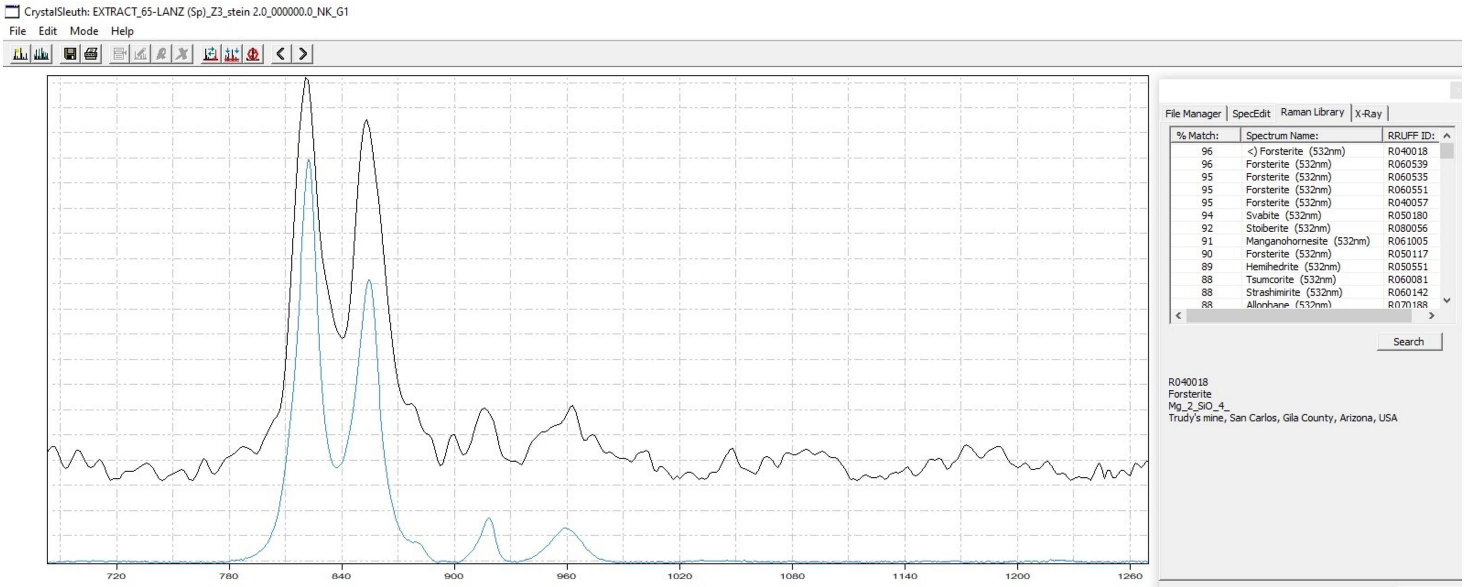
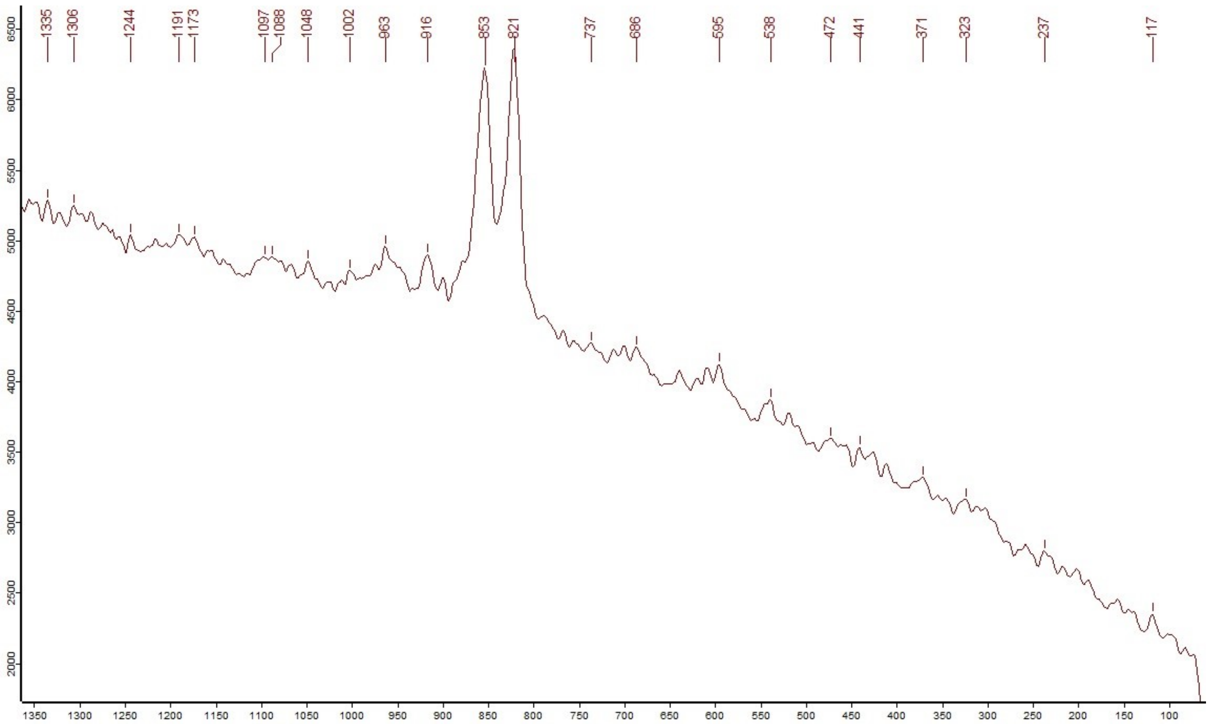
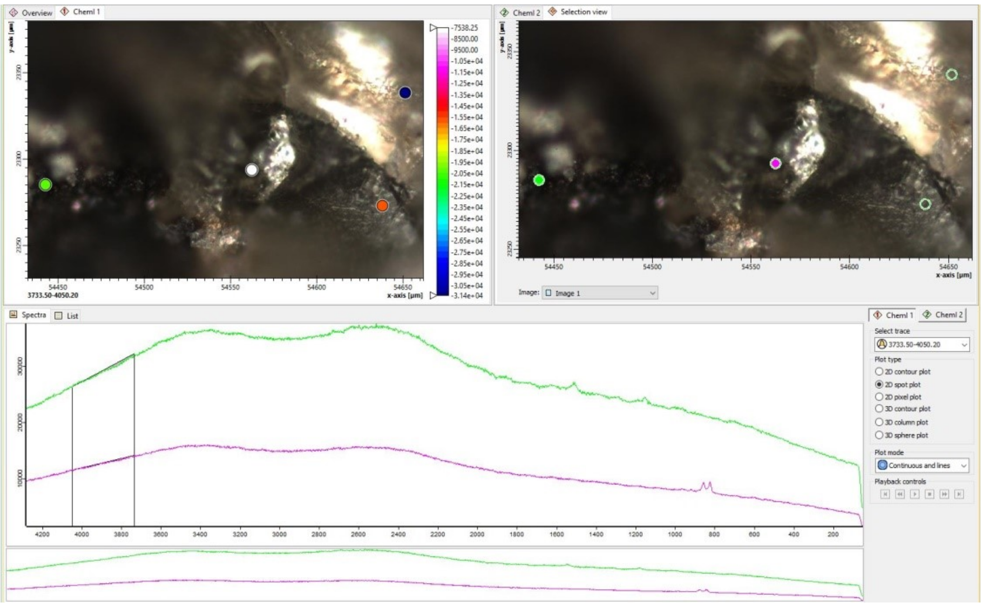




Sample Site 65 : Stone 2_spectra 2 indicates : Reyerite (→ see RRUFF_CS results)



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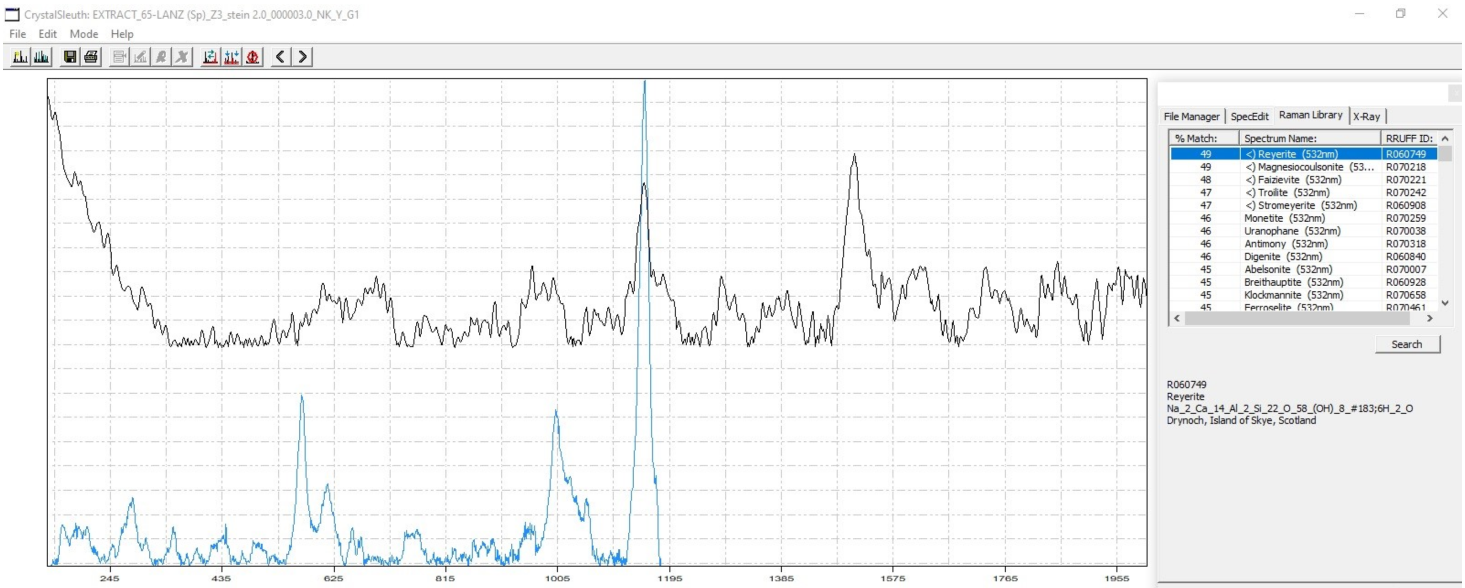
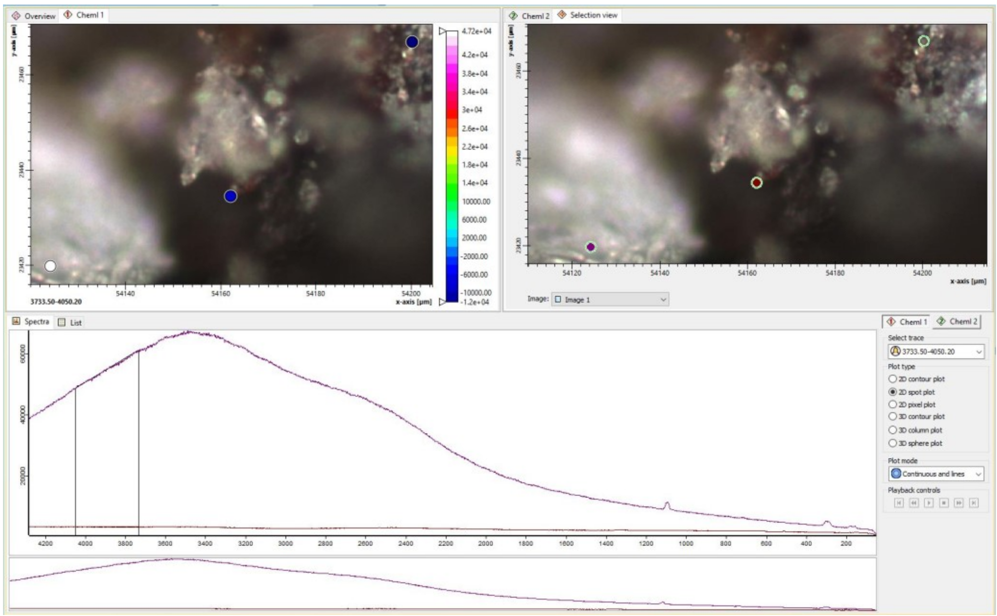


Sample Site 61 : Stone 1_spectra 1 indicates : Dolomite, Rosasite (→ see RRUFF_CS results)



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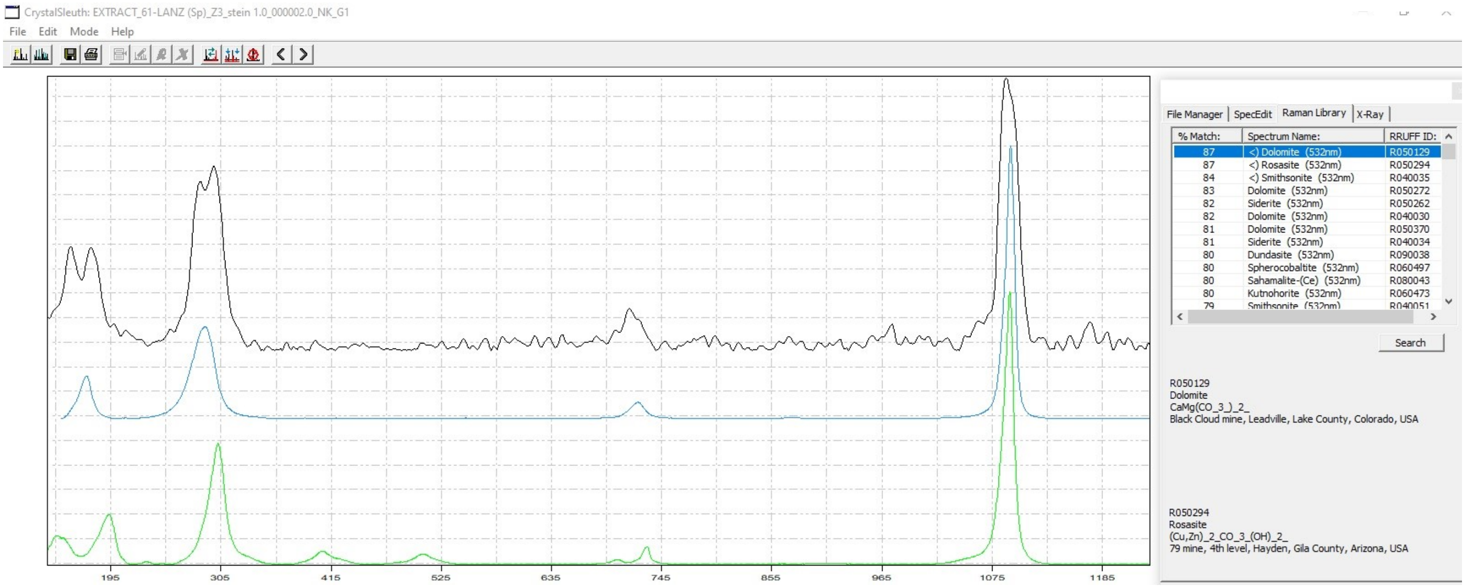
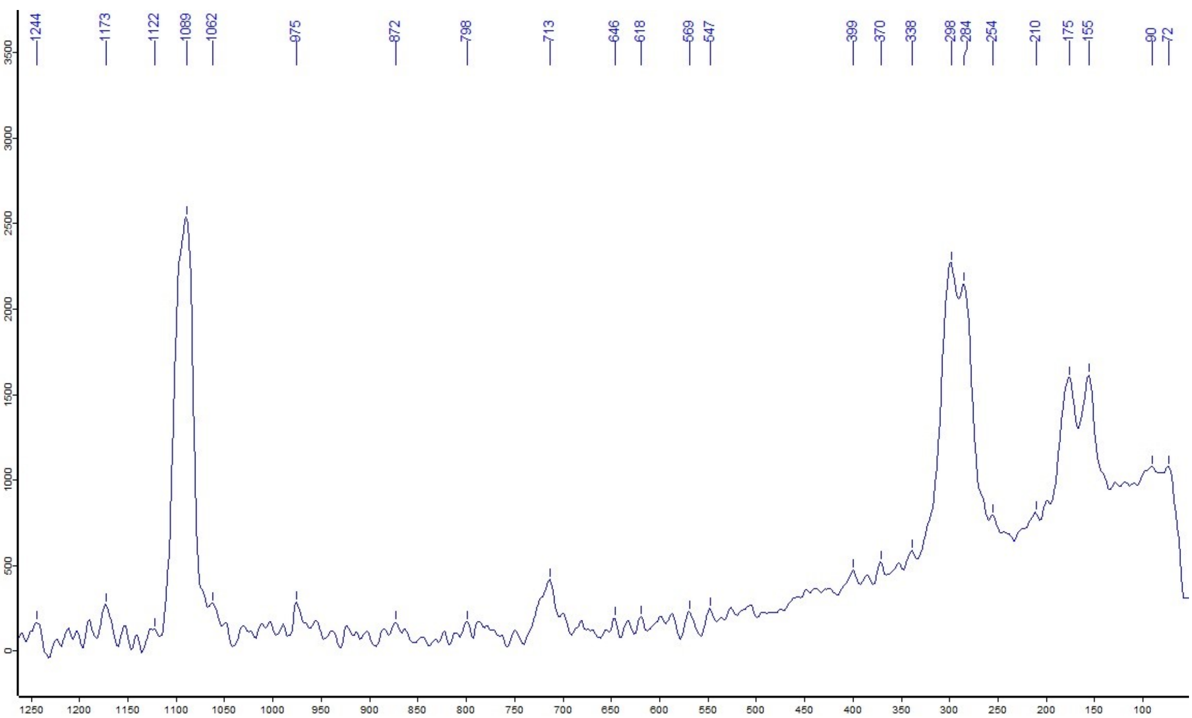
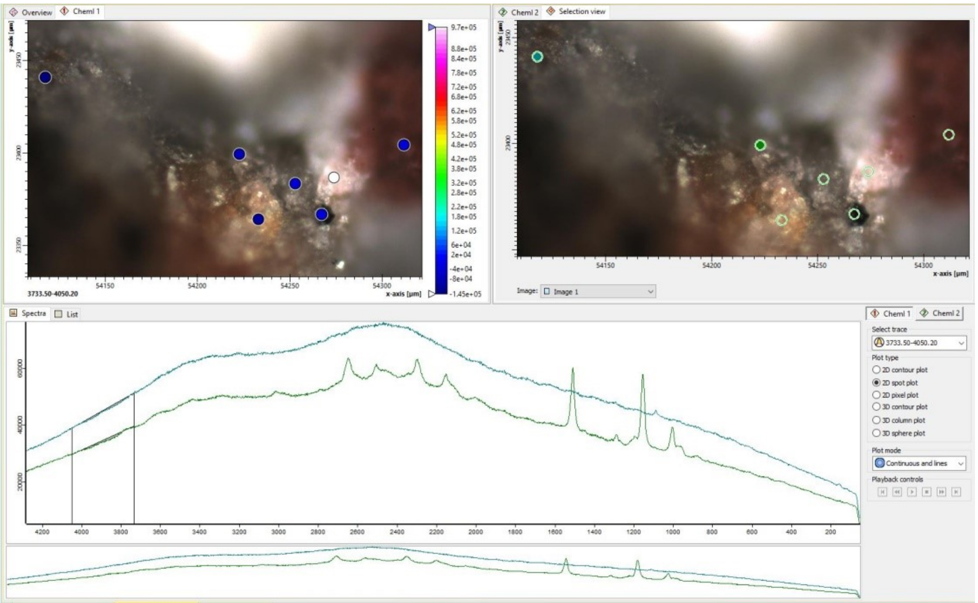




Sample Site 61 : Stone 2_spectra 1 indicates : Reyerite (→ see RRUFF_CS results)



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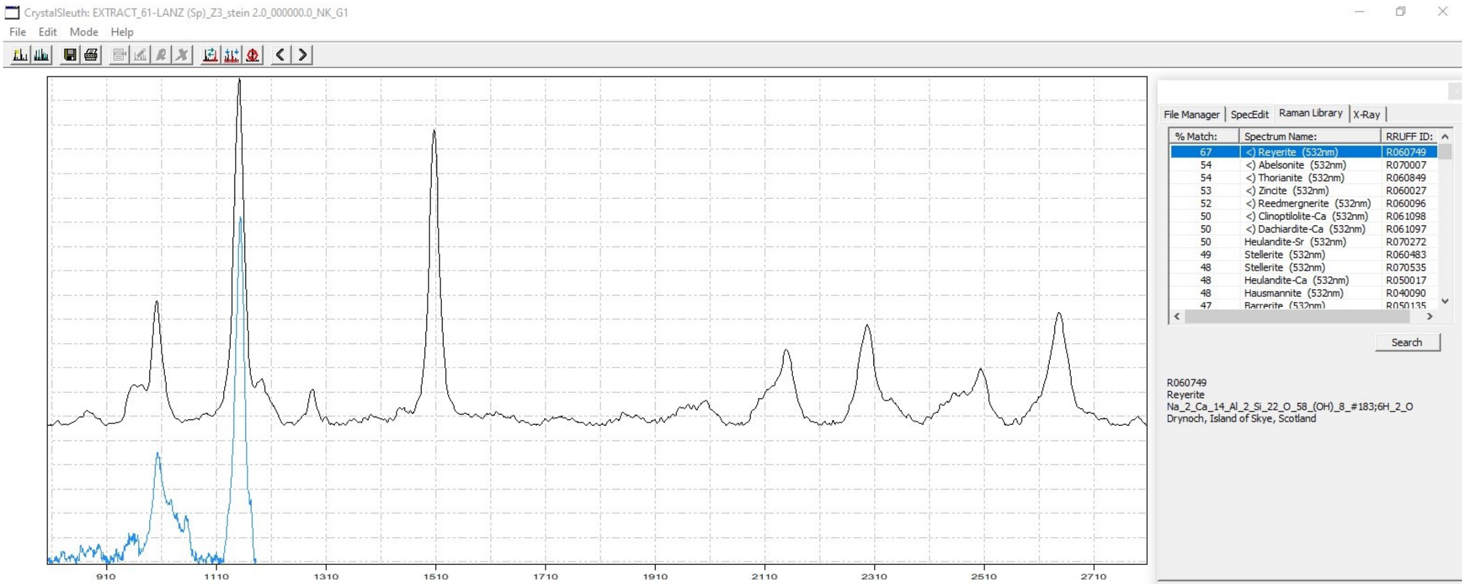
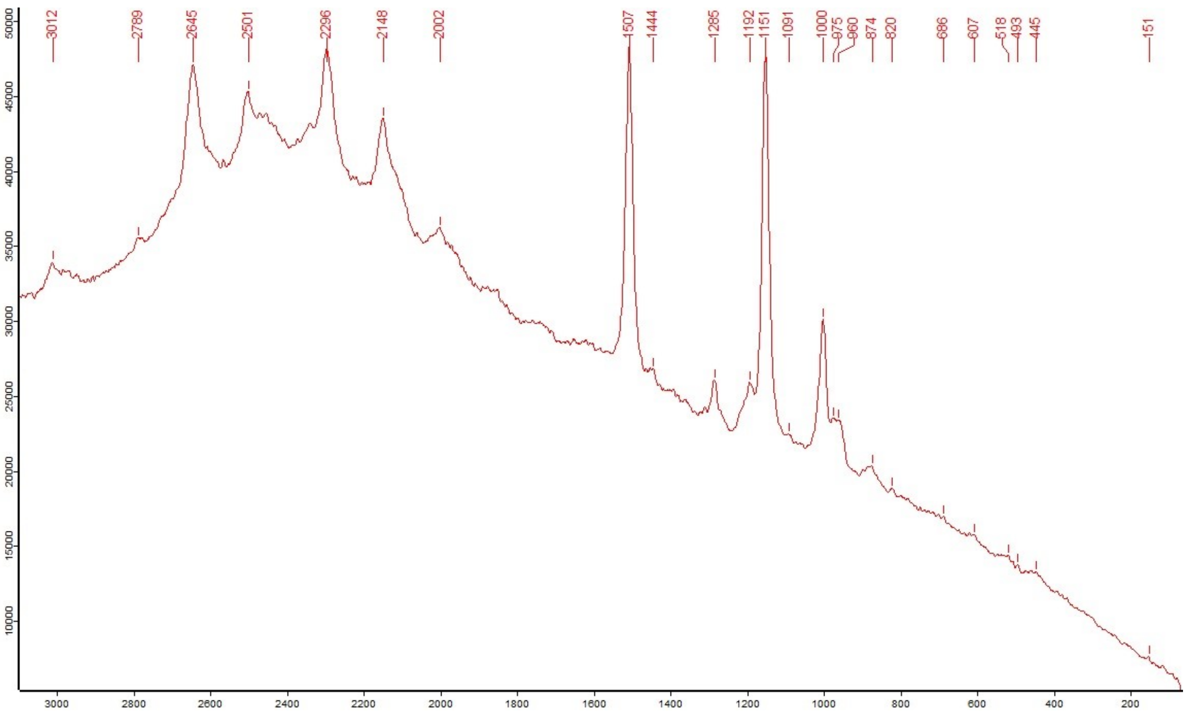
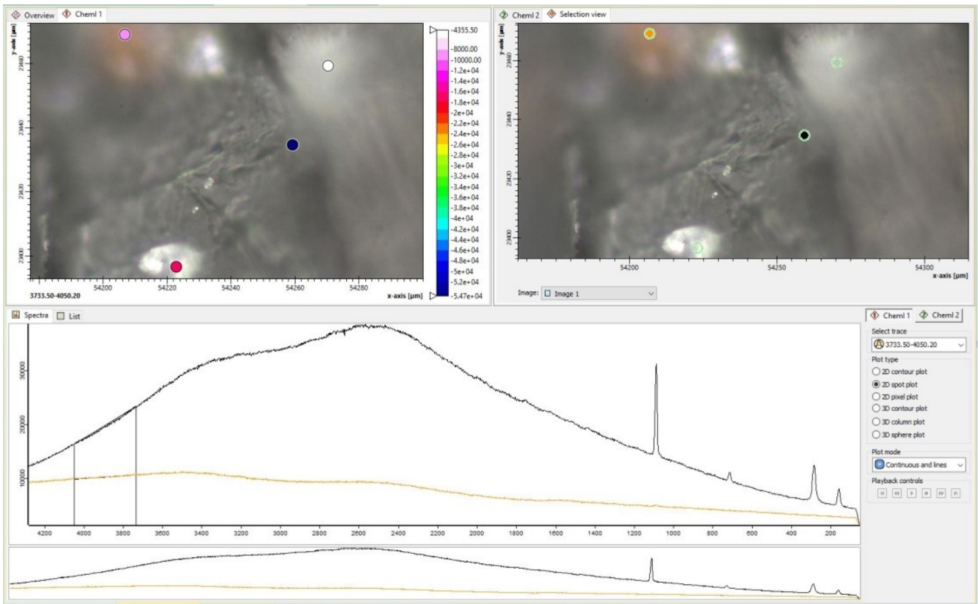
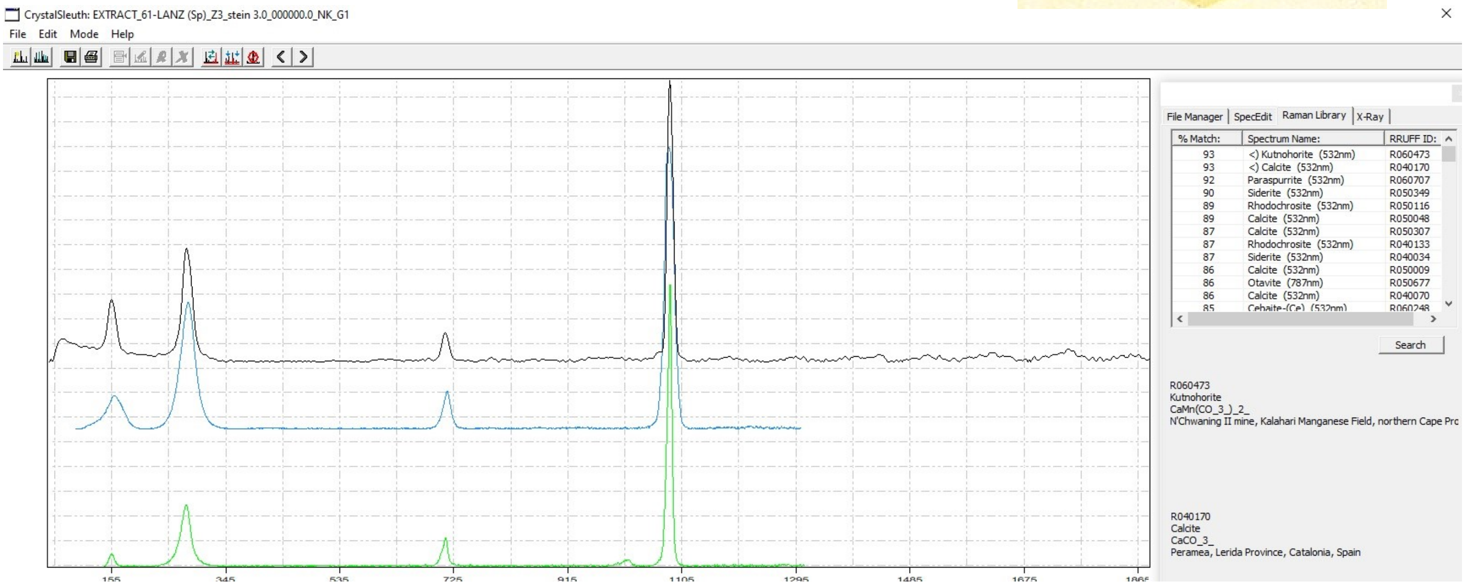


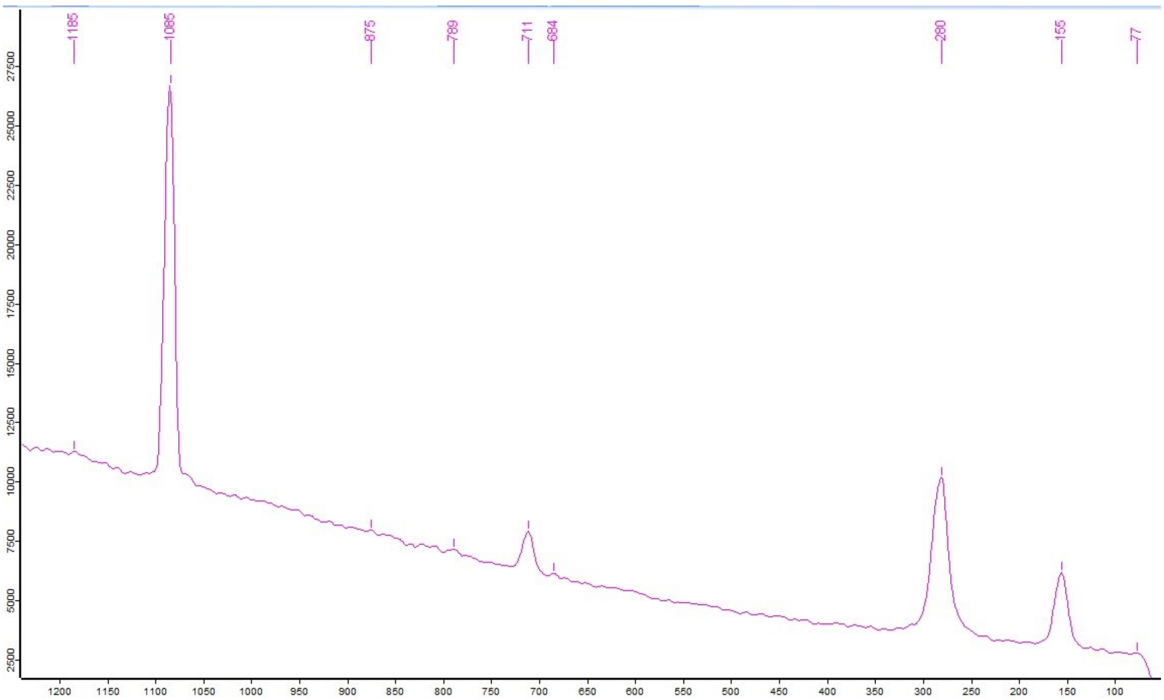


Sample Site 61 : Stone 3_spectra 1 indicates : Kutnohorite, Calcite (→ see RRUFF_CS results)



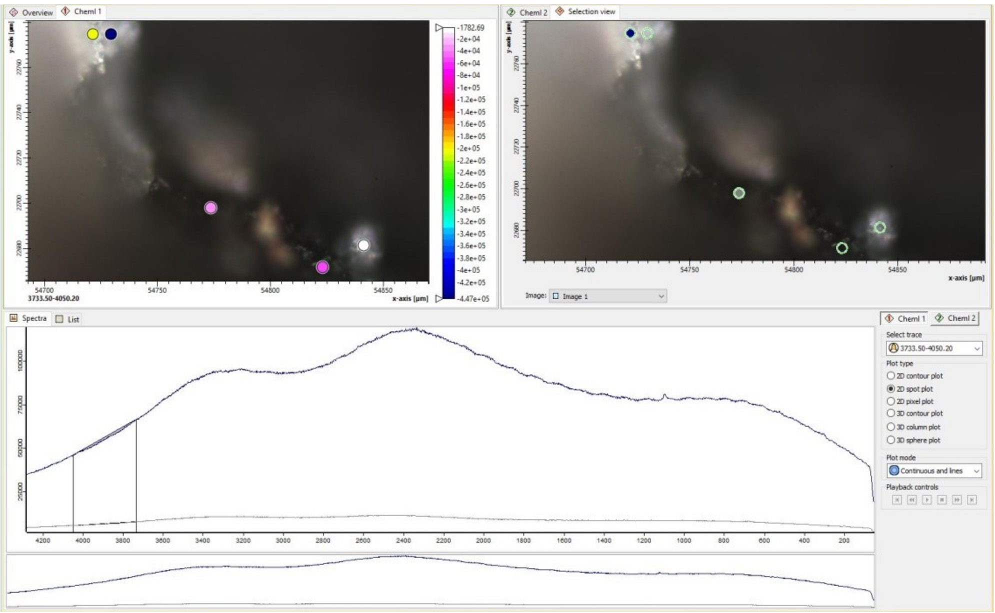
Sample :





Sample Site 66 : Stone 2_spectra 1 indicates : (Rynersonite) (→ see RRUFF_CS results)

This result is guesswork because the spectra contains less information !



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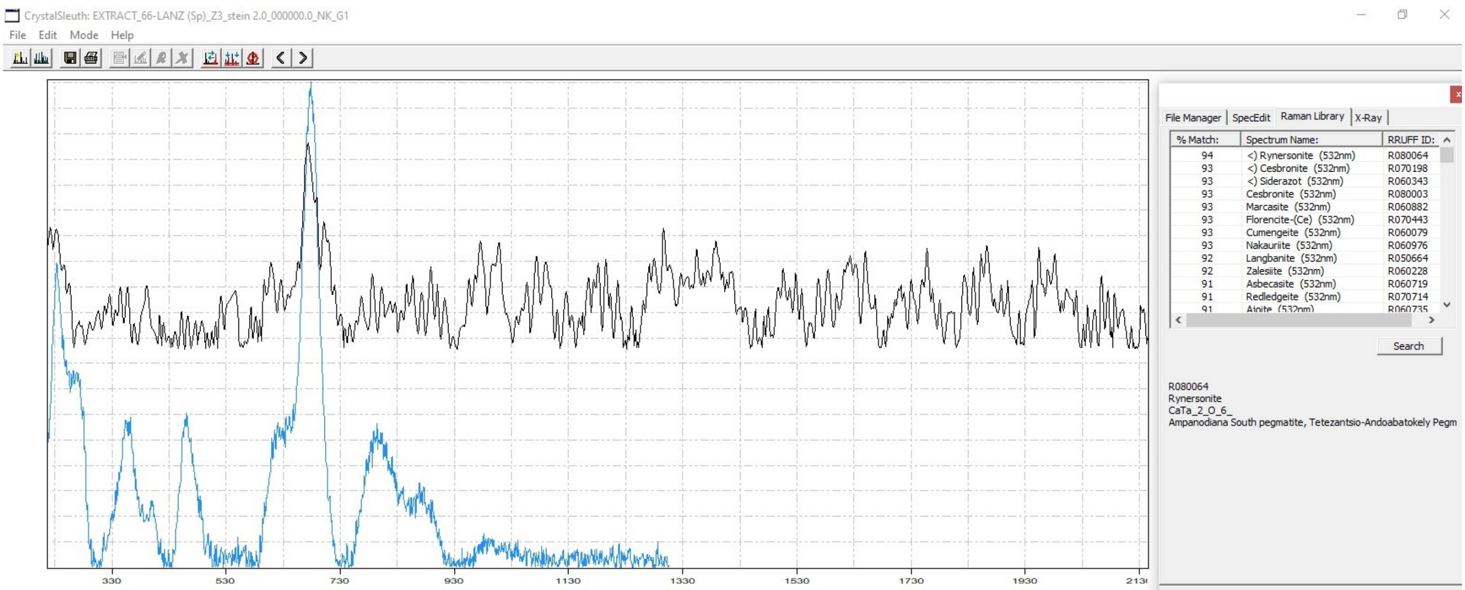
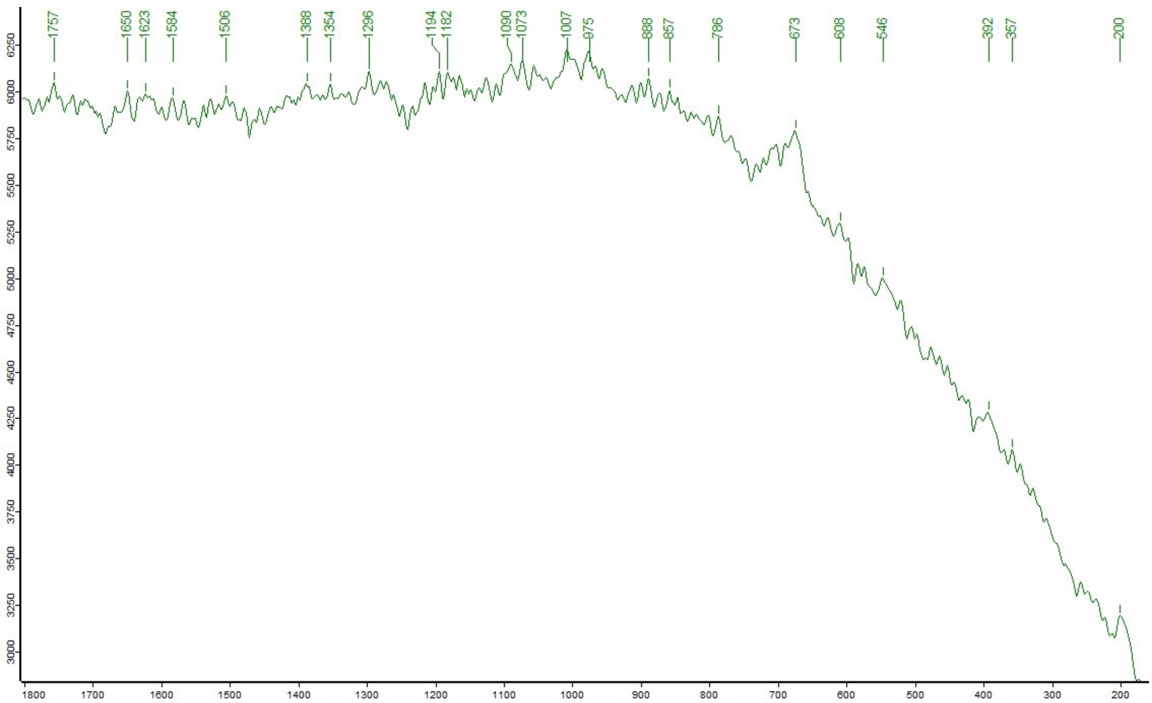




Appendix 1 : Photos of the rock samples from the sites : 61, 65, 67 and 68

→ See next page

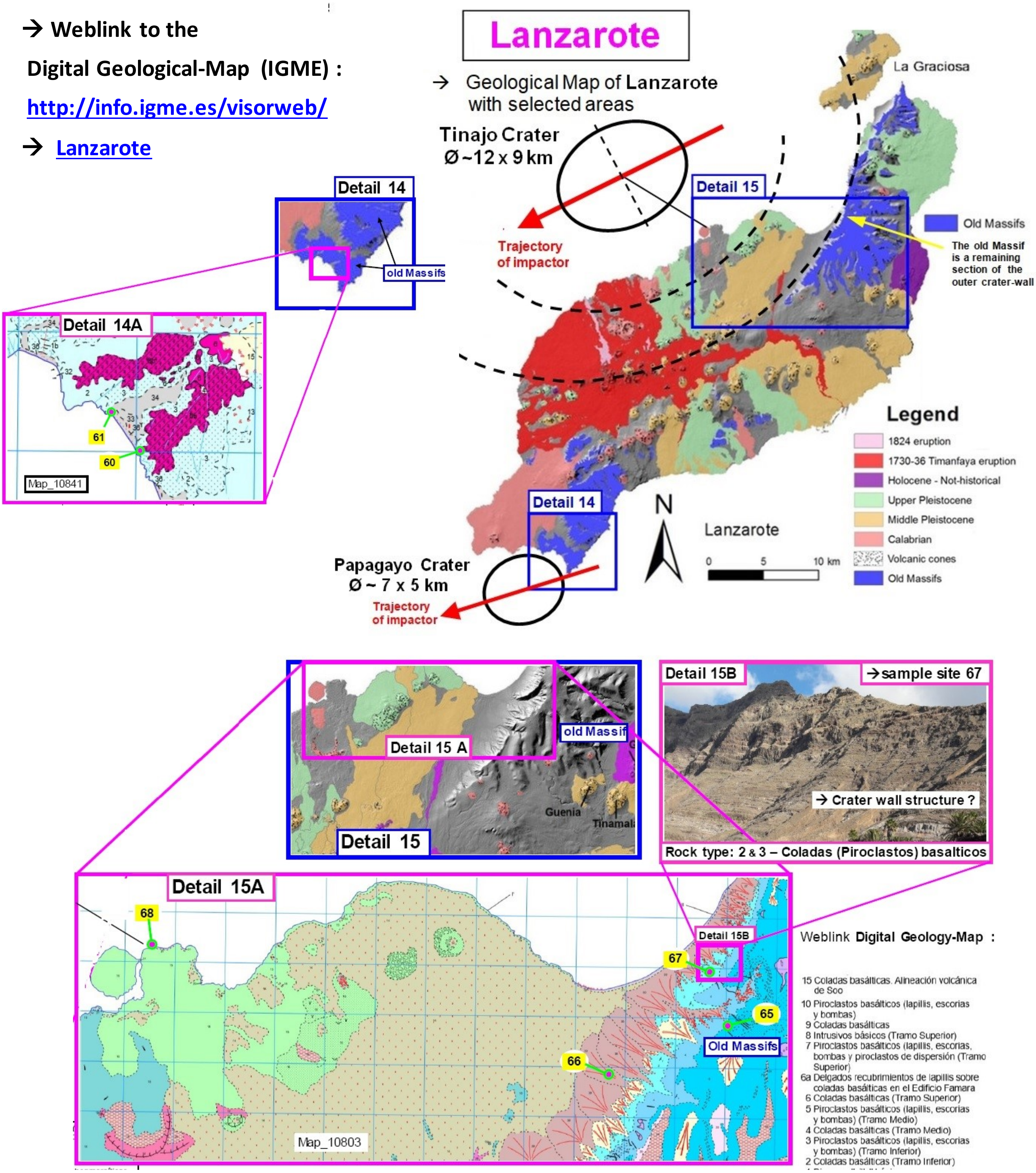
Note : Photos of the Sites 61, 65, 67 and 68 and other sample sites are available on my website. → : Sample Sites "Tinajo Crater" (or here) together with geological maps and a GPS-Data List of the sample sites.

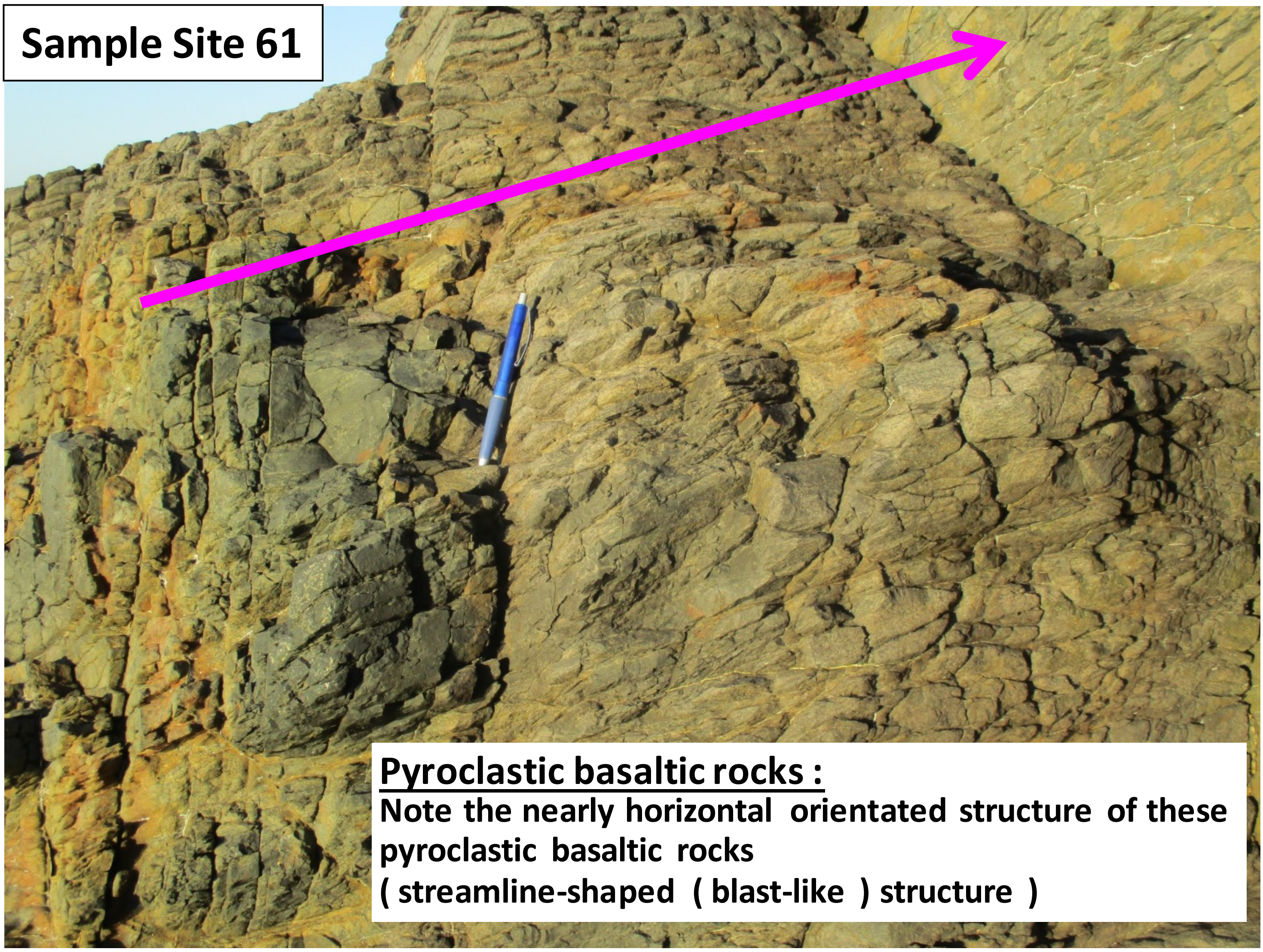
Geological maps of selected sample areas :

→ Weblink to the Digital Geological-Map (IGME) :

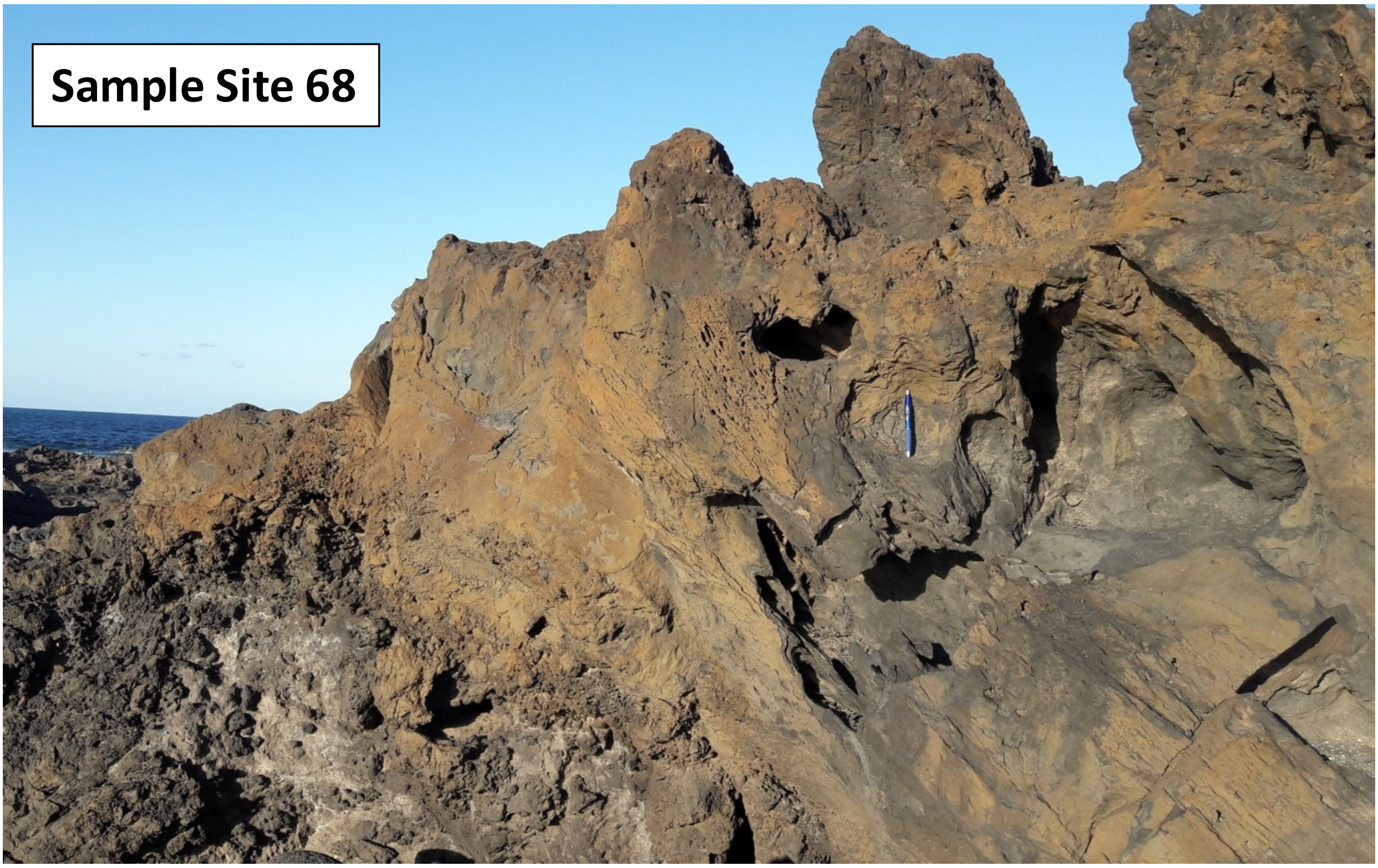
http://info.igme.es/visorweb/

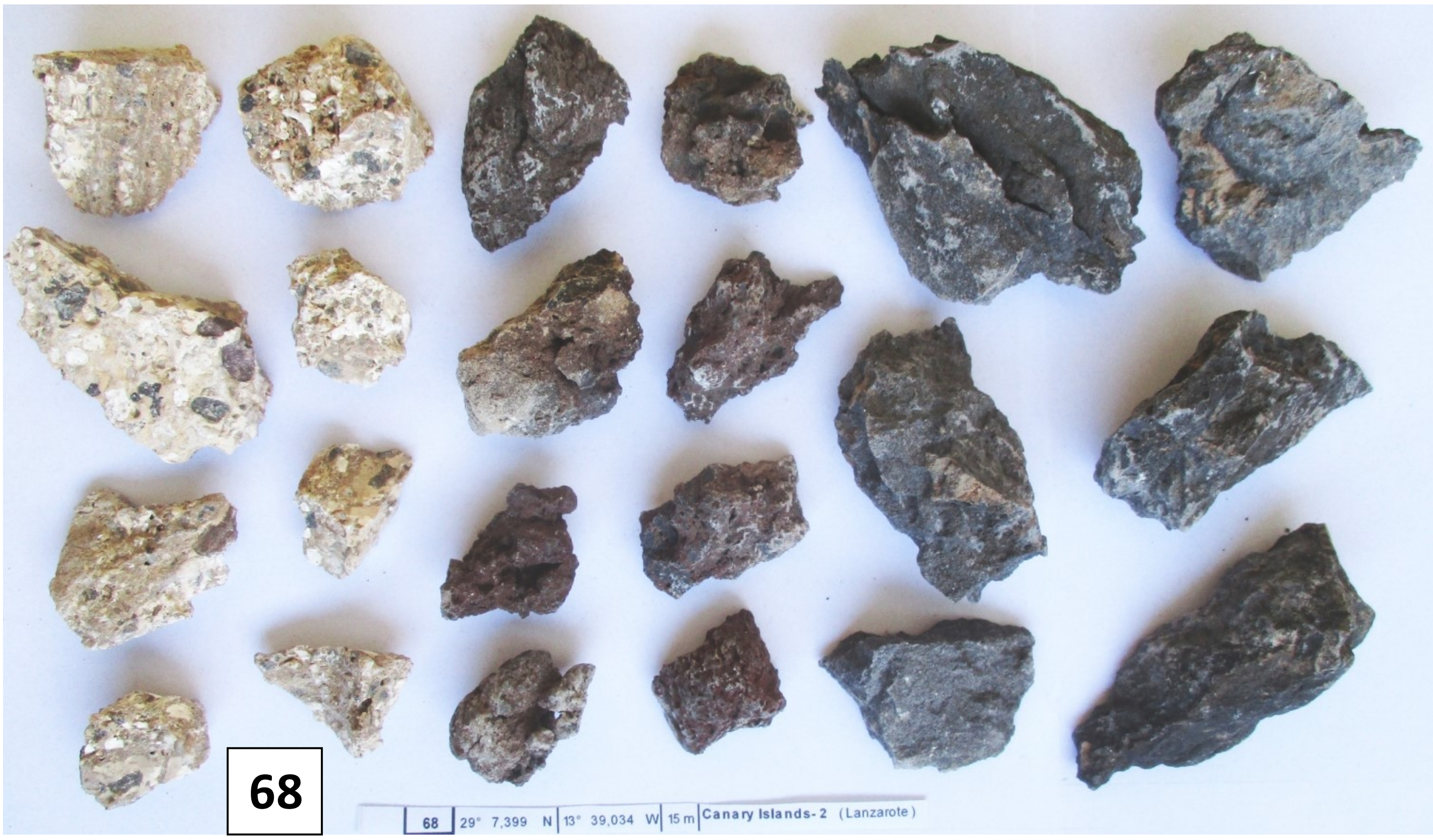
→ Lanzarote




Sample Site 61
Pyroclastic basaltic rocks :
Note the nearly horizontal orientated structure of these pyroclastic basaltic rocks
(streamline-shaped (blast-like) structure)

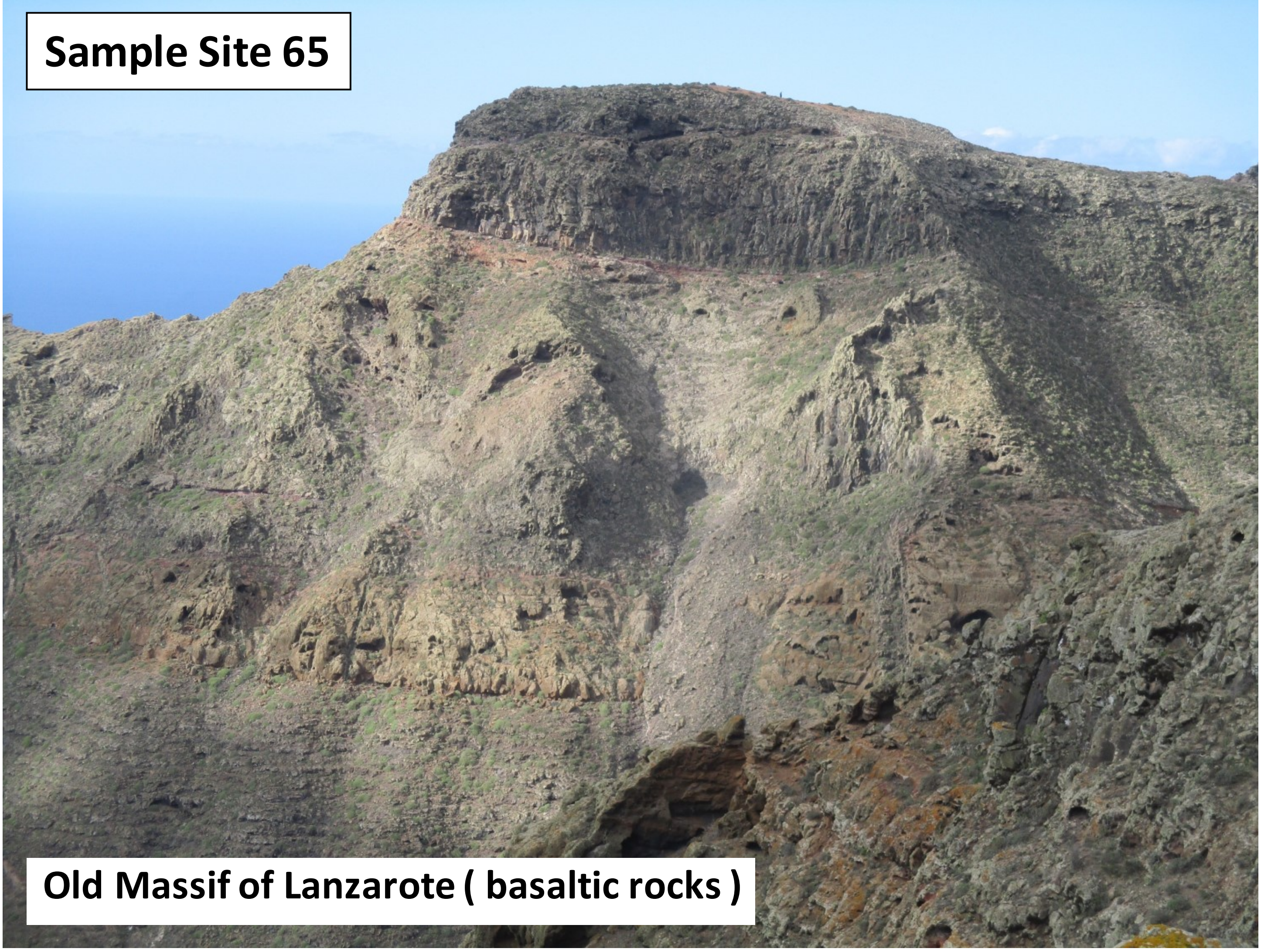

61
61 | 28° 51,342 N | 13° 47,600 W | 10 m | Canary Islands- 2 (Lanzarote)

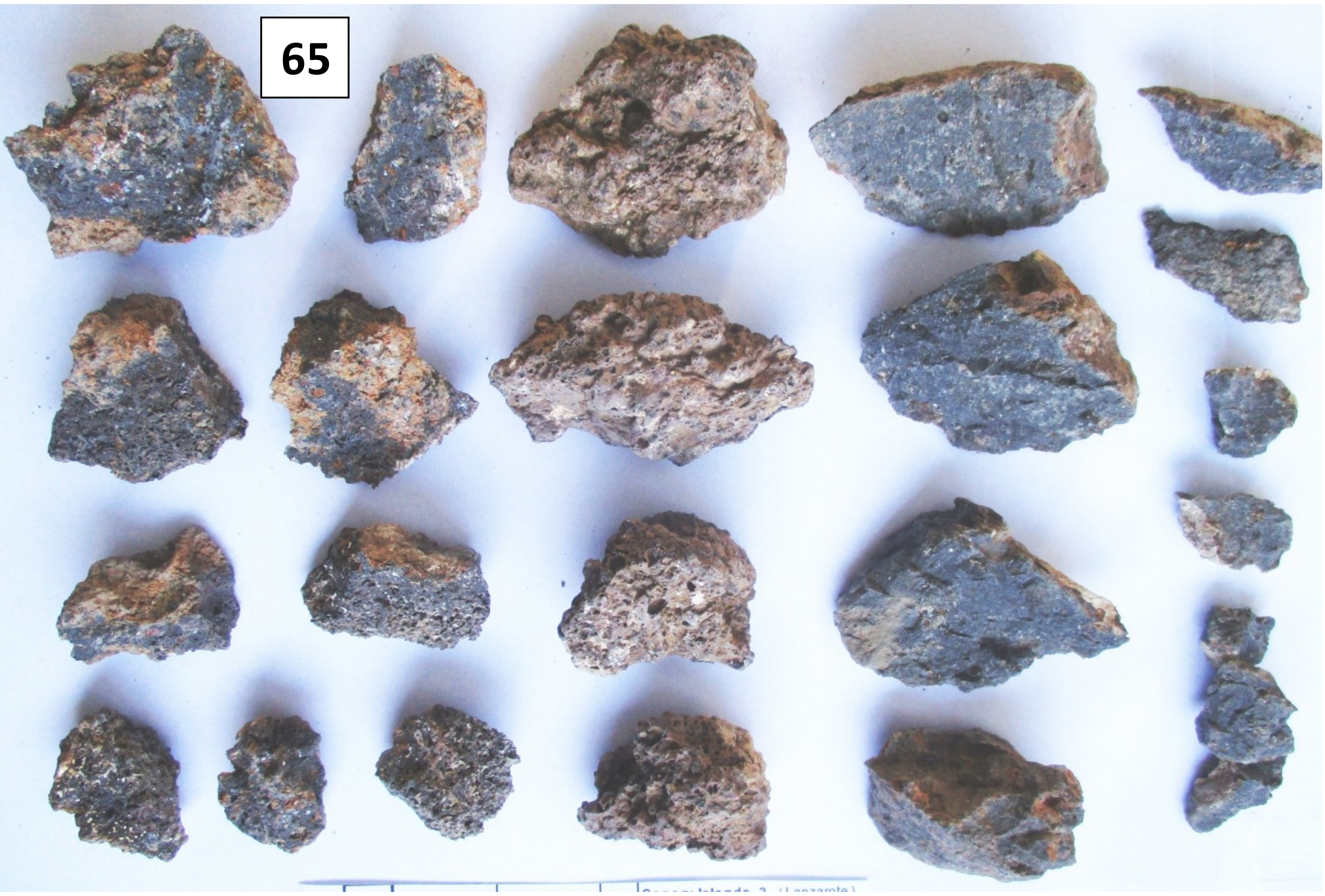

Sample Site 68


68
68 29° 7,399 N 13° 39,034 W 15 m Canary Islands- 2 (Lanzarote)

- Note the structure of this wall
(craterwall-like structure)

No analysis made of these rocks


Sample Site 65
Old Massif of Lanzarote (basaltic rocks)


65

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

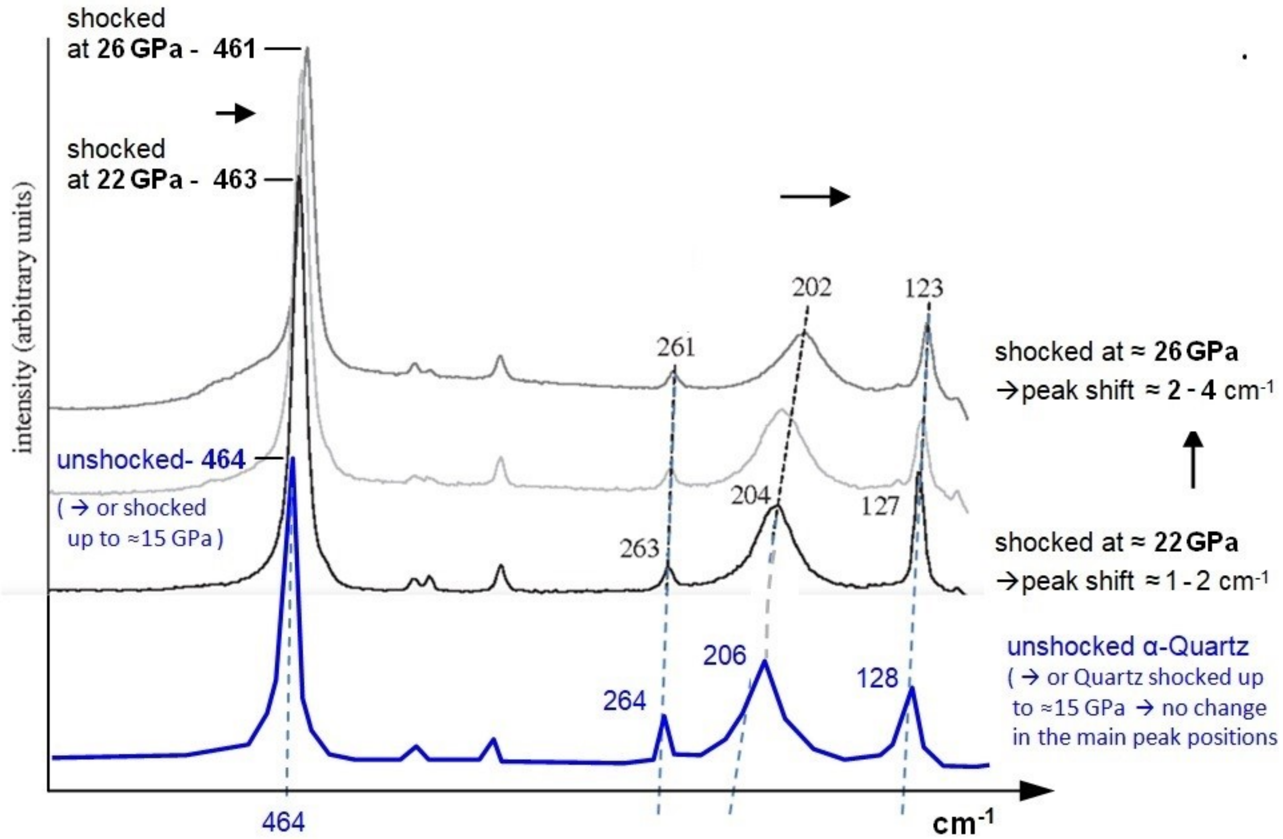
In order to verify a sample site as an impact site or impact structure, shock-metamorphic effects must be discovered in the rocks of the sample site. This can be done by different methods.

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

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

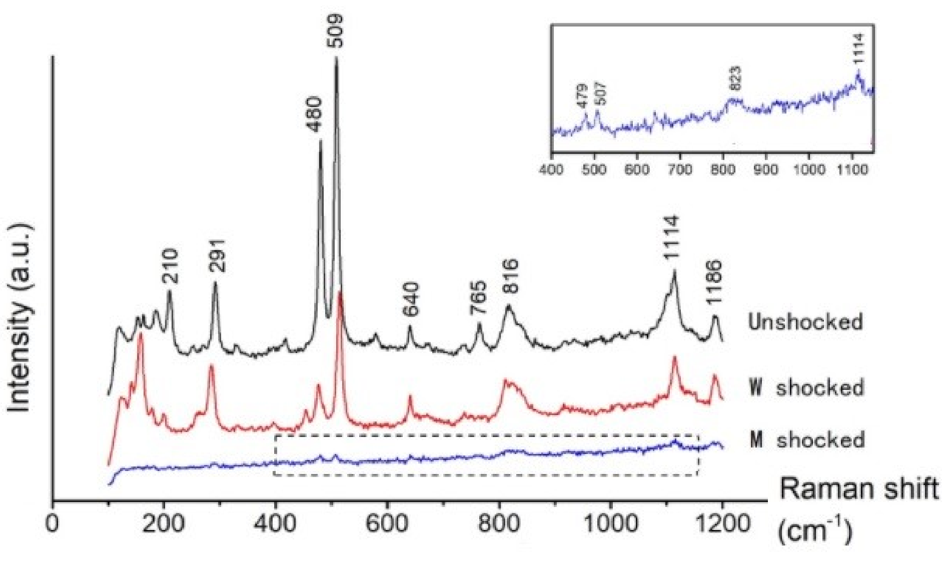
Mc Millan et al. (1992) and others have shown that the main RAMAN-peaks of Quartz shift towards lower frequencies if the Quartz was exposed the a shock-pressure > 15 GPa. → see diagram below

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



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

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



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

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

References :

Photos of all Sample Sites & Rock Samples are available on : Sample Sites "Tinajo Crater (Lanzarote)" (or here)

The following Impact-Craters & -structures belong to the same large-scale secondary impact event caused by the PTI :

The 130 x 110 km Bay-of-Lyon Impact Crater (France)_Raman spectra of selected Rock Samples (or here)

A 30 km Impact Structure and a 1.6 x 1.2 km Elliptical Crater in Southern Spain_Raman Spectra of Rock Samples (or here)

Weblinks to : Scientific Studies to the **Geology of** Fuerteventura & **the Canarian Islands** (→ on page 2 !) - (→ or here)

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
Stöffler - 2018 - Meteoritics & Planetary Science – Wiley: https://onlinelibrary.wiley.com/doi/epdf/10.1111/maps.12912

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