The Ø 1270 x 950 km Permian Triassic Impact Crater - Summary of the geophysical evidence

Please also read : **Part 1** to **Part 6** of my PT-Impact Hypothesis - more infos at : www.permiantriassic.de (or : www.permiantriassic.at)

by Harry K. Hahn / Germany - **26. September 2021** - **Note** : This document is not allowed for commercial use !

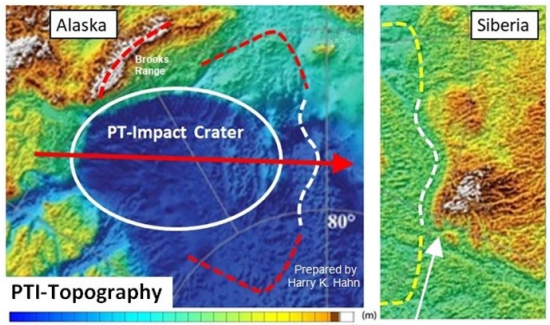
Abstract :

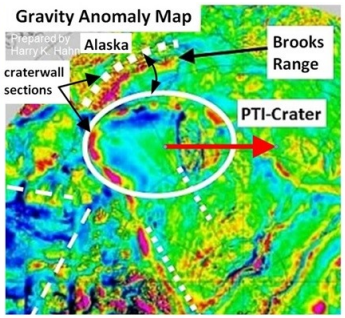
This is a summary of geophysical evidence for the Ø 1270 x 950 km Permian Triassic (PT)-Impact Crater which I have discovered and described in my hypothesis Part 1 to Part 6. A topographic map and a satellite image of the Arctic Ocean area, Alaska and Siberia provided the first indication for the PT-Impact Crater and –impact event. The similarities of structures visible on the topographic map to the structures calculated by a computer simulation of a shallow (oblique) impact with an impact angle of 5°, provide a strong indication for the existence of the Ø 1270 x 950 km PT-Impact Crater on the Arctic Ocean floor.
Especially the elliptical deep sea basin in the Arctic Ocean, the bow-shaped Brooks Range in Alaska and the northern edge of the Central Siberian Plateau (Siberian Traps), which has the same bow-wave- structure as the calculated structure, are strong indicators that the PT-Impact Crater was caused by a shallow impact of an asteroid or comet.

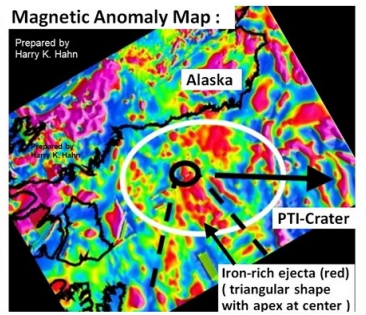
Further strong indication for the PT-Impact-Crater comes from a gravity anomaly map and from a magnetic anomaly map of the Arctic Ocean area and Alaska. The gravity anomaly map clearly shows sections of the elliptical crater-wall of the PT-Impact Crater (positive anomalies) . The Brooks Range in Alaska, which originally was part of the elliptical crater structure, is also indicated by a positive anomaly on the map. But this former section of the elliptical crater-wall drifted away from the PT-Crater, caused by forces of the massive amounts of ejecta material that was ejected from the crater, which probably was in the range of 100.000.000 to 200.000.000 km^3 of ejecta material ! The majority of the crater floor is visible as a negative anomaly (blue) on the map. The magnetic anomaly map of the Arctic Ocean area shows a triangular-shaped positive anomaly (red), which originates from the crater center. This indicates ejecta that was coming from an iron-rich impactor.

The big distance between the elliptical impact basin and the described bow-wave-shaped structure in Siberia, which originally was located directly at the front-end of the PT-Crater, is the result of a divergent tectonic motion and expansion tectonics process that was triggered by the shallow PT-impact. The leading edges (front edges) of the two gigantic ejecta wings which were caused by the PT-Impact, cut through Earth's crust and massive amounts of ejecta material and impactor material (e.g. iron) descended into Earth's mantle and caused the Pacific-LLSVP and the African-LLSVP. All volcanos of the Pacific Fire Ring and all volcanism on Earth can be explained solely by the PT-Impact !

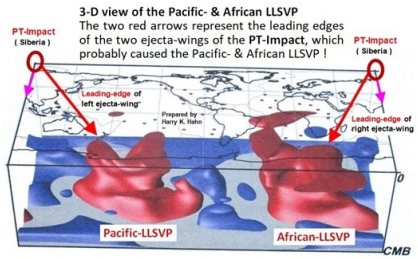
I also present six possible secondary craters of the PT-Impact Event in Europe & Australia and Raman spectroscopic analyses which provide proof for the PT-Impact (see: **Part 6** (**P6**)) Raman spectroscopic analyses results and images of Rock Samples & Sample Sites are also available on my website : www.permiantriassic.de (or : www.permiantriassic.at)

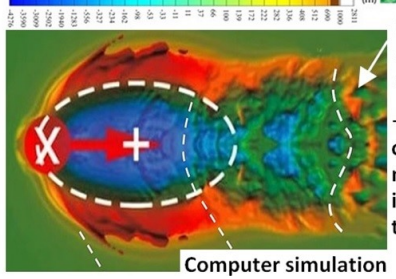






Because of the expansion tectonics process that is obviously going on in Earth's mantle since the PT-Impact, a revised model for Earth's mantle is required, which must consider a mantle that is probably consisting of a mixture of silicate minerals and high-pressure Ice, e.g. **Ice X** & **Ice XI** with a high density ≥ 3, which goes through a phase change because of the hot LLSVP-areas, towards a lower density, and is expanding Earth's mantle in this process ! Note : The water of Earth's oceans originates in Earth's mantle, and the PT-Impact has increased the release of super-heated salty "mantle-water" into the oceans along the mid-ocean ridges.



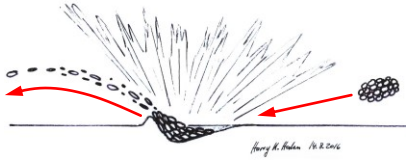


The elliptical deep sea basin in the Arctic Sea, the bow-shaped Brooks Range in Alaska and the northern edge of the Central Siberian Plateau, which has the same bow-wave- structure as the simulated structure, are strong indicators for the PT-Crater.

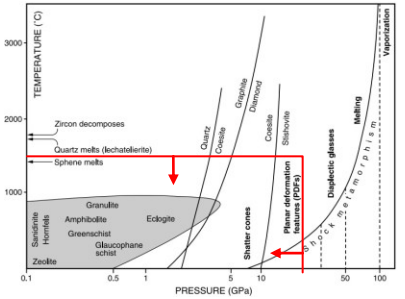
Contents :

Geophysical proof of the Ø 1270 x 950 km Permian Triassic Crater and summary of the mineralogical evidence

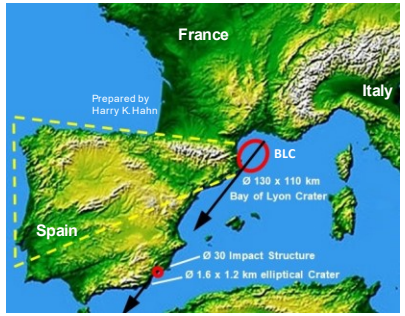
by Harry K. Hahn / Germany - 22.7.2021 - more info at: **www.permiantriassic.de** or at: **Part 6** (**P6**) of my **PTI-hypothesis**



The PT-Impact Crater was formed by a very shallow impact with low shock pressures

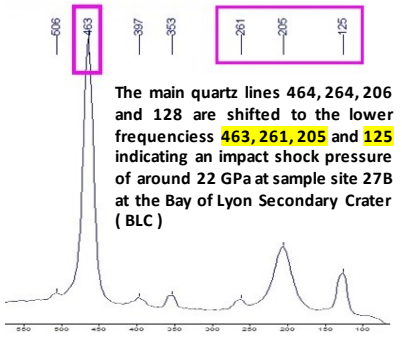


Shock metamorphic effects in PTI-ejecta → red marked box (shock metamorphism diagram)



This map shows the three most interesting PT-Secondary Craters for further research in Europe, according to my analysis.
The Ø130x110 km "Bay of Lyon Crater", the Ø30 km and the Ø1.6x1.2km Impact Craters

The Raman Spectra of quartz grains from sample site 27B at the BLC shows a clear shift of main quartz peaks to lower frequencies



The main quartz lines 464, 264, 206 and 128 are shifted to the lower frequencies 463, 261, 205 and 125 indicating an impact shock pressure of around 22 GPa at sample site 27B at the Bay of Lyon Secondary Crater (BLC)

To proof an impact-crater shock-metamorphic effects must be found which provide the evidence for the impact crater.
In the case of the **Ø 1270 x 950 km Permian Triassic Crater** described in my hypothesis (**Part 1** to **4** of my study) this isn't an easy job ! (→ mineralogical evidence in **Part 6** (**P6**)).

Two main reasons why it's difficult to proof the PT-Crater :

1.) The PT-Crater is located on the ocean floor of the Arctic Ocean in > 2000 m depth, and it is filled with sediments.

2.) The PT-Crater was caused by an oblique impact. This means the impactor, an asteroid or comet with a Ø 60 to 200 km, impacted in a very shallow angle of less than 8° with an impact velocity of < 8 km/s (=orbital velocity of a small moonlet close to Earth). That's why **the impactor impacted and moved in a nearly horizontal direction** along Earth's surface, excavating big amounts of crust- & mantle-material.

Therefore the impact pressure caused during the impact was relatively low and **most of the ejecta material** that was ejected **from the PT-Crater was exposed to a shock pressure of probably less than 20 GPa**. Impact glass probably doesn't exist in this ejecta material. And shock-metamorped minerals like Coesite probably only exist in small amounts.

The same is true for all secondary structures caused by ejecta from the PT-Crater. The shock-pressure was mainly < 20 GPa

Exceptions seem to be real PT-Secondary Craters which can clearly be identified on topography-, magnetic- and gravity-anomaly maps as crater structures. Here shock-metamorphic effects can be found in rocks inside of the crater, in the crater-rim area or close to the Crater (e.g. Cape York Cater)

My analysis indicates that shock-pressures in the range of 22-24 GPa can be identified in / near such Secondary Craters

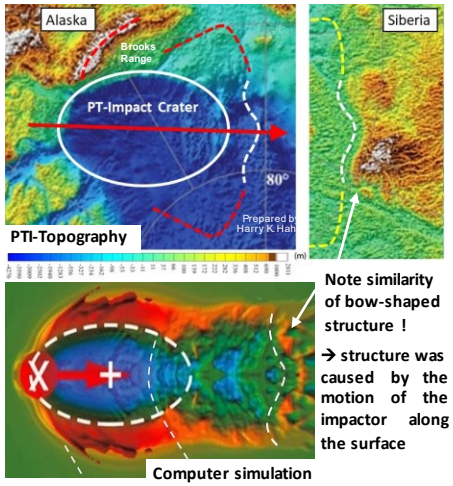
These impact shock-pressures can be identified with the help of **PDFs** or with **Micro-Raman Spectroscopy** on quartz grains

The Ø130x110km Bay-of-Lyon Crater and the Ø30km Impact Structure and the Ø1.6x1.2km Impact Crater in Spain are the most interesting PT-Secondary-Craters for further scientific research in Europe (→ proof of PT-Impact Event !). And the Ø320 km Cape York Crater and the Ø40x33km Pilbara Crater are the most interesting PT-Secondary Craters in Australia.
Detailed information about the material that was ejected by the PT-Crater can be found in studies about the **Siberian Traps**

The geophysical evidence for the Ø 1270 x 950 km PT-Impact Crater is provided by different map types.

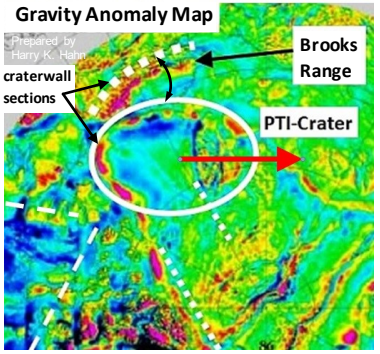
According to my hypothesis, the similarities of structures visible on a topographic map, to structures calculated by a computer simulation provide the most impressive indication (proof) for the PT-Crater !

Further indication for the enormous PT-Impact Crater described in my hypothesis comes from a gravity-anomaly- & magnetic anomaly map.



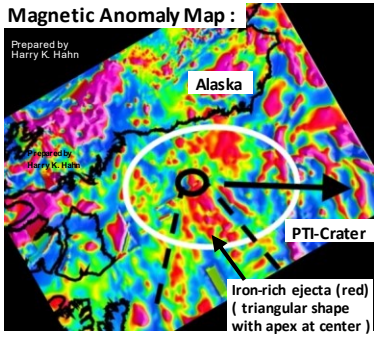
The gravity anomaly map is clearly indicating the elliptical PT-Crater and a section of the elliptical crater-rim that drifted away from the PT-Crater caused by forces of the escaping ejecta

This former section of the crater-rim is the Brooks Range in Alaska which indicates a formation age of ≈ 250 Ma ! Further there are linear structures noticeable, caused by ejecta rays.



The magnetic anomaly map shows a distinct triangular-shaped structure with the apex of the structure being congruent with the PT-Crater center.

This indicates iron-rich ejecta that was ejected from the PT-Crater (red color)



Further evidence comes from the distribution pattern and outline of the Siberian Traps. The map on the right shows the PTI-Crater in reference to the Siberian Traps as it was located at the time of the Impact. The trajectory of the impactor fits perfectly to the "main flow-direction" of the Siberian Traps (red). **Note :** The PTI ejected ≈ 100.000.000 - 200.000.000 km^3 material

Indication and evidence for the Permian-Triassic (PT) Impact Event which is coming from present studies :

A number of scientists specialized in impact research already proposed, that the Siberian Traps, the largest eruption of continental flood lavas on Earth, may be better explained by a large Impact than by a conventional mantle plume. Unfortunately the scientists haven't found the impact crater yet !

With my study (Parts 1 to 6) I want to proof that **Global Impact Events* are the primary cause for Plate-Tectonics** (and Expansion-Tectonics) on Earth and on other planets and moons of our solar system, and that such a Global Impact Event caused the formation of Continents and Oceans on Earth !

The hard evidence for the correctness of my hypothesis, is the confirmation of the **Ø 1270 x 950 km Permian-Triassic (PT) Impact Crater** described in my study

In the following I want to show now some extracts from a book written by the well-known impact researcher Prof. Dr. Christian Koeberl.
These extracts from the book show the existing indication and evidence for a Permian-Triassic (PT) Impact Crater. But no information is given for its location.

The title of the book : "Impact Markers in the Stratigraphic Record" – Authors : C. Koeberl & F. Martinez-Ruiz (ISBN : 3-540-00630-3)

Here the extracts from the book :

Page 29 : Siderophile element anomalies (e.g. enhanced Ir contents) were found at some P-Tr boundary locations (e.g., Holser et al. 1989). And recent research succeded in demonstrating the P-Tr boundary event was a much shorter event than thought. At Meishan, China, a negative excursion in the carbon isotopic composition had a duration of less than about 160,000 years and suggested that it could be the result of the impact of an icy carbon-rich comet.

Page 29 : Kaiho et al. (2001) reported sulfur isotope and chemical data for samples from the Meishan (China) Permian-Triassic (P-Tr) boundary section. They interpreted S-isotope data, as well as the occurrence of Fe- and Ni-rich particles, as evidence for a large-scale impact event that penetrated the Earth's mantle and formed a crater approximately **1000 km** in diameter.

see Study :
End-Permian catastrophe by bolide impact: Evidence of a gigantic release of sulfur from the mantle
by Kunio Kaiho, Y.Kajiwara, Yasunori Miura

A number of scientists pointed out that the Sibirian Traps cannot be the result of a mantle plume (e.g. Czamanske et al. 1998, Sharma 1997, Elkins-Tanton and Hager 2000)

Page 109 : An impact event is also supported by evidence from extraterrestrial noble gases in fullerenes found in P-Tr boundary beds in China, Japan, Hungary.

Page 109 : Because there is a similar duality of signals between likely volcanic and impact sources at the P-Tr boundary, similar to the K-T boundary, the hypothesis of Impact Researchers should be tested, which claims that the Siberian Traps could have been caused by decompression melting at the impact site. And that impact volcanism can uniquely explain the dual signals in the geological record.

Page 110 : An indicative model of Impact Researchers shows that it is possible for the volume of decompressed mantle beneath a large ~ 200 km sized crater to greatly exceed the excavated volume of the impact crater itself, primarily due to reduction of lithostatic load. Under suitable conditions of geothermal gradient, this would lead to near instantaneous melting with volumes of the order of 10^6 km^3 , similar to the characteristic volumes of LIP's.

Page 110 : And the induced large-scale vertical and horizontal thermal gradients are expected to have a long-term effect on secondary mantle flow.

Page 111 : Decompression melting may contribute more melt than conventional shock melting.

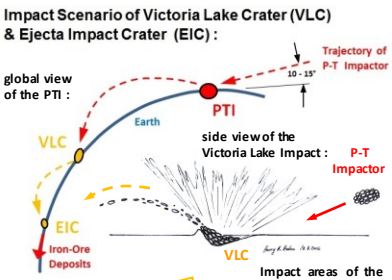
Page 111 : We propose that the Siberian Traps, which are accessible and currently under considerable scrutiny, may be better explained by a large impact than by a conventional mantle plume. The closure of a former ocean between Siberia and Mongolia, as well as amalgamation with north and south China blocks may also have been occuring during Permian-Triassic times. (→ These events were the result of the P/T-Impact Event !! → comment from Harry.K.Hahn)

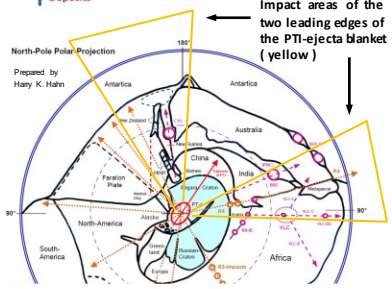
Page 97 : Decompression melting must be seriously considered whenever an impact is sufficiently large to cause the transient crater depth to excavate a substantial fraction of the local crustal thickness, and thereby cause a sudden drop in lithostatic pressure beneath the crater.

Another study which indicates a Permian-Triassic Impact Event in Australia : Raining lead around 250 mya : A smoking gun for an Australian impact origin of the Permian Extinction ; by Jim Standard & C. Austen Angell , Department of Chemistry and Biochemistry, Arizona State University, Tempe, AZ 85287

The result of the PT-Impact: The Pacific - LLSVP and the African - LLSVP were caused by the two main Ejecta Rays of the PTI

There is strong indication that the **Permian-Triassic Impact (PT-I)** and the ejecta rays which were caused by this enormous impact are responsible for the formation of the two main **LLSVPs** (Large low-shear-velocity provinces) inside Earth's mantle. These two large structures, which are characterized by slow (seismic) shear wave velocities and which consist of much hotter material (~4000°K) than the surrounding mantle material (~2000°K), extend laterally and vertically for thousands of kilometers from the core-mantle boundary. In all probability the remains of large secondary impactors and the powerful ejecta of the leading edges of the two ejecta-wings of the PT-I descended deep into Earth's Mantle and caused the **LLSVP's** as a result.

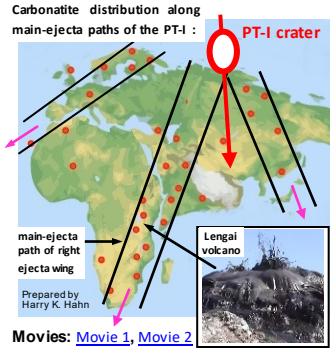




The diagram on the left shows the shallow (oblique) impact of the PT-Impactor which probably had a diameter of around **~60 to 200 km**. It also shows a side view of the **Victoria Lake Impact** (crater) (→VLC) which was caused by a large secondary impactor ejected from the PTI-crater. Part of the ejecta from the VLC was ejected forward in impact direction where it formed another secondary crater, the EIC. The rest (the majority) of the VLC-ejecta was again ejected in a butterfly-ejecta-pattern. Traces of "forward-ejecta", which always seems to be dense & ductile metal-bearing material, are also visible near the CYC- and PHC (BBC)-craters.

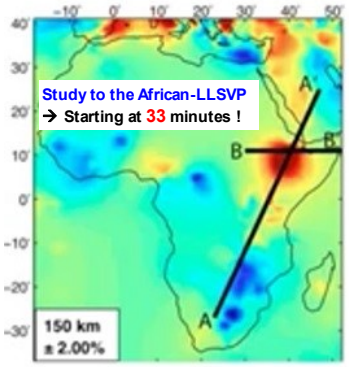
The majority of the ejecta from the PTI-crater was ejected in the form of a gigantic butterfly-shaped ejecta blanket. Where the leading edges of the two ejecta wings of this butterfly-ejecta blanket impacted on Earth's crust (in the yellow marked areas) extensive fractures (new continent borders) were formed

The north-polar-projection of Earth, shown on the left shows Earth at P/T boundary time



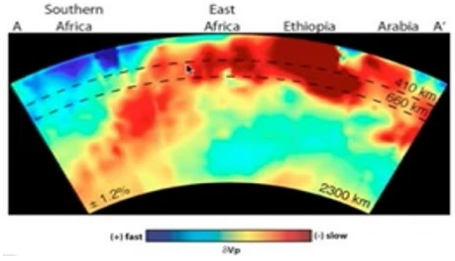
Movies: Movie 1, Movie 2

see: Study about Carbonatite Lava



A large part of the ejected material and a number of big secondary impactors impacted in these two yellow marked areas. → see also larger map in the chapter: **"Earth at the time of the PT-Impact Event"**

The world map on the left shows the distribution of **Carbonatites** in Africa & Eurasia. I have rearranged the position & orientation of Africa, Europe and India so as they were just after the PT-Impact 253 Ma ago (→ original map, Le Bas 1987). **It is clearly visible that the carbonatites are mainly located along the paths where the leading edges of the ejecta wings of the PTI impacted !!** This is especially clear for the impact path of the leading edge of the right ejecta wing along the east-coast of Africa (→ ejecta ray R4 & VLC-ray). Because the Carbonatites are probably derived from Earth's lower mantle, we can conclude that the shock-wave of the PTI-impact, or PTI-ejecta descenting into the mantle, brought carbonatites from the lower mantle to the surface, or the carbonatites were brought-in by the impactor itself ! Lengai Volcano in Tanzania still erupts Carbonatite-Lava today ! (→ from the African LLSVP !)



The two images on the bottom left side show a section view of the **African-LLSVP**. The section view A – A' runs from the Arabian Peninsula through the African Rift Valley and the Victoria Lake (VLC) area towards South-Africa. The section view runs essentially along the same path where the leading edge of the right ejecta wing of the PTI impacted.

It is clearly visible that the main structure of the African **LLSVP** is orientated along the same path as the impacting right leading edge of the PTI-ejecta. (→ LLSVP = red, orange & yellow area in the section view A – A'). The images are from a study of Andy Nyblade which used **African-Array Data**. He claims that evidences indicate that the African LLSVP is a thermochemical whole-mantle-structure without a separation in the 410-660 km region.

The same principles applies for the **Pacific LLSVP**

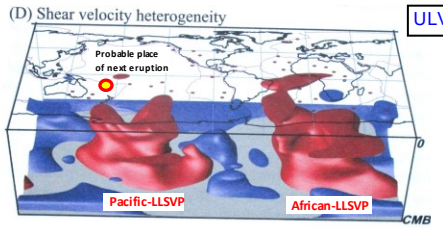
The two maps on the top right side show that especially the **ULVZ** at the **core mantle boundary (CMB)** within the Pacific LLSVP is mainly orientated along the path where the leading edge of the left ejecta wing of the PTI impacted. Because this ULVZ has a distinct chemical signature there is a high probability that the **ULVZ** is a direct result of ejecta of the PTI which descented to the CMB in this area.

Note: it seems that the Cape York Impact produced a permanent channel in the mantle which connects the Pacific-LLSVP/ULVZ with the surface. Through this channel in the mantle ≥8 violent magma eruptions occurred over the last ~200 Ma causing a number of big **LIP's** on the Pacific Plate (e.g. the **Ontong LIP**)

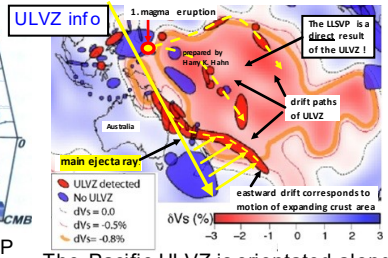
Warning : There is a high probability that another such violent magma eruption will occur !! My study indicates that the next magma eruption will take place near the **Fiji-islands** → see image on the right which shows the path of the source (outflow channel positions = yellow dots) of the magma eruptions. It seems the Pacific LLSVP is due for an eruption soon ! The solid upward pointing column at the top-end of the LLSVP, near the **Fiji's** may indicate the coming eruption (& mass extinction !). The vertical expansion rate of this column must be measured !!!

Note : All volcanos of the **Pacific Fire Ring** and all other volcanos on Earth can be explained by the Permian-Triassic Impact ! They are all located in the (fractured) crust areas which were directly caused by the ejecta of the PT-I !! The magma (molten mantle material) which causes these volcanos, in all probability is exclusively a result of the impact of ejecta & secondary impactors from the PTI !!!

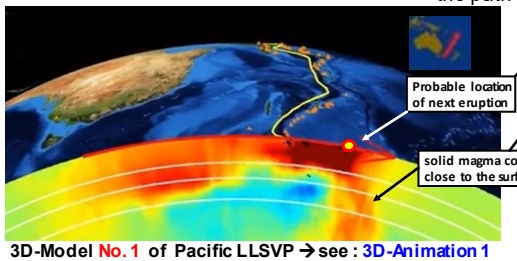
Therefore a revised model for **Earth's mantle** is required, which must consider a much higher share of volatiles, e.g. H_2O & CO_2 within the mantle material



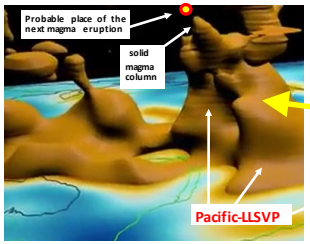
A 3-D view of the Pacific- & African LLSVP and the probable location of the next eruption



The Pacific-ULVZ is orientated along the path of a main ejecta ray of the PTI

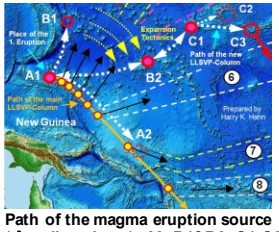


3D-Model No. 1 of Pacific LLSVP → see: 3D-Animation 1
3D-Model No. 2 of Pacific LLSVP → see: 3D-Animation 2

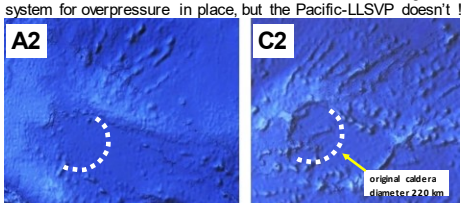


3D-view of Pacific-LLSVP with the possible location of next eruption

This 3-D Animation shows the African-LLSVP has a large vent system for overpressure in place, but the Pacific-LLSVP doesn't !



Path of the magma eruption source (→ yellow dots). A2, B1&B2, C1-C3 represent drift-off-copies & remains of the first magma-eruption-zone A1

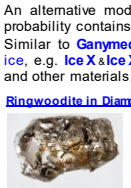


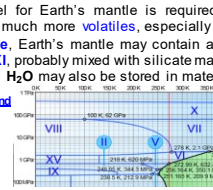
These two different ocean floor areas A2 & C2 which are thousands of km apart represent the same structure !!

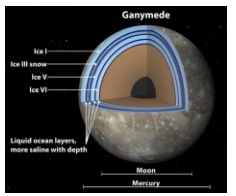
These "drift-off-copies" are an image of the first magma eruption which took place on position A1 ! These nearly identical structures, from two different crust layers (?), probably show the remains of a burst shield-volcano with a base Ø ~450 km and a caldera Ø ~220 km.

An alternative model for Earth's mantle is required !! Earth's mantle in all probability contains much more volatiles, especially H_2O, than currently believed ! Similar to **Ganymede**, Earth's mantle may contain a high share of high-pressure ice, e.g. **Ice X & Ice XI**, probably mixed with silicate material like in Callisto's mantle and other materials. H_2O may also be stored in materials like **Ringwoodite** etc.

Ringwoodite in Diamond





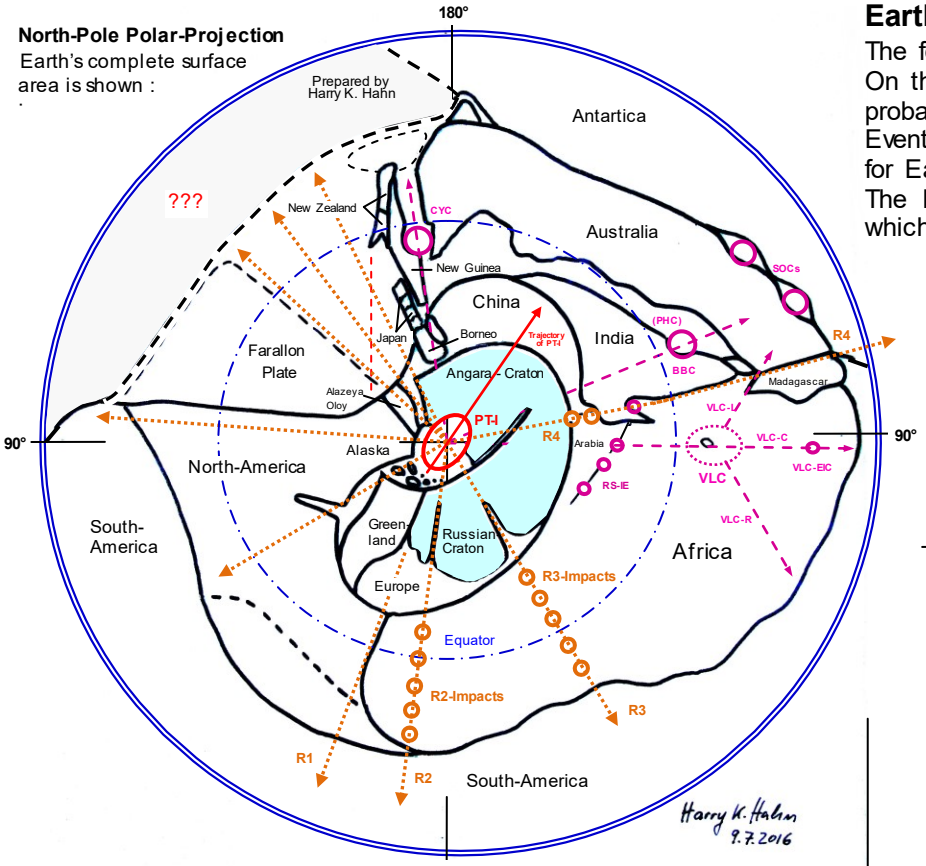


Earth at the time of the PT-Impact Event (with all PT-secondary craters shown)

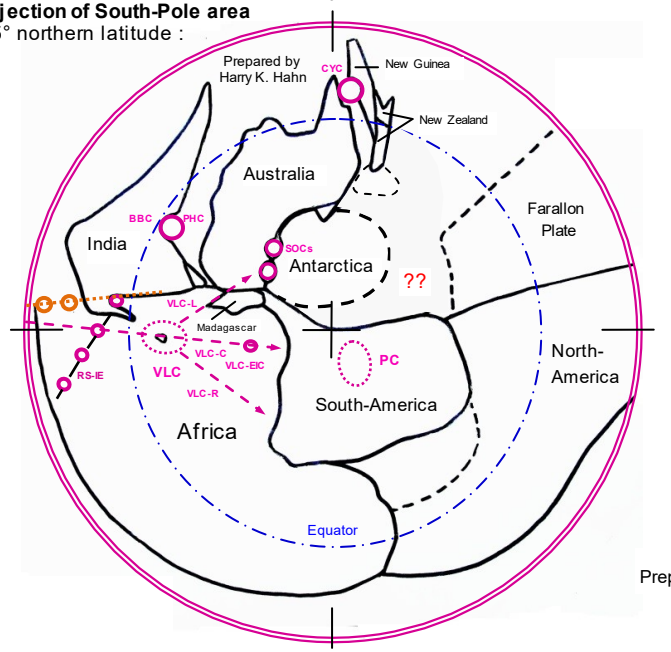
Prepared by Harry K. Hahn

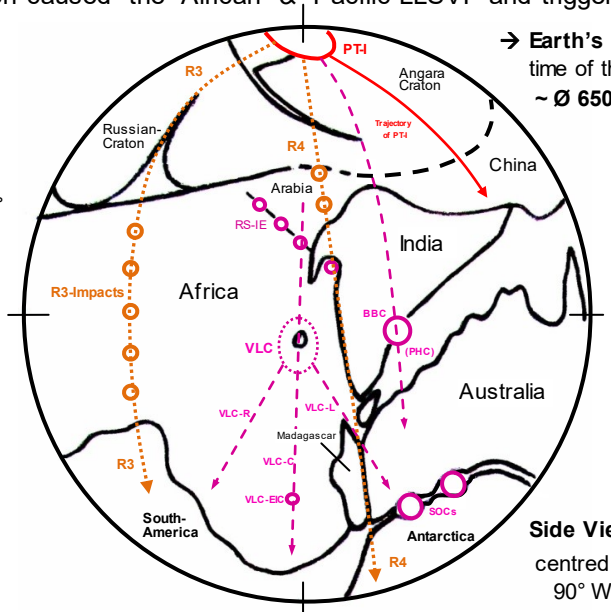
The following maps show how our planet Earth probably looked at the time of the Permian-Triassic (PT)-Impact. On these maps, the arrangement of Earth's continents at PTI-time is based on impact structures which in all probability were caused by the PT-Impact Event (especially the CYC-, the BBC / PHC- and the VLC-Impact Event and the Ejecta Rays (crater chains) R1-R4 were used as a reference). And an Expansion Tectonics model for Earth was used as base for these maps. The PT-Impact Event caused the shown fracture pattern on Earth. The leading-edges of the two ejecta-wings, cut through Earth's crust (along R4 and along the CYC-chain) which caused the African- & Pacific-LLSVP and triggered an expansion (tectonics) process in Earth's mantle.

North-Pole Polar-Projection
Earth's complete surface area is shown :

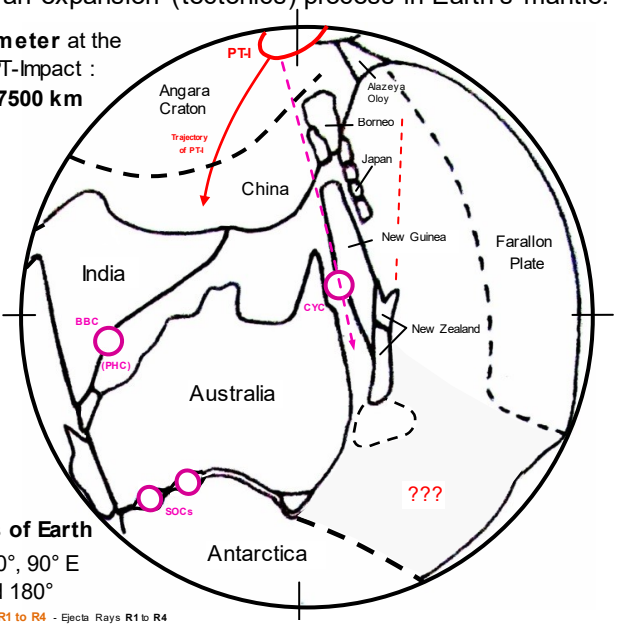


Polar-Projection of South-Pole area
up to ~ 45° northern latitude :





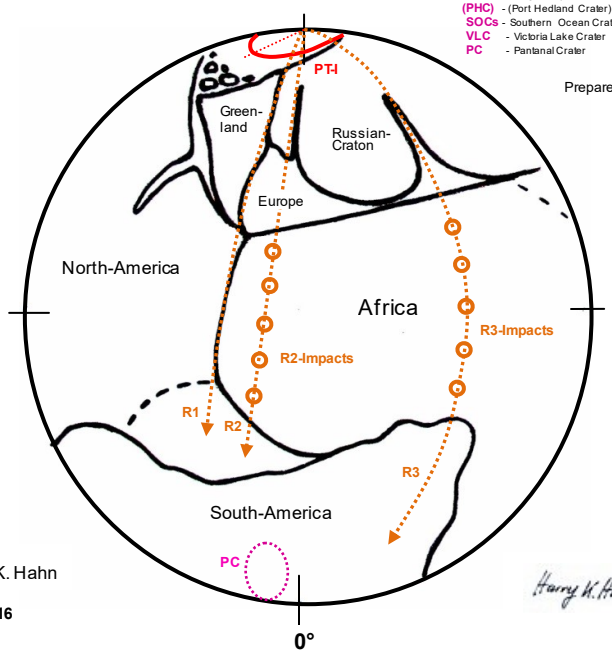
→ **Earth's diameter** at the time of the PT-Impact : **~ Ø 6500 - 7500 km**

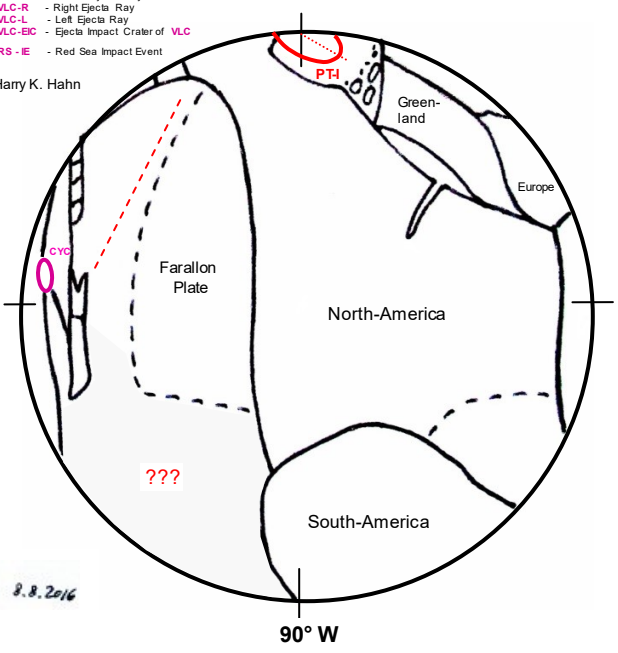


Side Views of Earth
centred on 0°, 90° E
90° W and 180°

PT-I	- Permian Triassic Impact	R1 to R4	- Ejecta Rays R1 to R4 (caused by PT-Impact)
CYC	- Cape York Crater	VLC-C	- Central Ejecta Ray of VLC
BBC	- Bengal Bay Crater	VLC-R	- Right Ejecta Ray
(PHC)	- (Port Hedland Crater)	VLC-L	- Left Ejecta Ray
SOCs	- Southern Ocean Craters	VLC-EIC	- Ejecta Impact Crater of VLC
VLC	- Victoria Lake Crater	RS - IE	- Red Sea Impact Event
PC	- Pantanal Crater		

Prepared by Harry K. Hahn



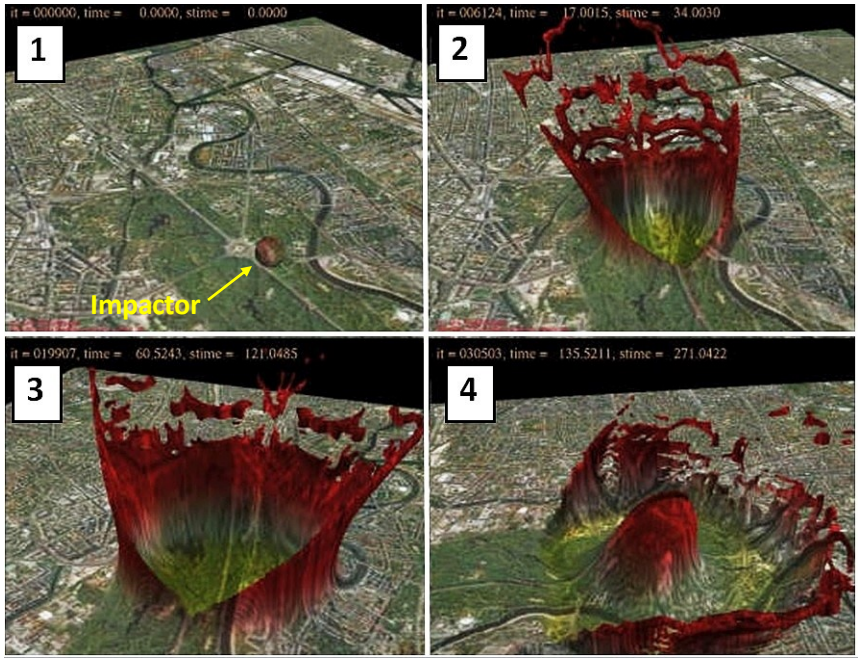


Harry K. Hahn 8.8.2016

Prepared by Harry K. Hahn

Update : 9-10-2016

The impact of the leading edges of the two Ejecta-wings of the PT-Impact caused the Pacific- LLSVP and the African- LLSVP

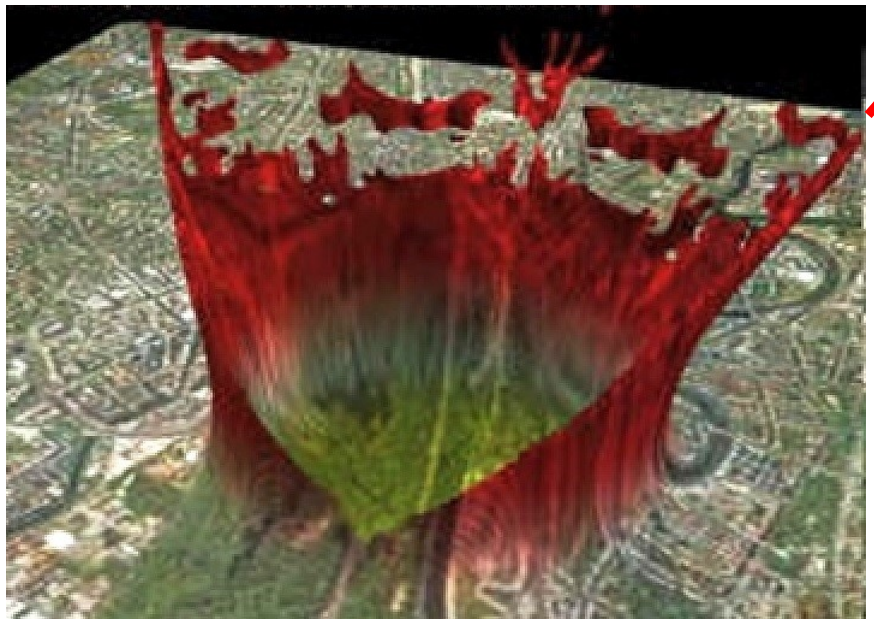


This image sequence 1-4 shows a shallow (oblique) impact of a meteorite. Because the impactor hits the surface in a shallow angle two ejecta-wings are caused by the impact. (computer simulation of such an impact event)

Leading-edge of the left ejecta-wing

The Permian Triassic (PT) Impact has caused two ejecta-wings (or–blankets) with powerful leading-edges of these ejecta-wings which cut through Earth's crust when they impacted on the surface. The ejecta material that has formed these leading-edges then descended into Earth's mantle where it caused the African- and Pacific-LLSVP, the two major LLSVPs.

Leading-edge of the right ejecta-wing



Magma (molten mantle material) in Earth's mantle probably is the result of ejecta material from the PT-Impact, which descended into Earth's mantle in the major fracture zones, caused by the leading edges of the PT-ejecta-wings.

All volcanos of the Pacific Fire Ring and volcanism on Earth can be explained by the Permian-Triassic Impact !

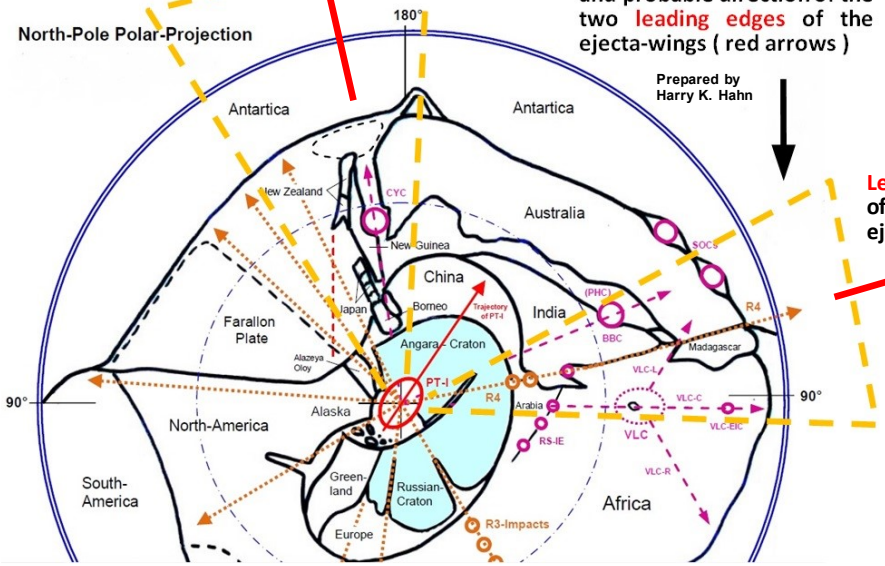
Therefore a revised model for Earth's mantle is required, which must consider a mantle consisting of a mixture of silicate minerals and high-pressure Ice, e.g. Ice X & Ice XI with a density ≥ 3, which goes through a phase change because of the LLSVP-areas and expands Earth's mantle !

Earth at the time of the PT-Impact :

Leading-edge of left ejecta-wing

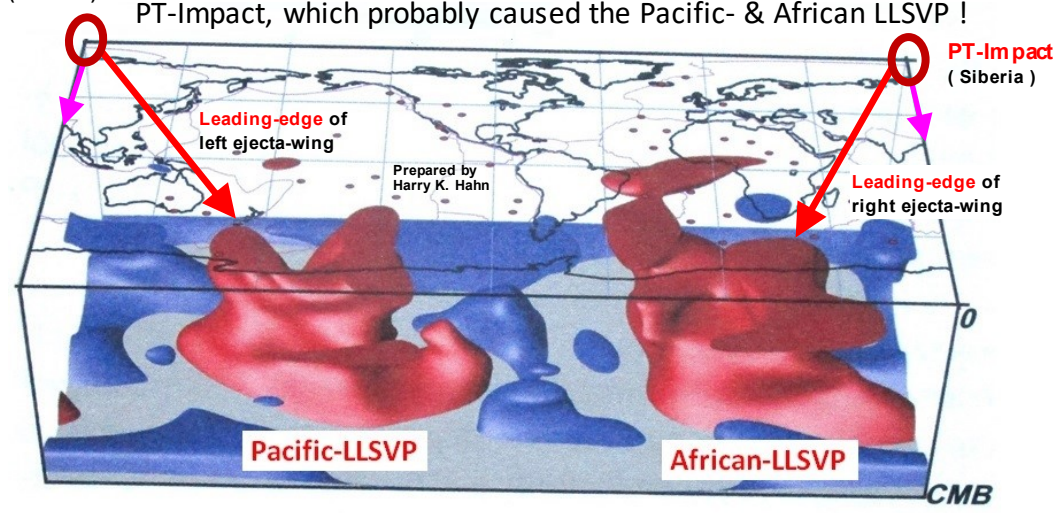
Impact areas of the most powerful sections of the two ejecta-wings (yellow lines) and probable direction of the two leading edges of the ejecta-wings (red arrows)

Prepared by Harry K. Hahn



Leading-edge of the right ejecta-wing

3-D view of the Pacific- & African LLSVP with the world map and the location of the PT-Impact Crater projected over it. The two red arrows represent the leading edges of the two ejecta-wings of the PT-Impact, which probably caused the Pacific- & African LLSVP !



→ Evidence of shock-metamorphic effects from six possible Secondary Craters of the PT - Impact Event

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1.) The ≈ Ø 130 x 110 km "Bay of Lyon Crater" in France :

→ **Shock-metamorphic effects of the Impact : Shocked quartz was found in rock samples from sample site 27-B**

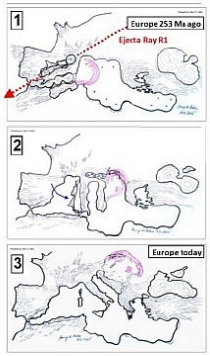
→ **Raman spectra of rock samples from the Bay-of-Lyon Crater** (or → **here**)

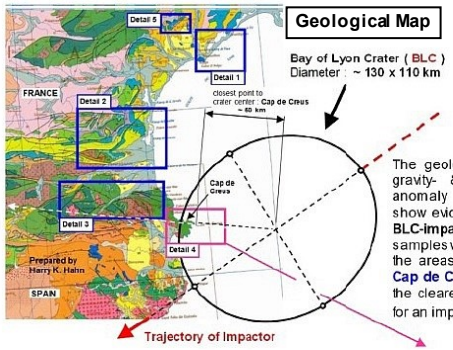
Photos of the Sample Sites & Rock Samples (No. 27-B3 (1-4)) are available here : ► Sample Sites "Bay of Lyon Crater"

The Ø 130 x 110 km Bay of Lyon Crater is the first member of a secondary impact crater chain which formed the coastline of Eastern-Spain and the western coastline of Italy. (→ see description in my PT-Impact hypothesis) It was the first and probably most powerful crater at the northern end of this secondary crater chain, and it represents approximatelly the pivet-point, around which the Italian mainland and the Yugoslavian Block, rotated after the PT-Impact Event (see image sequence 1-3 below). **Raman spectra of quartz** grains from **sample site 27-B** clearly indicate a shock-event caused by an Impact which has formed "Cabo de Creus" (site 27-B). **This is a first strong indication for the existence of the Ø 130x110km "Bay of Lyon" Crater**

The possible impact crater is noticeable on a gravity anomaly map and the crater-center has left a strong signature on the magnetic anomaly map too, which indicates that the impactor (a big ejecta fragment from the PT-Crater) probably consisted of a considerable amount of iron.

The closest point on land in reference to the assumed crater center of the "Bay of Lyon Crater" is **Cabo de Creus** in Spain. Here sample location **27-B** is located. The rock-type (46) marked in dark green on the geological map is ≈ 440-550 Ma old (Paleozoic Age) and therefore contains shock-metamorphic effects of the PTI-event, in this case from the "Bay of Lyon Crater". Sample site 27-B shows a large area which consists of rock that was partly melted and strongly deformed. In all probability all the rock on this site is partly melted ejecta from the Bay of Lyon Crater, and some of the rocks may be ejecta from the PT-Impact Crater as well. Cabo de Creus may represent a small remaining section of the original crater-wall of the "Bay of Lyon Crater"





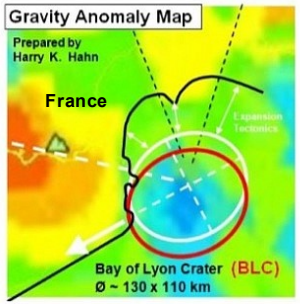
The geological map, gravity- & magnetic anomaly maps all show evidence for the **BLC-impact**. Rock samples were taken in the areas Detail 1-5. **Cap de Creus** shows the clearest evidence for an impact event.

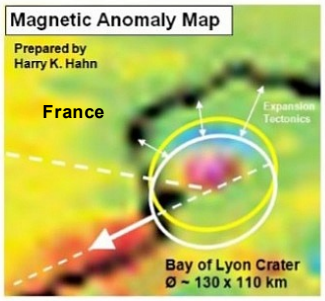
→ **Geological Map of Spain :**

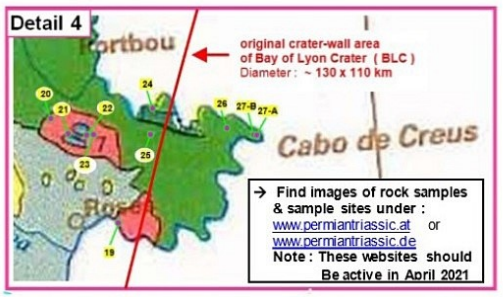
http://www.zonu.com/fullsize-en/2010-09-01-12020/Geological-map-of-Spain-1994.html

The above shown **Cap de Creus** is the closest point to the center of impact of the **Bay of Lyon Crater** (**BLC**). Distance to the crater center **~ 50 km**

It seems that **Cap de Creus** is a remain of the original crater-wall of the Bay of Lyon Crater ! Therefore it should be a primary research area for the scientific analysis of this Impact Event.







2.) The Ø 1.6 x 1.2 km elliptical Impact Crater in Southern-Spain (≈ 35 km East of Almeria) :

→ **Shock-metamorphic effects of the Impact : Shocked quartz was found in rock samples from Sample Site 40-B**

→ **Raman spectra of samples from the 30 km & 1.6x1.2 km Craters** (or **here**)

Photos of the Sample Sites & Rock Samples (No. 40-B and others) are available here : ► Sample Sites - Spain_3

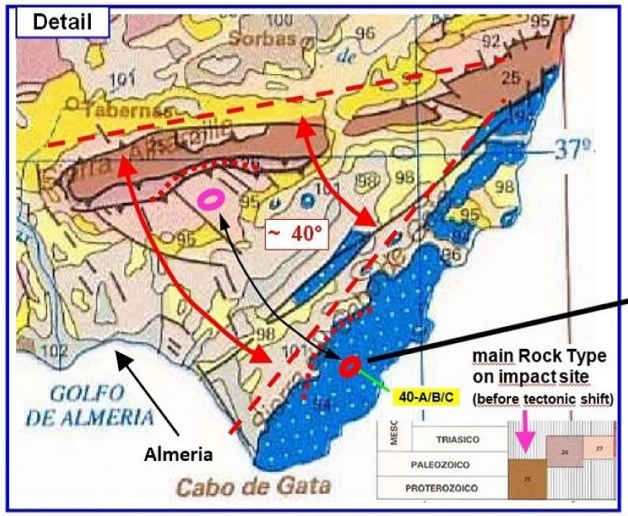
At the center of this elliptical Impact Crater shock-metamorphed rock (Impact-Breccia) crops out of the ground. This certainly isn't a volcanic structure ! It is a perfect Ø 1.6 x 1.2 km "oblique impact crater", but unknown to the geological society ! **RAMAN spectra of quartz from sample site 40-B point towards a shock-event caused by an Impact.** The spectra indicate that the quartz was exposed to an **impact shock pressure of around 22 GPa.** **This elliptical Impact Crater is very interesting because it has the potential to proof the large-scale impact-scenario in Southern-Spain, which in all probability was caused by the PT-Impact Event.** And it can proof the tectonic-shift and rotation of a large area consisting of Proterozoic Rock (> 250 Ma old) which in all probability was caused by the tectonic motion of the African Plate, that was triggered by impacting ejecta of the PT-Crater.

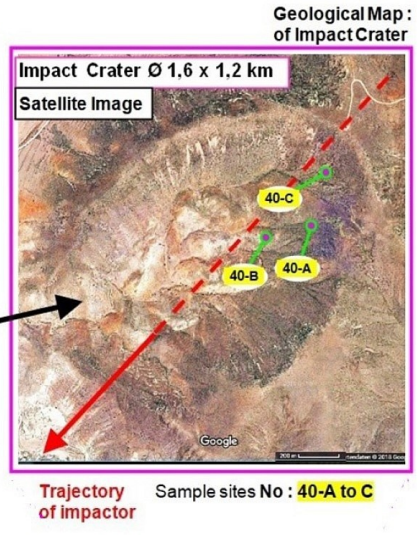
Please note that the crater originally impacted in the "brown-colored" rock-type 25, which is Proterozoic Rock ! (see Geological Map below !)

This is indicated by the curved cutout (or dent) visible in the brown rock-type (see map below), which represents a linear 300 - 400 m high mountain range. I have drawn-in a small pink-colored ellipse on the position where I believe the crater was originally located in reference to this mountain range.

This mountain range consisting of rock-type 25 in all probability is the remaining section of an ejecta ray from the PT-Crater, and the small elliptical crater was caused by a larger fragment from the ejecta of the PT-Crater. The blue-colored rock type is much younger and was produced by the volcanic activity which was triggered by the large-scale impact event.

The orientation, ellipticity and shape of the impact crater, which is perfectly orientated in line with the mountain range, provide precise information about the trajectory, impact angle and velocity of the ejecta from the PT-Crater that impacted here. Therefore this secondary-crater of the PT-Impact Event should be an important study object in order to bring light in the large-scale impact scenario caused by the PTI which took place in Europe ≈ 253 Ma ago





→ **Weblink to the Geological Map of Spain :**

http://www.zonu.com/fullsize-en/2010-09-01-12020/Geological-map-of-Spain-1994.html

3.) The ≈ Ø 30 km Impact Structure in Southern-Spain (near Puerto de Mazarron in Murcia in Andalucia) :

→ **Shock-metamorphic effects of the Impact : Shocked quartz was found in rock samples from the Sample Sites 50 and 19-B & 30-B**
→ **Raman spectra of samples from the 30 km & 1.6x1.2 km Craters** (or → **here**)

Photos of these Sample Sites & Rock Samples (and others) are available here : ► Sample Sites - Spain_3 & Sample Sites -Spain_1 & 2

The ≈ Ø 30 km bow-shaped Structure which is visible on the satellite image (→ see image below) was caused by an Impact Event. **Shocked quartz** that was found on **sample site 50** clearly indicates that the quartz was exposed to a **shock pressure of around 22 GPa**. (→ see Raman spectra on the next pages)

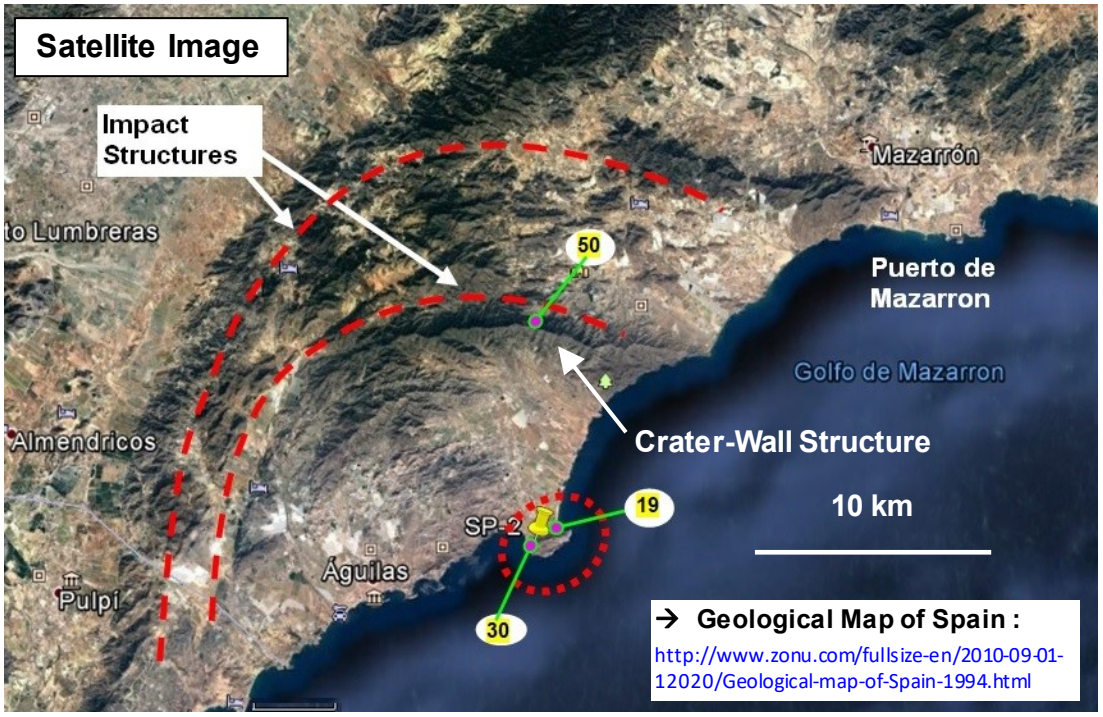
This large bow-shaped Impact Structure belongs to a large-scale impact event which according to my hypothesis was caused by ejecta material that was ejected from the Permian Triassic (PT) Crater in the Arctic Sea (see Parts 1 to 5 of my hypothesis).

The impact structure belongs to a large-scale Secondary Crater Chain that was caused by the PT-Impact Event. The "Bay-of-Lyon Crater" described under **1.)** and the Ø 1.6 x 1.2 km "oblique impact crater" described under **2.)** are impact craters which belong to the same Secondary Crater Chain (→ PT-Impact Event)

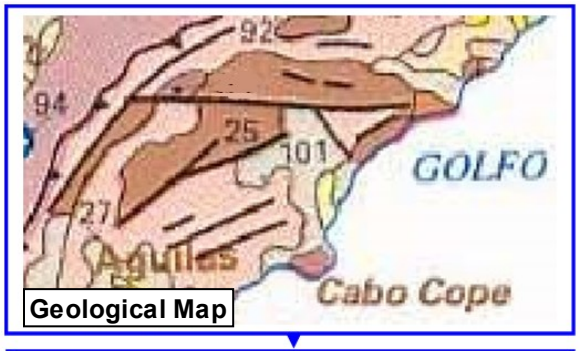
The Geological Map of Spain shows that the bow-shaped "Crater-Wall structure" consists of rock-type 25 (brown-colored on the geological map), which is Proterozoic Rock that probably is > 250 Ma (million years) old !

The age of the rock at sample site 50 also indicates that the impact structure can be a result of the PT-Impact Scenario described in my hypothesis.

Rock samples collected at the sample sites 19 and 30, at the center of the bow-shaped impact structure (Cabo Cope), also indicate a impact shock event. Quartz in these rock samples shows similar (but slightly weaker) shifts of the main Raman peaks, as the shocked quartz collected on sample site 50.



Sample Site 50 (at AP7 tunnel exit)



4.) The ≈ Ø 160 km "Salerno Crater" in Italy :

→ **Shock-metamorphic effects of the Impact : Indication for Shocked quartz was found in rock samples of Sample Sites 20 & 21**

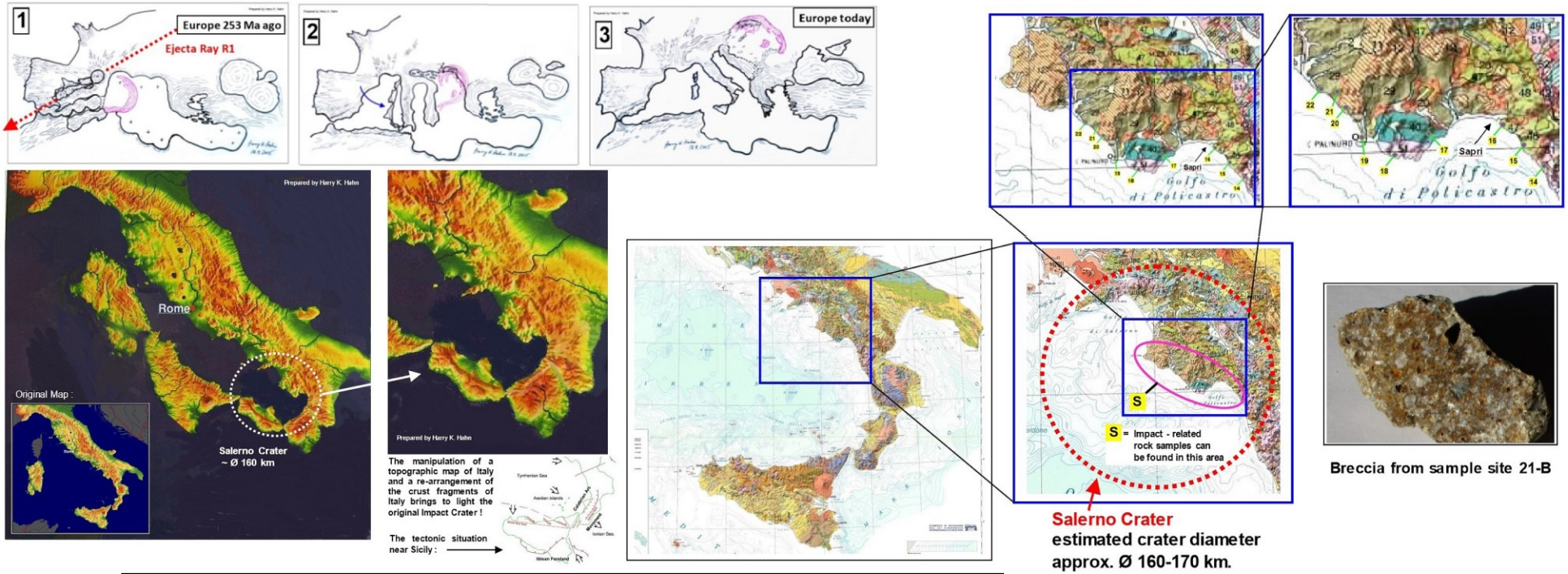
➔ **Raman spectra of rock samples from the Salerno Crater** (or → **here**)

Photos of these Sample Sites & Rock Samples (and other sample sites) are available here : ► Sample Sites "Salerno Crater"

The Ø 160 km "Salerno Crater is part of the same secondary crater chain as the "Bay of Lyon Crater" described under **1.)** , which in all probability was caused by ejecta that was ejected from the Permian Triassic Crater Ø 1270 x 950 km Permian Triassic Impact Crater (PTI) in the Arctic Sea near Alaska
This secondary crater chain probably consisted of at least four major secondary craters. (→ see image sequence **1** to **3** below)
The first crater of this crater chain is the "Bay of Lyon Crater" (→ probably the most powerful crater) and the last crater was the "Salerno Crater" which is still noticeable on the topography map of Italy, if the crust fragments which form Italy are arranged in their positions as they were approx. 200 Ma ago.

In the **Raman Spectra of quartz grains** from rock samples collected at the **sample sites 20 & 21** there are shifts of main Raman bands (peaks) to the lower frequencies noticeable in the spectra, which indicate that the quartz was exposed to a **shock pressure of ≈ 20 - 22 GPa.**
But these shifts of the main Raman peaks are less pronounced than the peak shifts in the samples of the "Bay of Lyon Crater" (BLC). This indicates that the impact pressure or shock pressure was less at the end of the described crater chain than at the start of the chain (at the BLC).

Microscope images of some of the analysed quartz grains in samples from the **sites 21 & 20** also seem to indicate an impact shock event.
In order to confirm the Salerno Crater as a secondary crater of the PT-Impact Event an analysis for PDFs (planar deformation features) should be done.



→ **Geological Map 1:250000** → other geological maps → raster selection 1:100000

5.) The ≈ Ø 320 km "Cape York Crater" in North-East Australia :

→ Shock-metamorphic effects of the Impact : Shocked quartz was found in rock samples from the Sample Sites 46 & 50 (2.trip)

The sample site 49-C / 23 (1. & 2.trip) also indicates an impact event → Raman spectra of rock samples from the Cape York Crater (or **here**)

Photos of Sample Sites & Rock Samples are available here : ► Sample Sites CY-Crater 2 (2.trip) **& Sample Sites CY-Crater 1** (1.trip)

The yet unknown giant Ø 320 km "Cape York Crater" (CYC) in NE-Australia is located on the ocean floor just east of the Cape York Peninsula.

The possible impact crater is noticeable on different gravity anomaly maps and on topographic maps.
According to my PT-Impact Hypothesis the crater belongs to a Secondary Impact Crater Chain, which was caused by ejecta material that was ejected from the Ø 1270 x 950 km Permian Triassic Impact Crater (PTI), located in the Arctic Sea near Alaska. (→ see my **Study** about this Crater).

The closest point on land in relation to the crater center is **Cape Melville** which probably represents a small section of the original outer crater-wall and which is only reachable on a difficult 4W-track or with a boat (probably the best option !). The satellite image of Cape Melville shows hills of **large grey boulders of up to Ø 20 m**. These grey boulders consist of **Cape-Melville-Granite with an Early-Permian Age**. But I haven't been on this site yet !

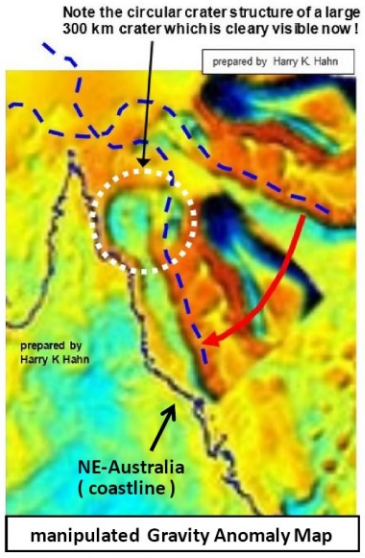
The closest site that I could reach on my 2.trip (Cape York 2), in reference to the Ø 320 km Crater, is **sample site 46** located approx. 75 km south of the crater-rim of the Ø 320 km "Cape York Crater" (→ see map). This sample site is a hill consisting of Silurian-/ Devonian-age rock, accessible per road

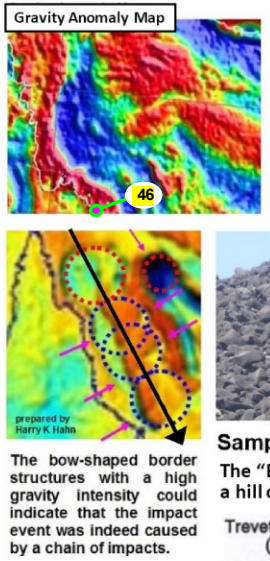
RAMAN spectra of quartz grains from sample site 46 clearly indicate a shock-event caused by an Impact. This is strong indication for the existence of the Ø 320 km "Cape York Crater". Further evidence comes from sample site 50. **The RAMAN spectra of quartz from sample site 50 also provides evidence for a large-scale impact event.** It shows similar shifts of the Raman peaks of the quartz to the lower frequencies, which indicates a **shock pressure of ≈ 20 - 22 GPa** that was caused by the large-scale "secondary impact event" (crater-chain) described in my hypothesis.

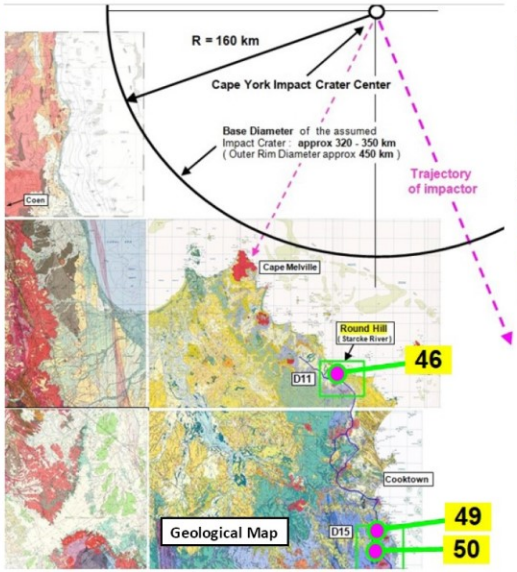
Sample Site 49-C is located at the "Black Mountains" 20 km south of Cooktown. These "Ejecta-Boulder-Hills" (Black Mountains) probably were formed during the large-scale Cape-York Impact. **The boulders** of the "Black Mountains" **consist of Trevethan Granodiorite with a given age of 259 +/- 1 Ma** which is very **close to the PT-boundary age of ≈253 Ma**. Cape Melville also seems to consist of these kind of Ejecta-Boulders from the PT-boundary

RAMAN spectra from quartz at site 49-C also indicate a shock event. However the shift of the RAMAN peaks is less and the evidence therefore weaker.

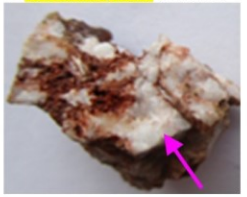
Weblinks : Gravity Anomaly Map 1 ; Gravity Anomaly Map 2 - **Geological Maps :** Cape Meville ; Cooktown area







Sample Site 46 : Silurian / Devonian rock



6.) The Ø 30 km Mt Warning Impact Crater & 1.5 km Impact Crater (East Australia) :

→ **Shock-metamorphic effects of the Impact : Shocked quartz was found in rock samples from the Sample Site 8-B2 /-B3**

→ **Raman spectra of samples from the 30 km Mt Warning Crater** (or → **here**)

Photos of these Sample Sites & Rock Samples (and others) are available here : ► Sample Sites "Mt Warning Crater"

The Ø 30 km crater-shaped Mt Warning area and a smaller ≈ Ø 1.5 km crater structure, which is located directly near the crater-rim of the Mt Warning Crater, seem to belong to the large-scale impact event caused by the Ø 320 km Cape York Crater and by other large secondary craters of the PT-Impact Event.

(→ see Study : **The 320 km Cape York Crater** (link2))

Mount Warning seems to be the result of a large **secondary impact** caused by the Cape York Impact Event in NE-Australia. And it is not the rest of an erroded shield-volcano as currently believed ! Therefore the true age of the Mt Warning crater may be ~253 Ma (→ PT-boundary age).

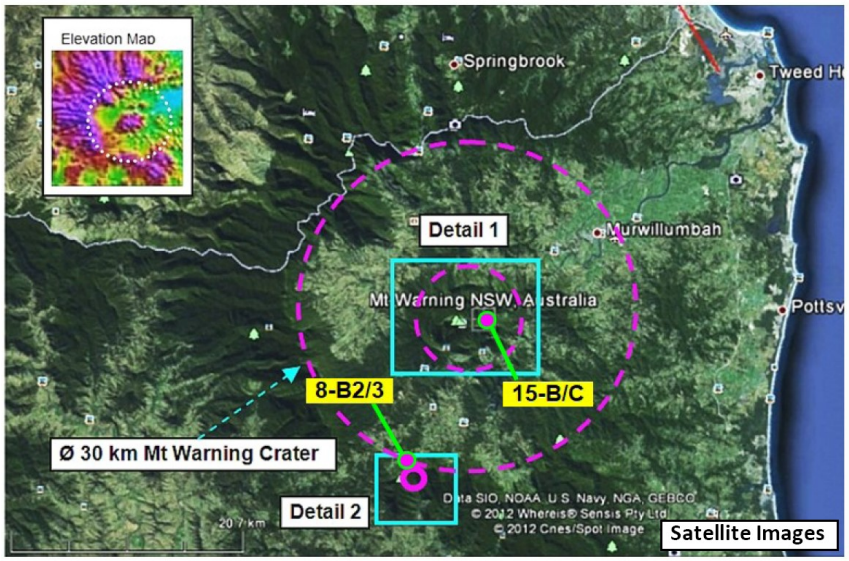
The chaotic looking central area of the Mt Warning crater-area (**Detail 1**) probably is the result of a shield volcano which grew on top of the Mt Warning impact crater after the Impact Event. When the volcanic activity ended, this shield volcano then heavily eroded and collapsed into the visible chaotic structure, which consists of magmatic material. Only the original Crater-wall of the Mt Warning crater is a remain of the original earlier impact event. (→ my hypothesis)

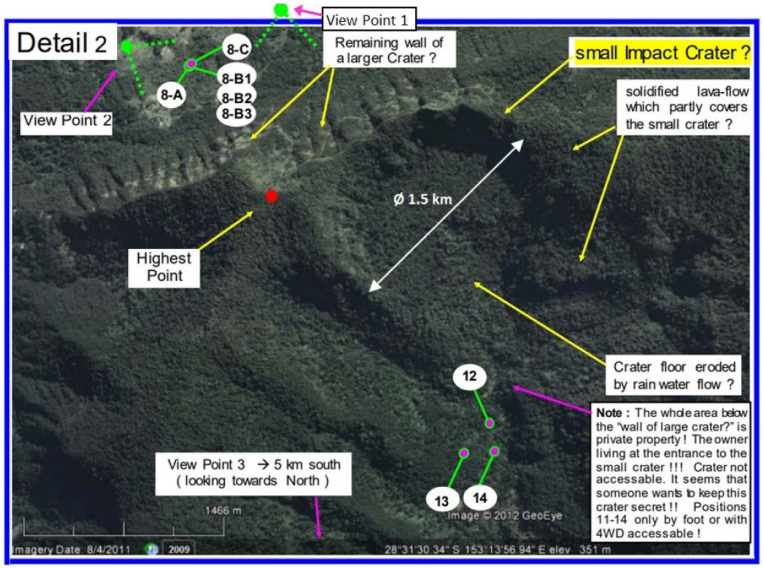
The samples 8-B2 /-B3 were collected on the foot of a possible remain of the original crater-wall of the Ø 30 km Mt Warning Impact Crater.

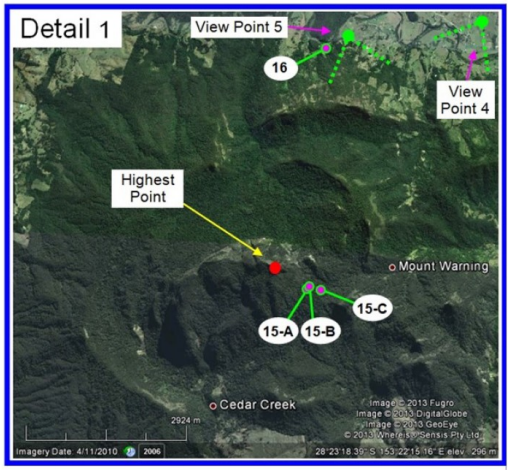
The **Raman spectra** of quartz from sample site **8-B2,** on the foot of the Mt Warning crater-wall, and on the outside of the smaller Ø 1.5 km circular crater visible in **Detail 2** provides **first indication for an impact event !** The shifts of the main Raman peaks of the analysed quartz grain to lower frequencies, which is visible in Raman-spectra, indicates that the quartz from this site in all probability was exposed to a **shock pressure of around 20 - 22 GPa**.

The spectra of the rock samples from site **15-B** and **15-C,** the central mountain in the Mt Warning Crater, all indicate magmatic material.

Geological Map : → **Moreton Geology :** go to : **Geology Maps** → type in : **WARWICK**







7.) The Ø 8 x 7 km elliptical "Warwick Crater" in East-Australia

→ Shock-metamorphic effects of the Impact structure: Shocked quartz was found in rock samples from the Sample Sites 43, 51, 53 & 54

→ Raman spectra of samples from the 8x7 km elliptical Warwick Crater (or → **here**)

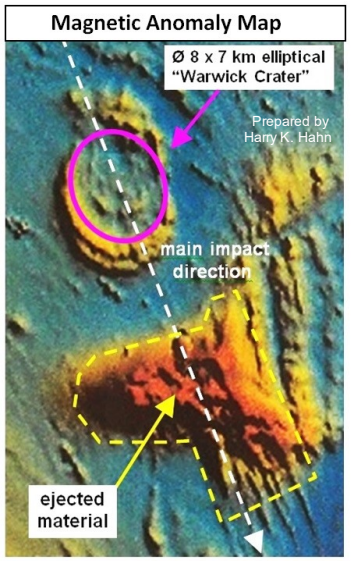
Photos of these Sample Sites & Rock Samples (and other sample sites) are available here : ► Sample Sites – Ø 8 x 7 km Warwick Crater

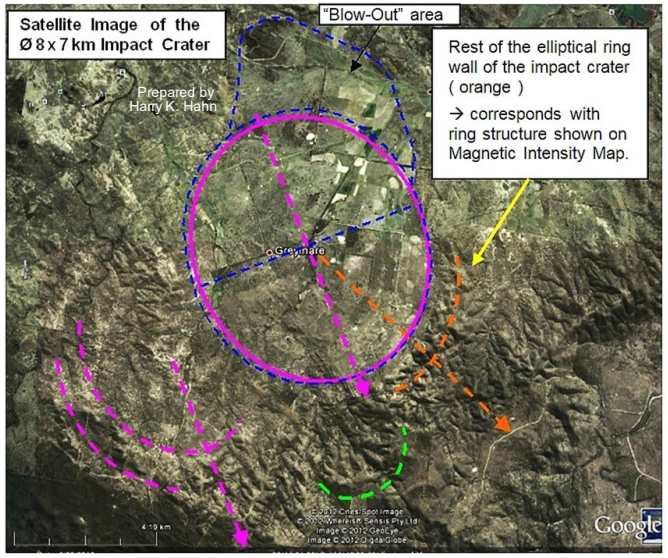
The Ø 8 x 7 km elliptical Warwick Crater is located ≈150 km south-west of Brisbane, near the Town Warwick (≈ 160 km west of the Mt. Warning area.).

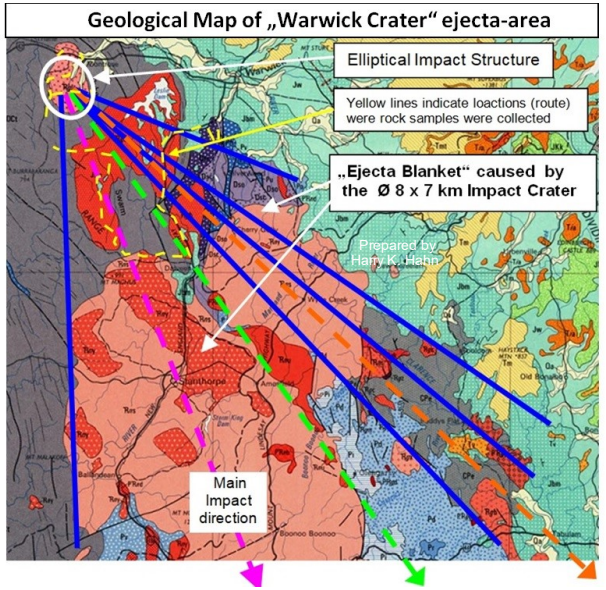
There is a precise **Elliptical crater structure** noticeable on the **Magnetic Intensity Map**. This **elliptical ring structure** is not completely closed, which is an indication that the impactor arrived in a shallow angle. The orientation of the elliptical ring structure corresponds to the orientation of the (assumed) ejecta blanket. (see marks (lines) on the geological map below) The age of the oblique impact in all probablility is ≈ **253 Ma**. (PT-boundary age)
(see explanation in Part 2 of my hypothesis about the PT-Impact Event)
The geological map of the surrounding area clearly shows a distribution of certain rock types along sectors, which are limited by „rays“, which all seem to come from the same starting point. And it seems that all rays have their starting point within the elliptical impact structure ! Only the rays which limit the sector of the grey colored rock type seem to have their starting point shifted a bit towards the direction where the impactor came from. It seems that the pink & red colored rock types were scattered during the impact towards the south-east, in a cone-shaped pattern. These rock-types probably represent the remains of the impactor that formed the crater.
The **Raman spectrum of quartz from sample site 43 provides first evidence for an impact shock event.** The shifts of the main Raman peaks, of the analysed quartz, to the lower frequencies **463** and **204 cm^{-1}**, provide indication for an impact event that caused a shock pressure of around 22 GPa.

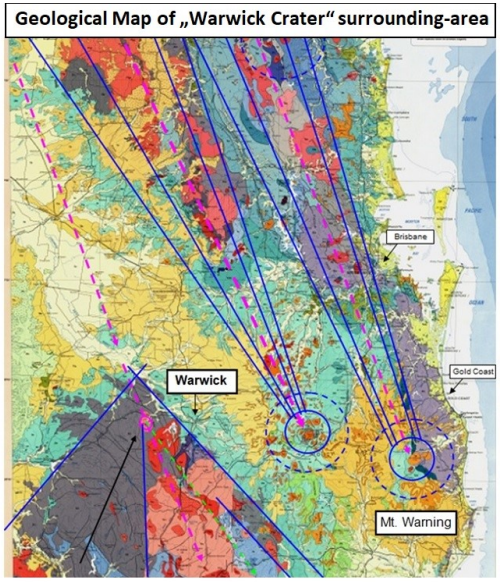
Further indication comes from the Raman spectra of quartz grains from the **sample sites 53, 51 and 54** which show shifts of the main Raman peaks to the lower frequencies **263** and **205** (**204**) **cm^{-1}**, to the lower frequencies **263** and **205 cm^{-1}**, to **260** and **126 cm^{-1}** and to **262** (265) and **204** (207) **cm^{-1}**

The main impact direction of this elliptical Impact Crater points towards the Cape York Crater (chain). Therefore in all probability the Ø 8 x 7 km “Warwick Crater” was caused by a large ejecta fragment of the Cape York Impact Event. But it is also possible that it was caused by a large ejecta fragment of the PT-Impact Crater.
(→ Please also read the Study : The 320 km Cape York Crater (link2))









8.) The Ø 40 x 33 km elliptical Pilbara Crater near Port Hedland (NW-Australia)

→ **Shock-metamorphic effects of the Impact : Shocked quartz was found in rock samples from the Sample Sites 25, 10 and 11**

→ **Raman spectra of samples from the 40 x 33 km Pilbara Crater** (or → **here**)

Photos of these Sample Sites & Rock Samples (and other sample sites) are available here : ► Sample Sites Pilbara Crater 1

The Ø 40 x 33 km elliptical impact crater is located near the town Port Hedland in the North of Western Australia.

Because of the ellipical shape of the crater it is the result of an **oblique impact**. That means the impactor which formed the crater impacted in a very shallow angle of probably less then 10°. Because of this shallow impact angle, fragments of the impactor were ejected from the crater and caused complex secondary impact structures 40 km and 80 km further east of this elliptical crater. (sample sites 10 and 11 are located here)

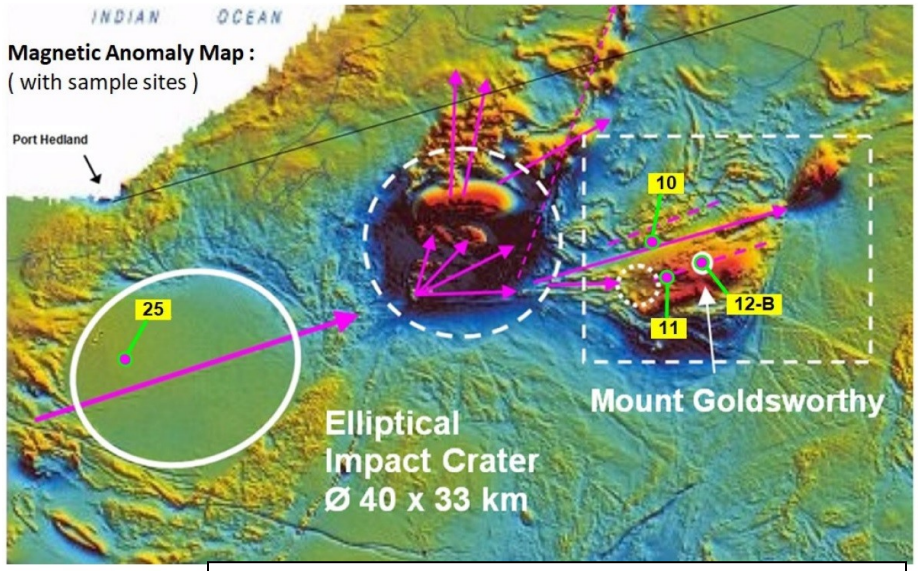
One of the secondary impact structures is **Mount Goldsworthy**, which is a famous **Iron Ore Mine** that contained the world's richest deposits of ferrous (iron)-ore with a share of up to 68 % iron. These impact structures are all noticeable on a magnetic anomaly map (→ see map below)

The Ø 40 x 33 km elliptical Impact Crater near Port Hedland probably was formed by ejecta material that was ejected by a larger crater near Onslow, a town on the NW-coast of Western Australia. This crater near Onslow in all probability was caused by the Permian-Triassic Impact Event 253 Ma ago (in my opinion) The rock of the area were the Impact-Structures are located in, is ≈ 2.9 Ga old. **But the impact structures seem to be much younger !** (→ see iron-outcrops)

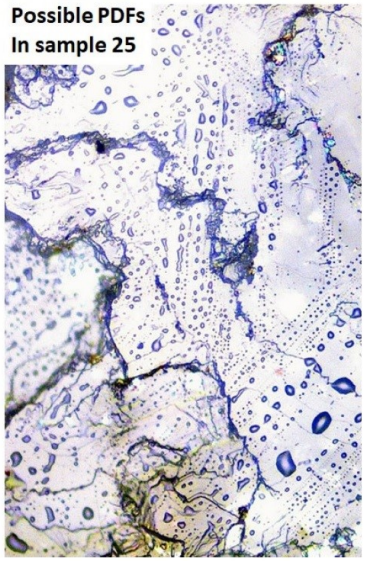
Raman spectra of quartz grains from the sample site 25 near the center of the elliptical crater **and from the sample sites 10 and 11** located in the secondary impact structures of this crater **clearly indicate a shock-event caused by an Impact.**

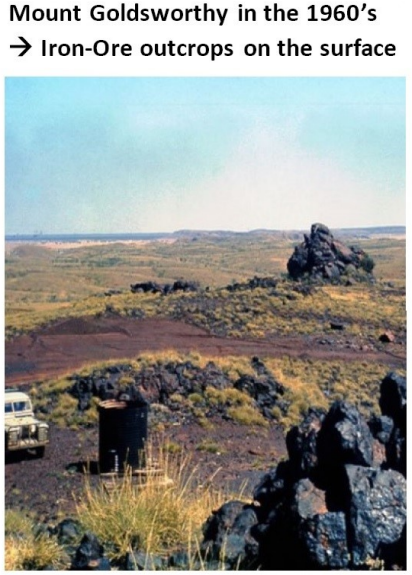
The shifts of the Raman peaks of the analysed quartz samples to lower frequencies indicates an **impact shock pressure of ≈ 20 - 22 GPa**

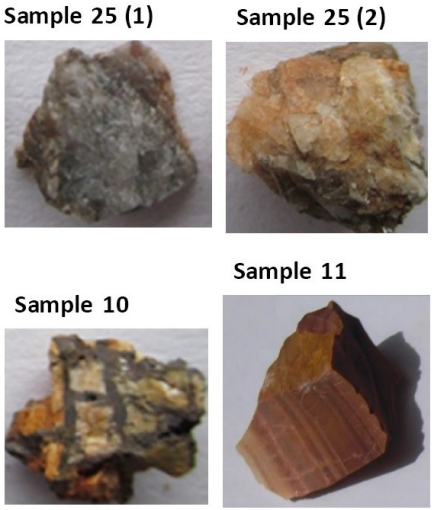
Further evidence comes from a **microscopic image of sample 25** which **indicates planar deformation features (PDFs).**



→ **zoom-in to : Geological Map**: Port Hedland-Bedout Island







9.) The Ejecta Ray from the ≈ Ø 420 km "Southern Ocean Crater (SOC)" in Western Australia

→ **Shock-metamorphic effects of the Impact structure : Shocked quartz was found in rock samples from the Sample Sites 50, 52 & 55**

→ **Raman spectra of Ejecta-Ray samples of the 420 km Southern Ocean Crater** (or **here**)

Other interesting rock samples are: **55** (ground consists of coherent mass of light-weight ceramic-like material which contains pipe-shaped gas-bubbles!)
53 (ground is full of black glass-like stones → Micro-Tectites ?) ; **49** (shocked quartz may be present here too !)

Photos of these Sample Sites & Rock Samples (& other sample sites) are available here : ► Sample Sites - Ejecta Ray of the 420 km SOC

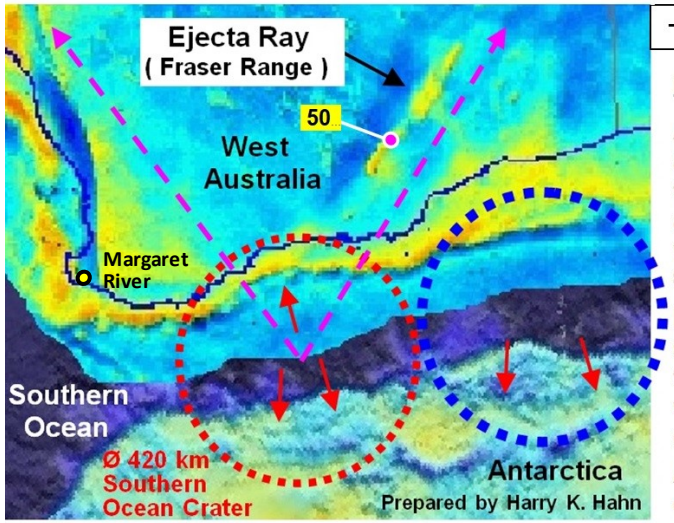
Note : Shock-metamorphic effects caused by ejecta from the Ø 420 km Southern Ocean Crater may also be found in rocks of another area where I have collected samples : ► Sample Sites - Margaret River Area ; interesting sample areas : ► : 7-A & 7-B and 8-A & 8-B

The massive ejecta ray of the ≈ Ø 420 km "Southern Ocean Crater" is noticable on gravity- & magnetic anomaly map of Australia. A map combination of a gravity anomaly map of Australia and a topographic map of Antartica, arranged to each other so as they were ~200 Ma ago, shows the outline of the Ø 420 km SOC.

A magnetic anomaly map provides clear evidence of the circular structure of the crater. And a geological map of the area south of Kalgoorlie indicates the precise linear structure of the **Fraser Range** which represents the massive ejecta ray that was ejected from the crater. The age of the rock which forms the linear Fraser Range is given with ≈1.3 Ga. This is the age of the crust-material that was ejected by the SOC. But the impact event itself was at the PT-boundary!

Rock samples from the center line of this linear mountain range provide first evidence for an impact event. The **Raman spectra of quartz from sample sites 50, 52 & 55 provide first indication for an impact event !** The shifts of two main Raman peaks of the analysed quartz grains from **sample site 55** (Stone 1) to the lower frequencies **263** and **205 cm^{-1}** and to **261/264** and **205 cm^{-1}**, and the shifts of two main Raman peaks in the quartz grains from **sample site 50** (Stone 2) to the lower frequencies **204** and **124 cm^{-1}** and to **260/265** and **204 (200,209) cm^{-1}** (double peaks), and similar shifts in samples from **site 52**, which are visible in the Raman Spectra provide a first indication that the quartz from these sample sites was exposed to a **shock pressure in the range of 20-22 GPa**

The rock material from sample sites 50 and 55 may provide further evidence for the ejecta-ray-theory. On **site 55** the rock consists of **glass-like material that contains pipe-shaped bubbles filled with air** (or gas). Microscopic images of some analysed quartz grains from site 50, 52 & 55 may provide further proof for a shock event (see : **Raman spectra of Ejecta-Ray samples of the 420 km Southern Ocean Crater** (or : here)



→ **Gravity Anomaly Map 1**

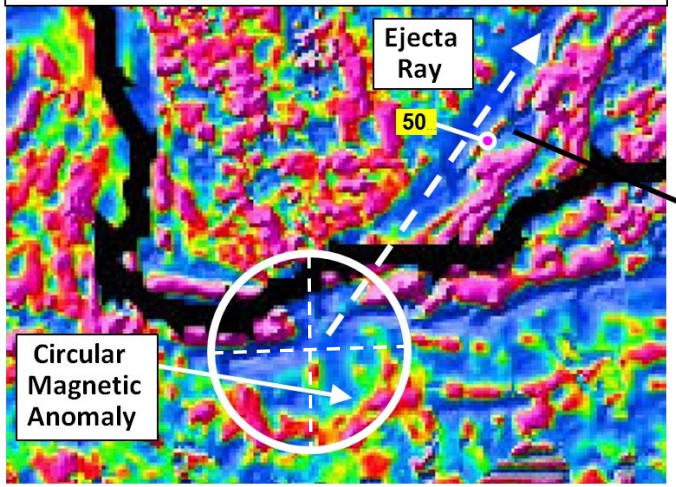
Explanation to this map :

A map combination of a gravity anomaly map of Australia and a topographic map of Antarctica, arranged to each other, so as they were ~ 200 Ma ago indicate a ≈ Ø 420 km Impact Crater.

Note the ring structures, the strong ejecta ray and the triangular shaped gravity anomaly which has its apex in the center of the red marked impact crater.

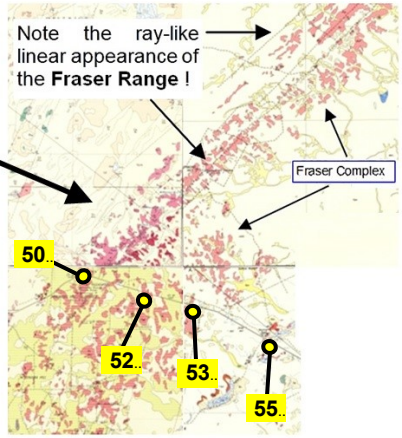
And there may be another impact crater (blue marked).

Magnetic Anomaly Map of SW - Australia



Geological Maps
→ go to : "Geology" – 1:250K maps then select : Norseman / Balladonia

→ 4 Geological Maps joined together



References :

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Weblinks to my studies on → vixra.org :	**Weblinks to my studies on → archive.org**
Part 1 : https://vixra.org/abs/2012.0210	Study-Part 1
Part 2 : https://vixra.org/abs/2101.0052	Study-Part 2
Part 3 : https://vixra.org/abs/2101.0096	Study-Part 3
Part 4 : https://vixra.org/abs/2101.0067	Study-Part 4
Part 5 : https://vixra.org/abs/2101.0127	Study-Part 5
Part 6 : https://vixra.org/abs/2104.0099	Study-Part 6

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3. C. Koeberl, F. Martinez-Ruiz : **Impact Markers in the Stratigraphic Record** 2003 ; Springer Verlag ; ISBN : 3-540-00630-3

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alternative : https://www.semanticscholar.org/paper/A-Raman-spectroscopic-study-of-shocked-single-McMillan-Wolf/cfaaf6eb3e46fbd2912fb91c7acf40e88e721132

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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

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https://www.researchgate.net/publication/339672303_A_Study_of_Shock-Metamorphic_Features_of_Feldspars_from_the_Xiuyan_Impact_Crater

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