Short overview of the current Plate Tectonics Theory for our Earth

And why does this theory needs an Update ??

and

Impact Craters on Earth, Moon and Mars : → A comparison

and why Impact Craters are important for the Mining Industry

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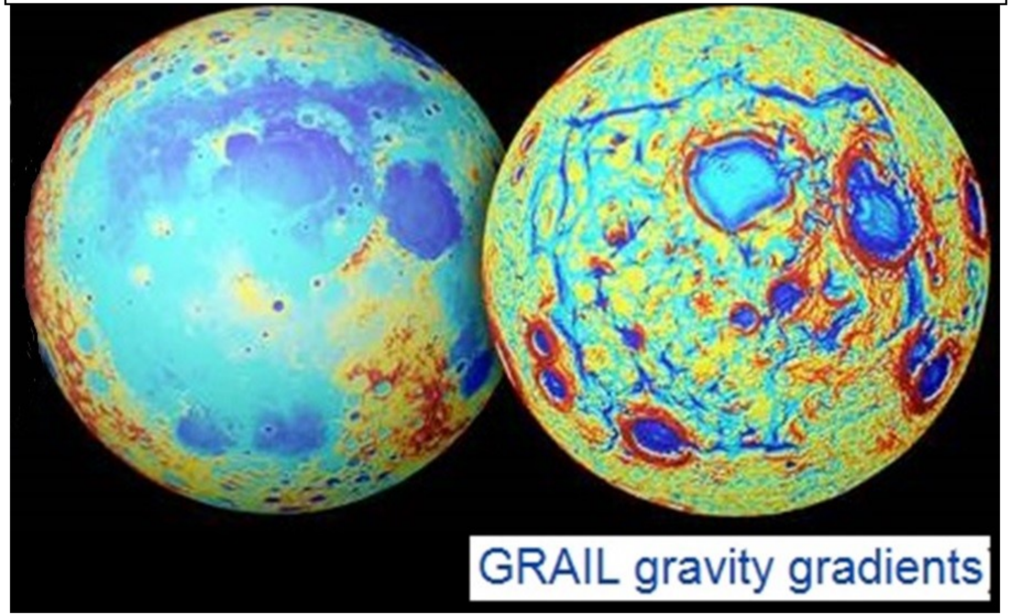
by Harry K. Hahn / Germany - 3.12.2018

www.permiantriassic.de → Please read my Study

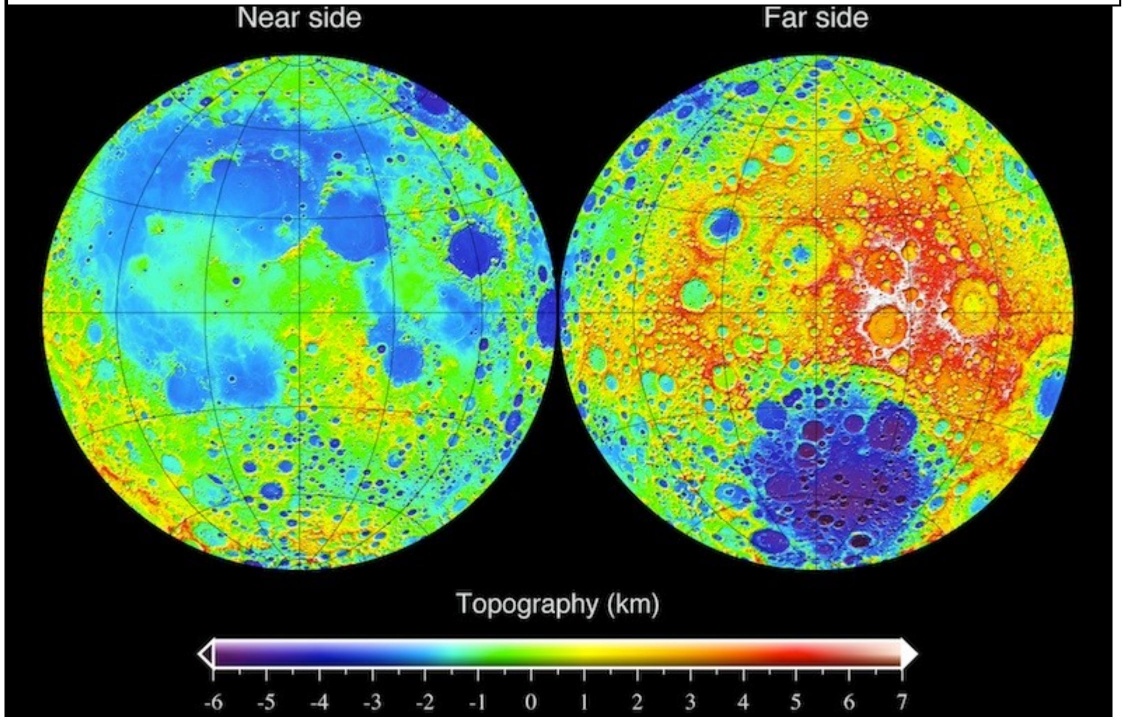
Impact Craters are the primary cause for crust deformation processes on the Moon

Moon - Near side

Topography **Gravity Anomalies**



Moon - Topography



Gravity Anomalies show that Moons flood-lava filled Mare were caused by impact craters in the diameter range of 220 km to 600 km

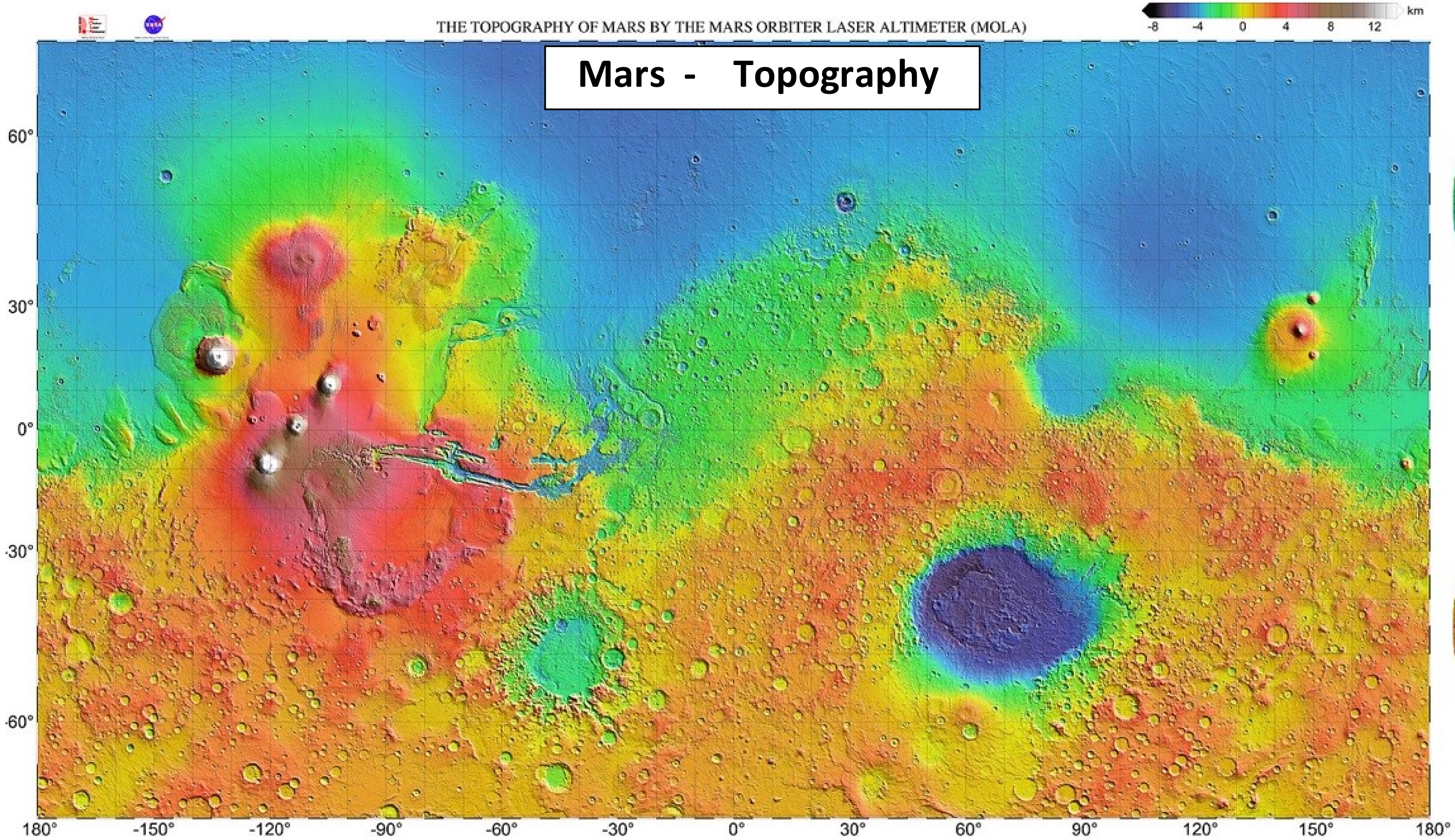
Moon :

> **100** Impact-Craters known with a diameter **≥ 150 km**

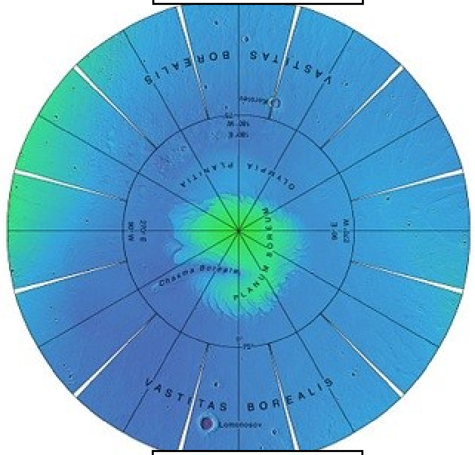
> **150** Impact-Craters known in the diameter range **100 to 150 km**

> **850** Impact-Craters known in the diameter range **50 to 100 km**

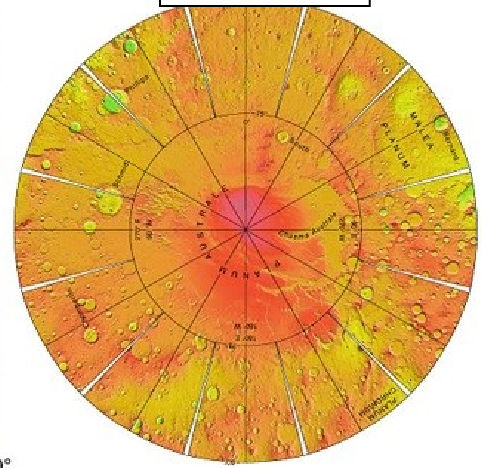
Impact Craters are the primary cause for crust deformation processes on Mars



North Pole



South Pole



Similar to the moon the blue marked low areas are flood-lava filled areas which were caused by impact events.

the low area in the northern hemisphere (blue) is an ancient ocean basin (now dry)

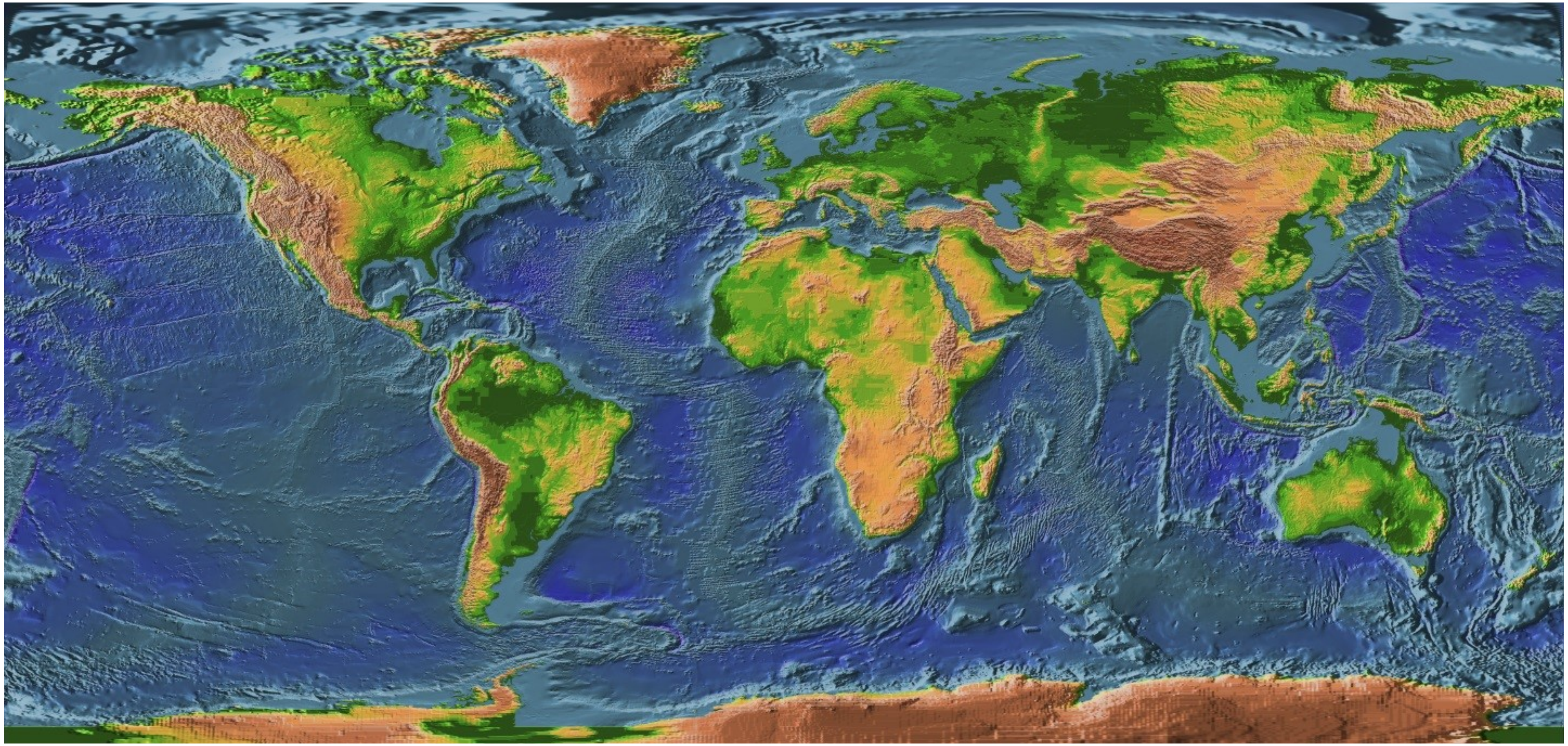
Mars :

- > **100** Impact-Craters known with a diameter **≥ 150 km**
- > **200** Impact-Craters known in the diameter range **100 to 150 km**
- > **1700** Impact-Craters known in the diameter range **50 to 100 km**

<u>The theory says</u> : Craters are <u>not the primary cause</u> for crust deformation on Earth !

On Earth **"Plate Tectonics"** caused by mantle plumes are the primary cause for crust deformation.

→ But this seems to be unlogical if we look at the strong impact cratering going on Moon & Mars !



Earth :

Only **3** Impact-Craters known with a diameter **≥ 150 km**

Only **3** Impact-Craters known in the diameter range **100 to 150 km**

Only **10** Impact-Craters known in the diameter range **50 to 100 km**

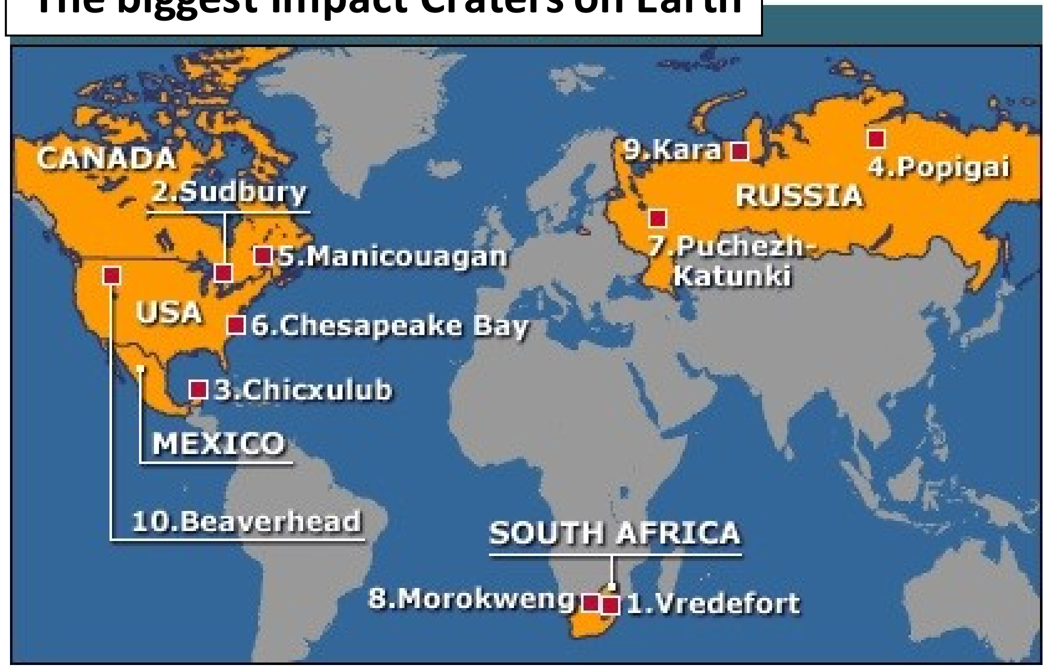
Why do we find only very few big impact craters on Earth ?

The main reasons are :

- **Water- & Wind Erosion**
- **Sedimentation of the eroded material, covering the craters**
- **The special case (???) of "Plate Tectonics" on Earth**
- **The Permian Triassic Impact Event which "overprinted" Earth's previous surface structure globally !! (H. K. Hahn)**

➔ see my webside : www.permiantriassic.de or read my Study !!

The biggest Impact Craters on Earth



Name	Diameter in Kilometer	Age in million years	Visible on surface ?	Location
Vredefort	300	2.023	Yes	Africa
Sudbury	250	1.850	Yes	North-America
Chicxulub	180	65	No	North-America
Woodleigh	120	370	No	Australia
Manicouagan	100	214	Yes	North-America
Popigai	100	35	Yes	Asia
Acraman	90	590	Yes	Australia
Chesapeake Bay	85	35	No	North-America
Puchezh-Katunki	80	167	No	Europe
Morokweng	70	145	No	Africa
Kara	65	70	No	Asia
Beaverhead	60	600	Yes	North-America
Siljan	55	370	Yes	Europe
Tookoonooka	55	128	No	Australia
Charlevoix	54	357	Yes	North-America
Karakul	52	5	Yes	Asia

Craters with diameters ≥ 150 km (pink)

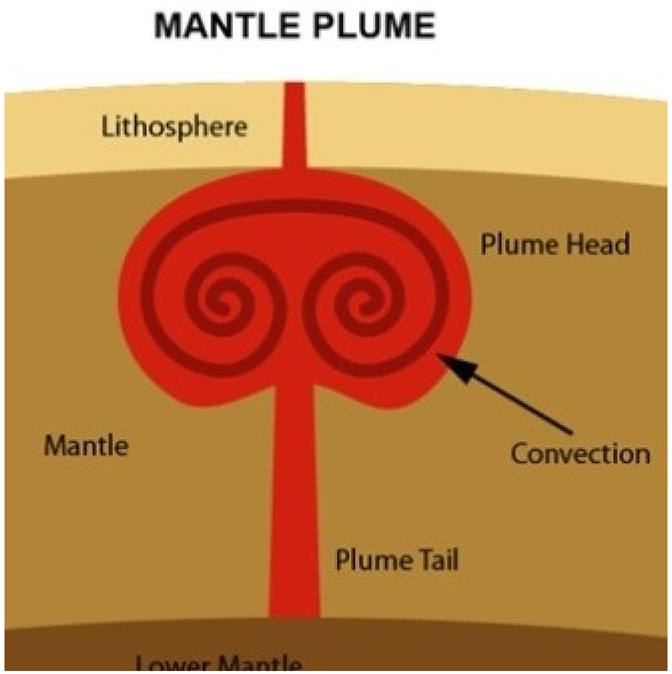
Craters with diameters 100 - 150 km (yellow)

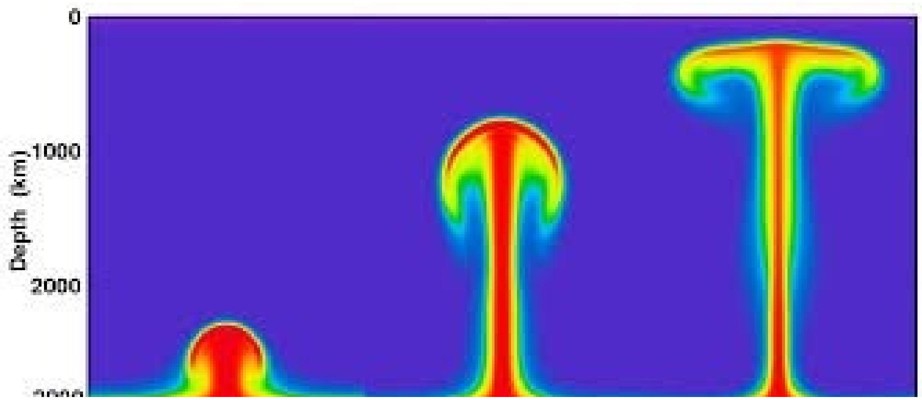
Craters with diameters 50 - 100 km (cyan)

<u>The current theory says</u> : Mantle Plumes are the cause for Plate Tectonics on Earth

→ According to the theory big mantle plumes cause the break-up of Supercontinents

A mantle plume is the upwelling of hot rock within the Earth's mantle

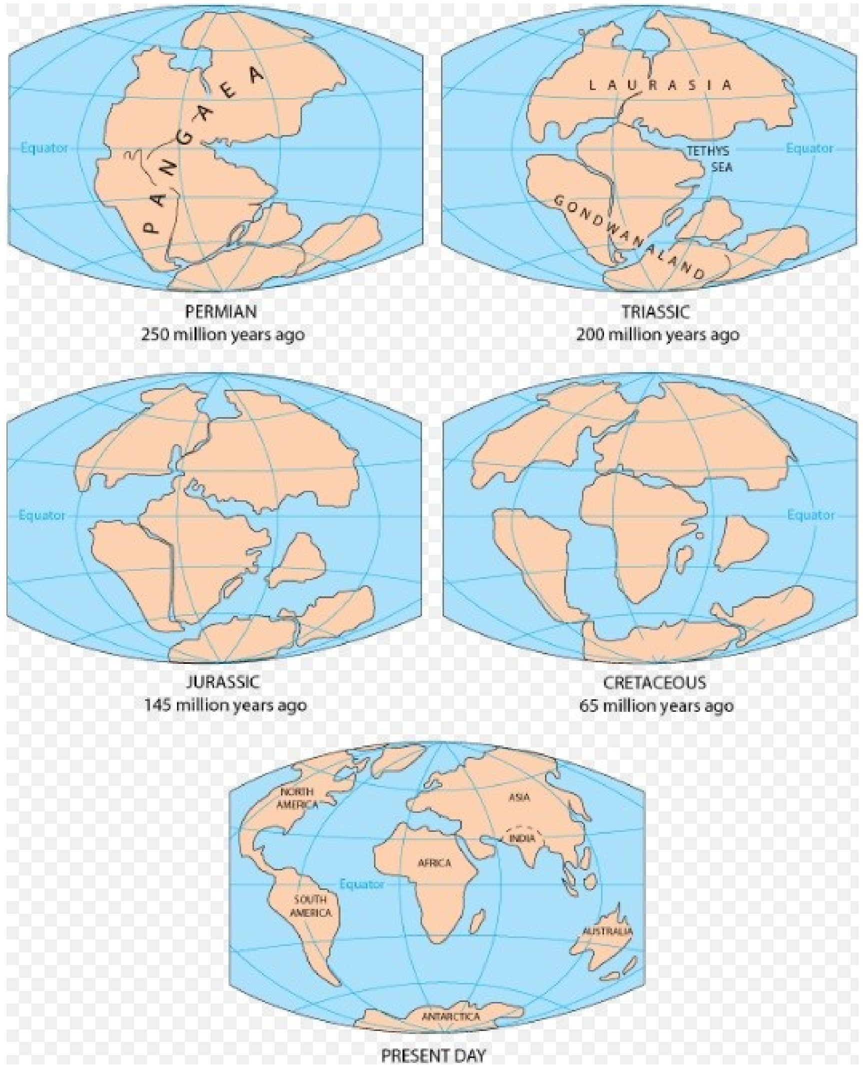




A **supercontinent cycle (Wilson-Cycle)** is the quasi-periodic aggregation and dispersal of Earth's continental crust. Or in other words : The formation of a supercontinent and then later the break-up of the supercontinent → caused by a big mantle plume.

One complete supercontinent cycle is said to take 300 to 500 million years.

Break-up of the Supercontinent Pangea :



Impact Craters and their Ejecta Patterns

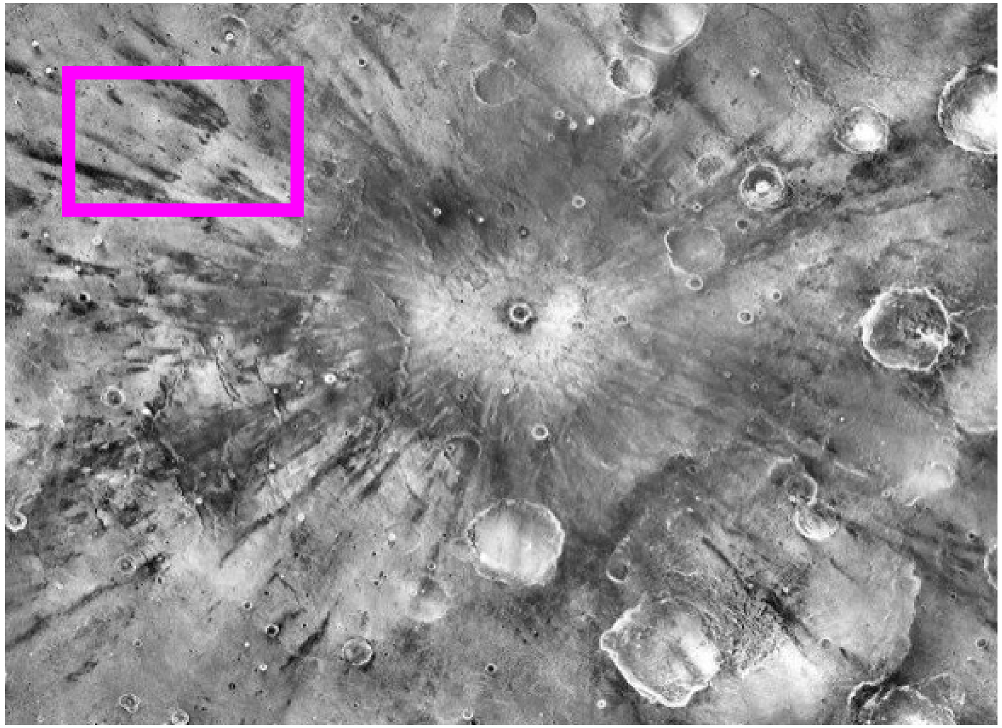
Without atmosphere : (e.g. on the Moon)

→ Craters produce thin linear Ejecta Rays

Moon Crater

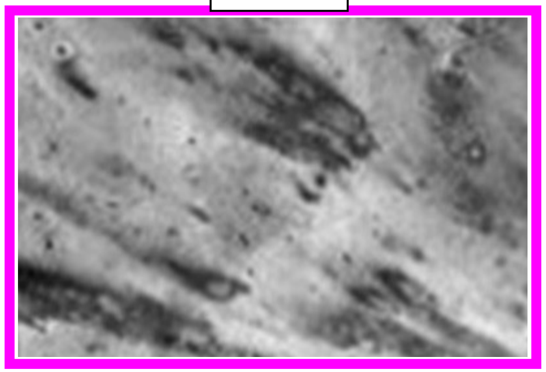
With atmosphere : (e.g. on Mars)

→ Craters produce thick "lumpy" Ejecta Rays



Gratteri Crater on Mars

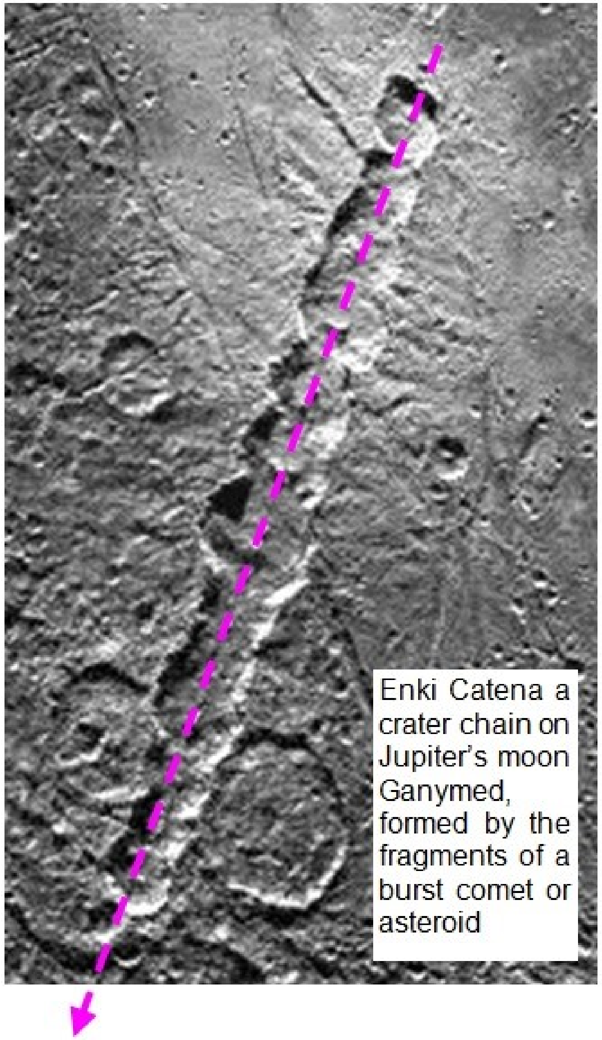
Detail



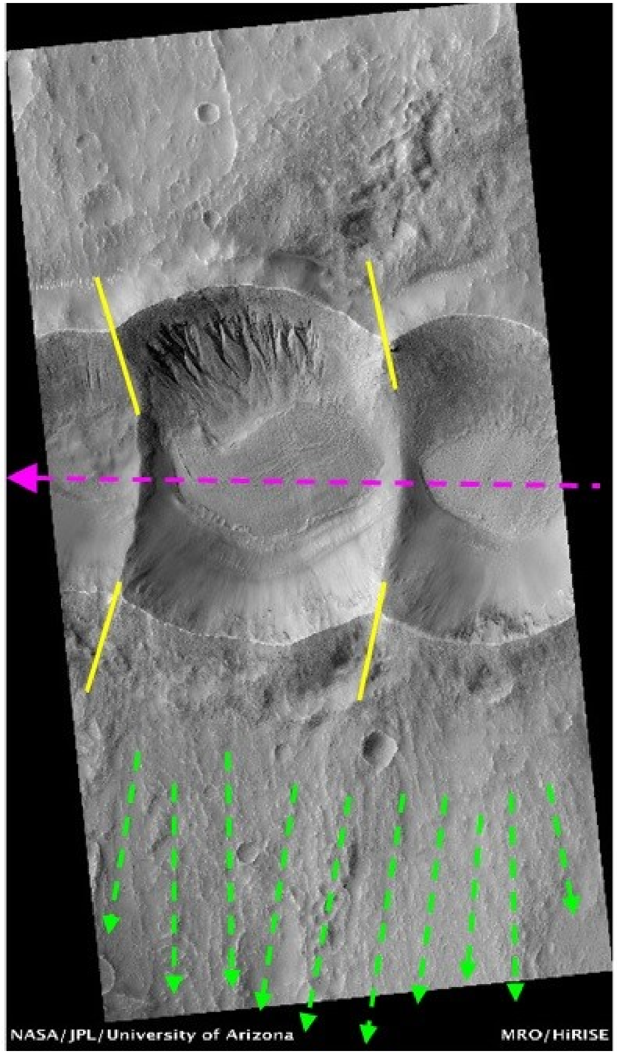
Note the shape of the secondary impact areas caused by the „lumpy" ejected material

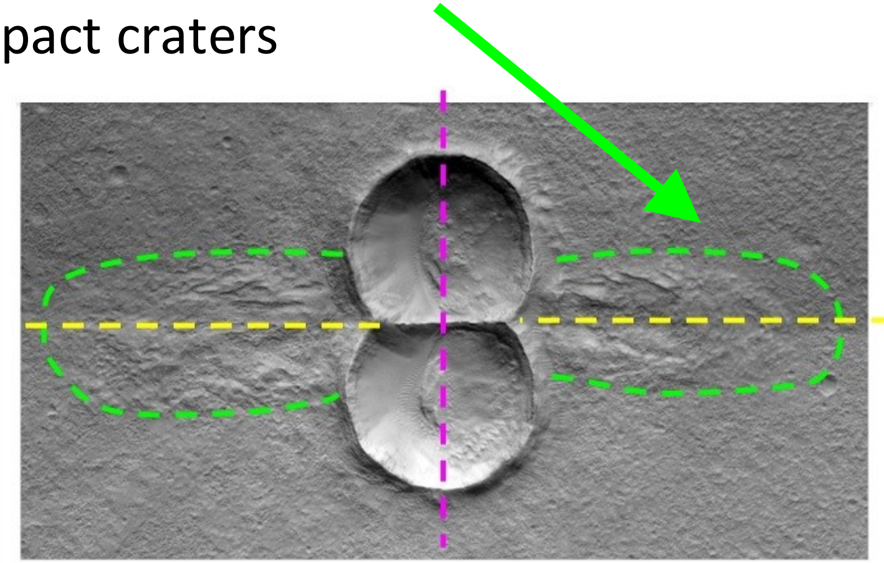
Crater-Chains cause „compressed“ Ejecta Rays

→ the ejecta material accumulates along the intersection zones of the spherical shock-waves caused by the different impact craters



Enki Catena a crater chain on Jupiter's moon Ganymed, formed by the fragments of a burst comet or asteroid

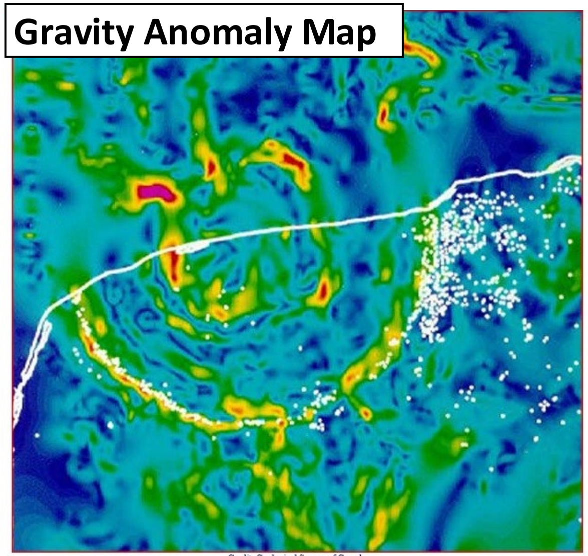




22. On to Mars next - this image shows a remarkable double crater with a shared rim and North-South trending ejecta deposits. These two craters must have formed simultaneously. Image acquired in February, 2011 by NASA's High Resolution Imaging Science Experiment (HiRISE), a camera on board the Mars Reconnaissance Orbiter (MRO). (NASA/JPL/University of Arizona)# #

Gravity Anomaly- & Magnetic Anomaly- Maps → the key to find Impact Craters

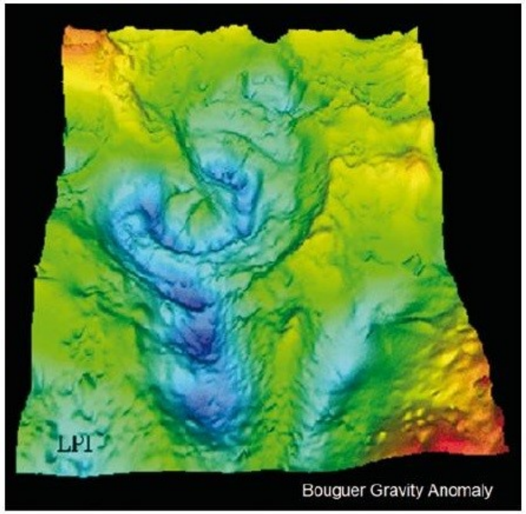
Chicxulub Crater Ø 180 km :



Credit: Geological Survey of Canada

Gravity anomaly map of the Chicxulub Crater area. Red and yellow indicate gravity highs; green and blue indicate gravity lows. The white line indicates the coast of the Yucatan Peninsula. White dots are sinkholes, called "cenotes."

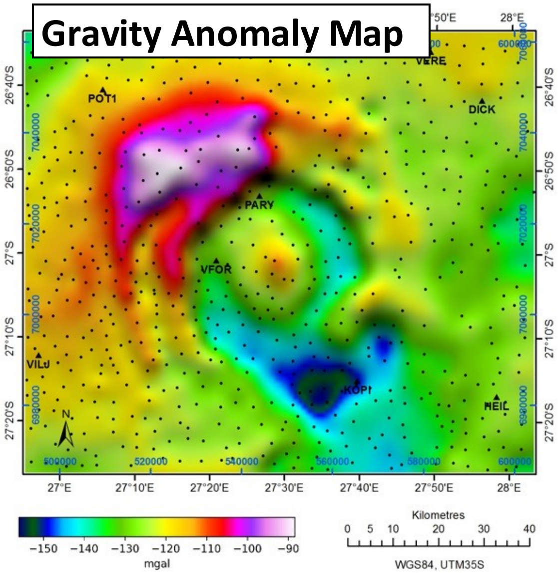
A positive gravity anomaly (red) exhibits more gravity than predicted by the model — suggesting the presence of a sub-surface positive mass anomaly, while a negative gravity anomaly (blue) exhibits a lower value than predicted — suggestive of a sub-surface mass deficit



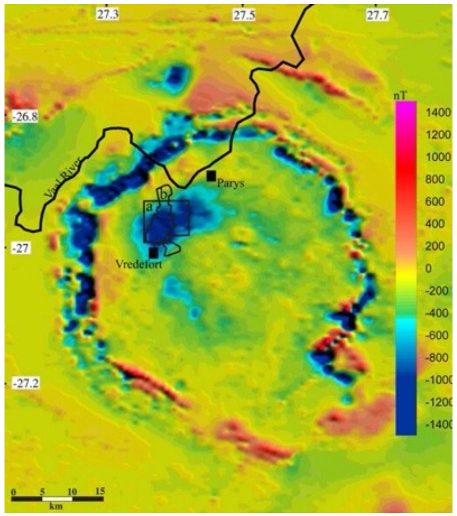
The Chicxulub impact crater is part of a select group of unique geological sites, being a natural laboratory to investigate crater formation processes and global effects of large-scale impacts. Chicxulub is one of only three multi-ring craters documented in the terrestrial record and impact has been related to the global environmental/climatic effects and mass extinction that mark the Cretaceous/Paleogene (K/Pg) boundary. The crater is buried under ~1.0 km of carbonate sediments in the Yucatan peninsula. The buried structure was initially identified from geophysical surveys of the PEMEX oil exploration program in southeastern Mexico. On the surface its influence is marked by the circular ring of cenotes that have formed from differential compaction and fracturing between the impact breccias and surrounding limestone sequences. The crater is about ~200 km in rim diameter, half on-land and half off-shore with geometric center at Chicxulub Puerto, making it possible to use land, marine and aerial geophysical methods. The Yucatan carbonate platform is an ideal place to have the crater, tectonically stable with no volcanic activity, having formed by slow deposition of carbonate sediments. These characteristics permit high resolution imagery of the crater underground structure with unprecedented detail. The impact and crater formation occur instantaneously, with excavation of the crust down to ~25 km depths in fractions of a second and lower crust uplift and crater formation in the next few hundred seconds. Energy release results in intense fracturing and deformation at the target site, generating seismic waves traveling the whole Earth. Understanding the physics of impacts on planetary surfaces and modeling of crustal deformation and rheological behavior of materials at high temperatures and pressures remain major challenges in geosciences. The K/Pg ejecta layer is the only global stratigraphic marker in the geological record, allowing correlation of events worldwide. In the last 20 years much has been learned about the Chicxulub crater and the K/Pg boundary; however what is perhaps most interesting are the questions remaining, which include fundamental aspects of Chicxulub impact and its environmental effects.

Figure 2. Oblique 3-D representation of Bouguer gravity anomaly map over the Chicxulub crater (from Sharpton *et al.*, 1993). Observe the presence of a circular concentric anomaly with a high in the central zone.

Vredefort Crater Ø 300 km :



Magnetic Anomaly Map of Vredefort Crater :



The Vredefort Crater environment → a source area of large Gold-fields :

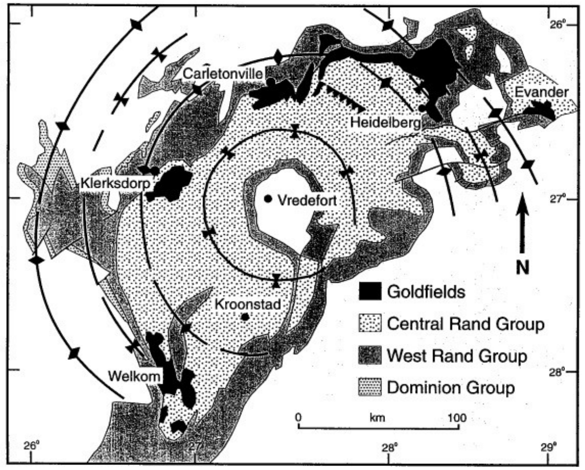


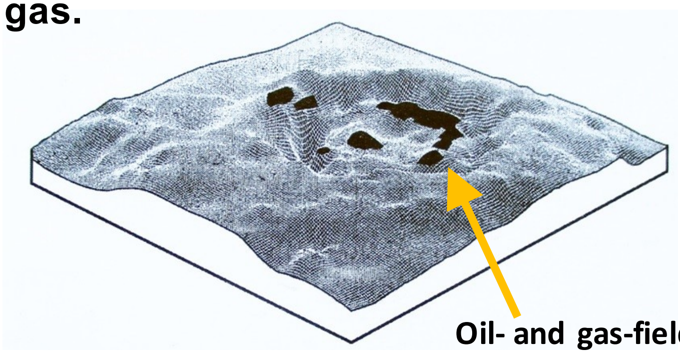
Figure 3. Geologic sketch map of the Witwatersrand basin, South Africa, showing the main gold and uranium fields of the Central Rand. Also shown are the concentric structures associated with the ≈300-km Vredefort impact structure. See text for details.

The ø14 km Ames Impact Crater / USA → A source of productive oil- & gas-fields

Oil-fields within the Ames Impact Crater in Oklahoma / USA :

About 100 wells have been drilled at Ames with a success rate of 50%. The reserves at Ames exceed 50 million barrels of oil and 15-20 billion cubic feet of gas.

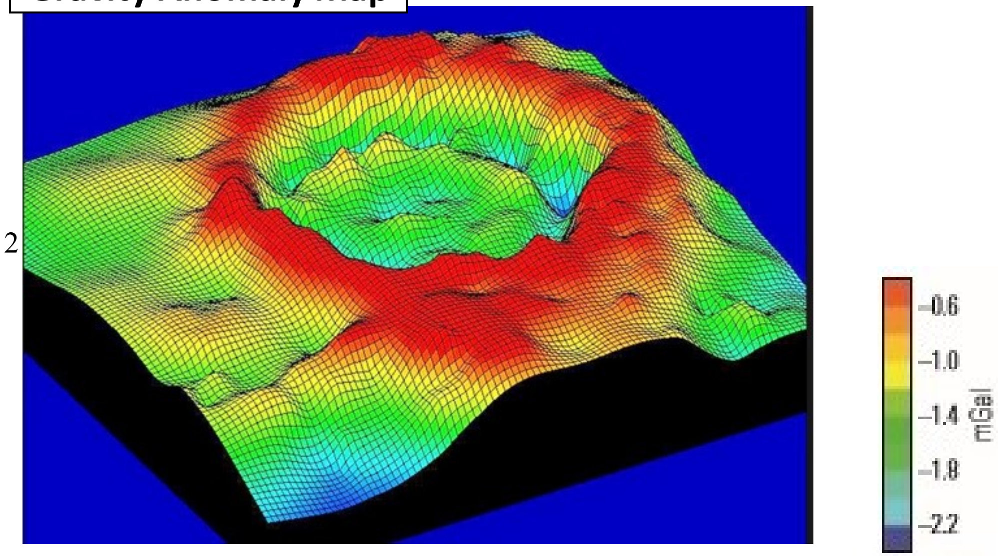
The Ames Impact crater, which has a central uplift, is buried under 3 km of Ordovician Oil Creek shale and more recent sediments.



Oil- and gas-fields In the crater (black)

Gravity Anomaly Map

2



^ Gravity signature of the Ames crater. Bouguer gravity anomalies indicate lateral subsurface density variations. In sedimentary rocks impact craters that have diameters similar to that of the Ames structure typically produce a negative gravity anomaly. A negative anomaly signifies material of low density. (Image courtesy of Judson Ahern.)

Impact Craters are potential exploration targets:

→ **Impact Craters not only produce the required <u>structural traps</u>** (by impact induced fracturing and brecciation of the rock under the crater, which results in very effective porosity & permeability), **but also the <u>palaeo-environment</u> for the <u>deposition of post-impact shales</u> that provide the oil & gas**, upon subsequent burial and maturation.

Oil- and gas-wells in the Crater :

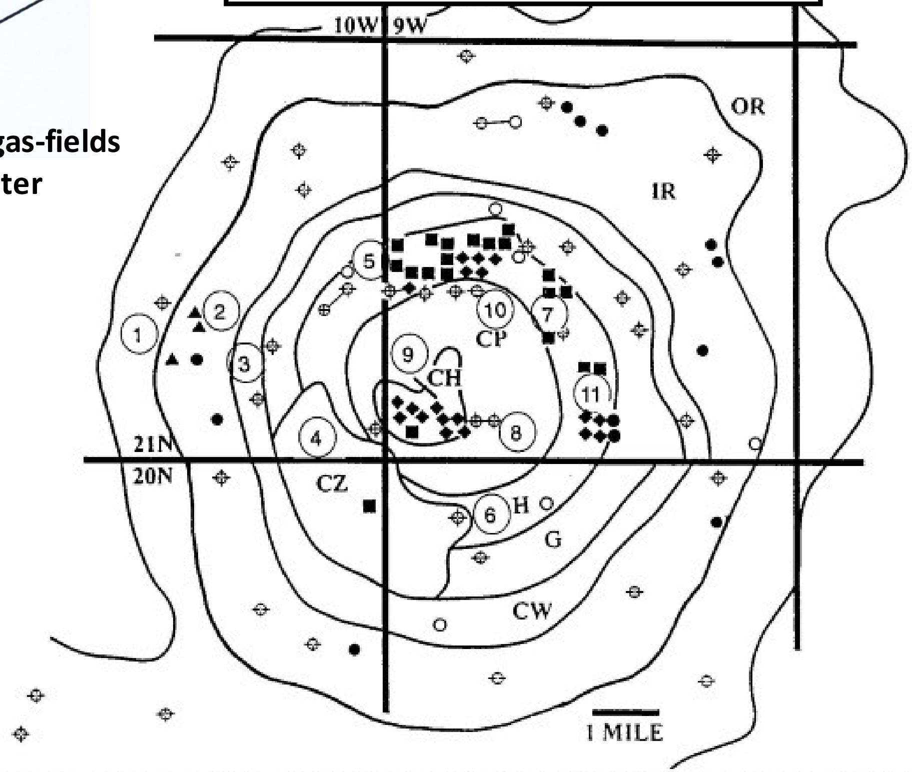


Figure 4. Distribution of production and well tests (as of January 1995) and morphological boundaries of the Ames impact structure as defined by the concentric solid lines. Well symbols: Open circle with cross—dry hole. Straight line from well symbols—horizontal well. Open circle—drilling or testing hole. Solid circle—production from West Spring Creek Formation and/or Kindblade Formation. Solid triangle—production from ejecta and/or fallout. Solid square—production from dolomite in crater. Solid diamond—production from granite breccia. Crater morphology abbreviations: IR—inner rim, OR—outer rim, CW—crater wall, G—graben, H—horst, CZ—collapse zone, CP—central pit, CH—central high. Note the apparent right-lateral offset of the eastern part of the crater wall along the township line between T. 20 N. and T. 21 N. Circled numbers (1–11) represent example vertical sequences as shown in the crater subcrop model (Fig. 2).

Impact Structures (craters) which contain productive Oil- and Gas-fields

Structure	Diameter and Morphology	Age	Hydrocarbon Accumulation	Structural Association
Ames, OK	14 km	450 Ma	• 50 MMbbl oil • 20-60 BCFG • source rock controlled by structure	• karsted rim dolomites • brecciated granite-dolomites of the central uplift and crater floor
Red Wing Creek, N.D.	9 km - C	200 Ma	• 40-70 MMbbl oil recoverable • 100 BCFG recoverable • 12.7 MMbbl oil and 16.2 BCFG total production • provided trap to migrating hydrocarbons	• brecciated Mississippian reservoir in central uplift
Avak, Alaska	12 km - C	3-100 Ma	• 37 BCFG reserves • provided trap to migrating hydrocarbons	• listric rim faults which form structural traps in competent blocks
Marquez, Tx	22 km - C	58 Ma	• some gas production	?
Newporte, N.D.	3.2 - C	500 Ma	• oil shows in Cambrian-Ordovician sands	• highly fractured basement
Calvin, Mich.	?	?	• 600 MMbbl oil	?
Steen, AB	22 km - C	95 Ma	• 600 bbl per day	• rim complex
Viewfield, Sask.	2.4 km - S	Triasic-Jurassic	• 400 bbl per day • 20 MMbbl recoverable oil • formed trap to migrating hydrocarbons	• Mississippian carbonate breccia • Mississippian in the rim
Tookoonooka, Australia	55 km	?	• forms shadow zone to migrating hydrocarbons from Eromanga Basin	• potential for stratigraphic traps

Table 1. Structures associated with hydrocarbon accumulation. Simple and complex crater morphology is denoted by an "S" and "C" respectively. (Sources: Isaac and Stewart, 1993; Grieve and Masaitis, 1994; Hodge, 1994; Buthman, 1995).

diameter range of impact structures : Ø 2 - 55 km

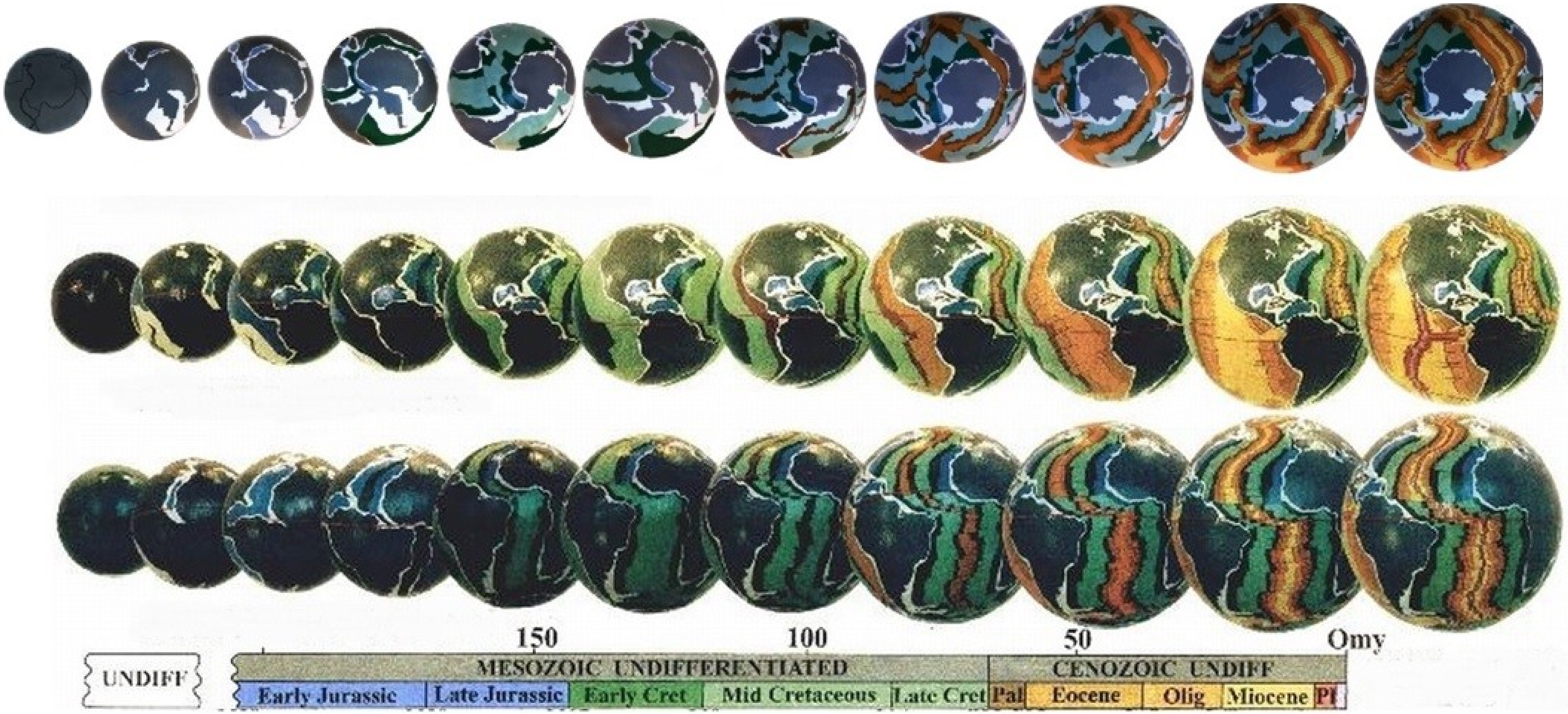
age range of impact structures : ~ 50 – 500 Ma

"Expansion Tectonics" Earth Model :

From James Maxlow & other geologists and geo-physicists who support this Theory :

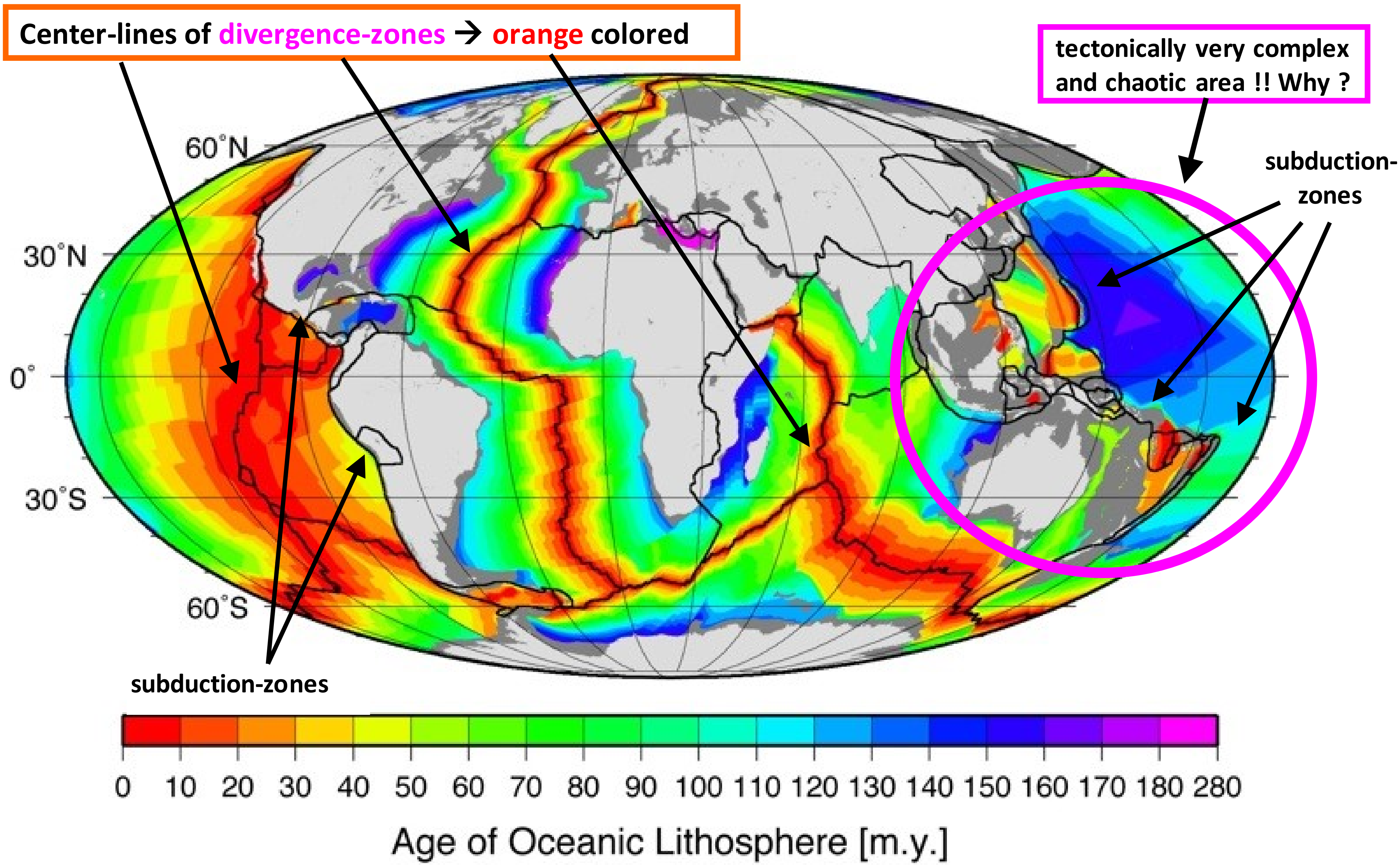
➔ According to this theory Earth is slowly expanding for the last 200 million years.
However the cause for this expansion is not clear. **(➔ the cause was the PT-Impact ! H.K.Hahn !)**

Web-Links : L1, L2+L3, L4, L5, L6, L7+L8, L9, L10



The Ocean-Floor-Age Map clearly shows more divergence !- than subduction-zones

→ **Note:** Subduction-Zones (& volcanic zones) are nearly exclusively located around the **Pacific Ocean** !



Problems of the current “Plate-Tectonic“ Earth-Model :

1. There is no adequate driving force for plate tectonics.

Perhaps the biggest problem with plate tectonics is the idea of whole mantle convection. No evidence exists to support mantle convection, but the physical laws to contradict such a process are overwhelming.

2. No adequate explanation exists for how plate tectonics began or how subduction originated?

Nowhere in literature any scientist adequately addresses how the observed “plates” came into existence in the first place

3. There is no Panthalassan Ocean Crust left. Nearly 70 % of Earth’s surface area disappeared without trace !

The supercontinent Pangaea was surrounded by the superocean Panthalassa around 250 Ma ago, which covered almost 70 % of Earth’s surface. Since that time the complete Panthalassan Ocean Crust disappeared because of subduction ! This is Impossible!!

4. Plate tectonics cannot adequately explain the configuration or large number of volcanoes (seamounts and guyots) in the Pacific basin.

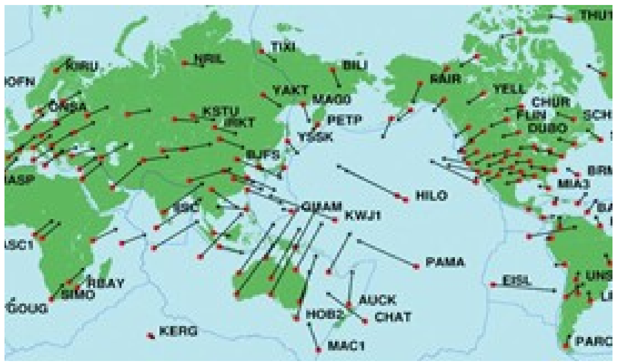
More than 40,000 sumarine volcanoes (many of which are seamounts) are located in the Pacific basin; whereas very few seamounts are found in the Atlantic. Plate tectonics cannot answer this strane phenomenon.

5. How can subduction zones and spreading centers exist at the same location?

There are three locations in the Pacific basin where trenches and ridges are concomitant. These locations are at: 50.5oN latitude and 130oW longitude, 20.5oN latitude and 107oW longitude, and 46.3oS latitude and 75.7oW longitude. The same— or even closely spaced—mantle material cannot be going both up and down at the same time and at the same place.

6. Crustal GPS signals on Earth do not support plate tectonics theory.

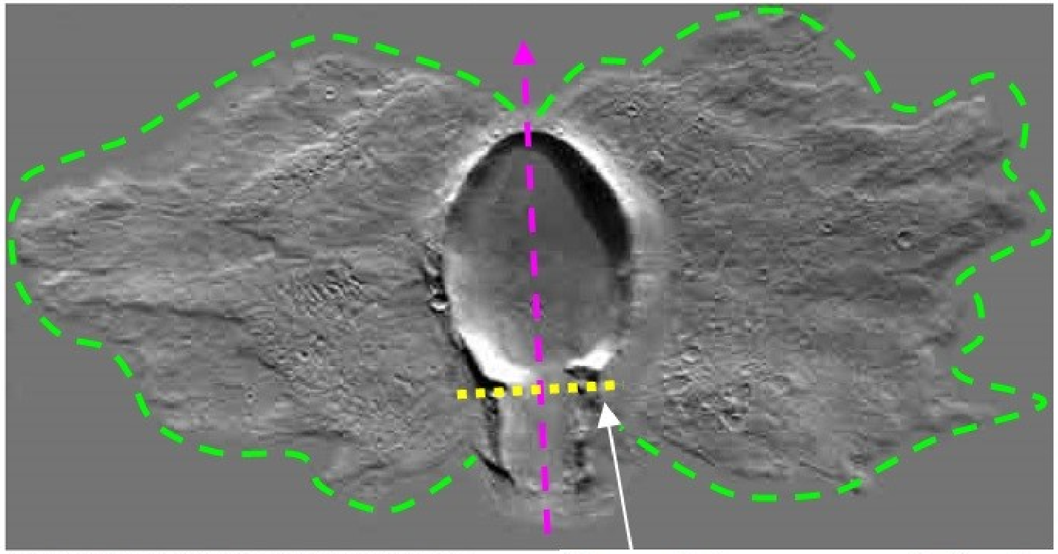
Most surprisingly is the fact that the motions do not conform to rigid “tectonic” plates (the plate borders - outlined in blue in theimage). Even on a globe (spherical surface), the vector directions do not produce a pattern that would conform to rigid plate motion



And there are many other problems with the Plate Tectonic Theory….

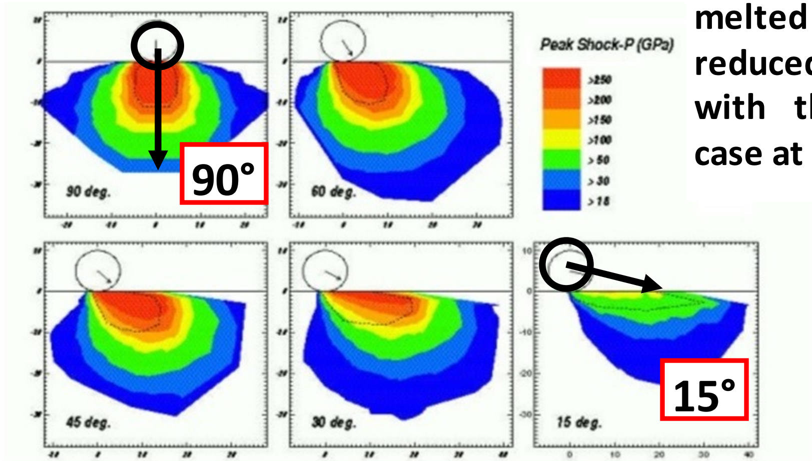
At impact angles < 15° elliptical (oblique) craters are formed, which eject material in two butterfly-shaped „ejecta wings“

At impact angles ≤15° shock pressure in the target rock is much lower, and material melted by the impact is reduced by 90% compared with the vertical impact case at 90° impact angle !!

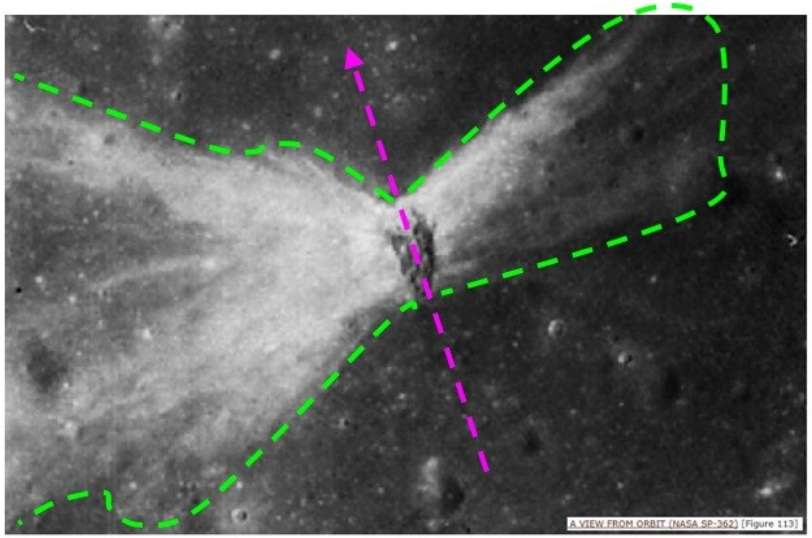


Example Mars Impact with Butterfly Ejecta distribution
Credit: NASA / JPL / ASU / mosaic by Emily Lakdawalla

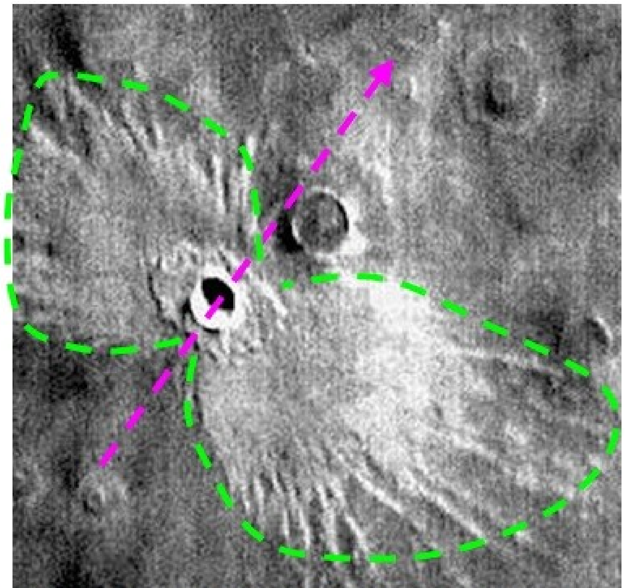
blow-out rim on rear end of crater



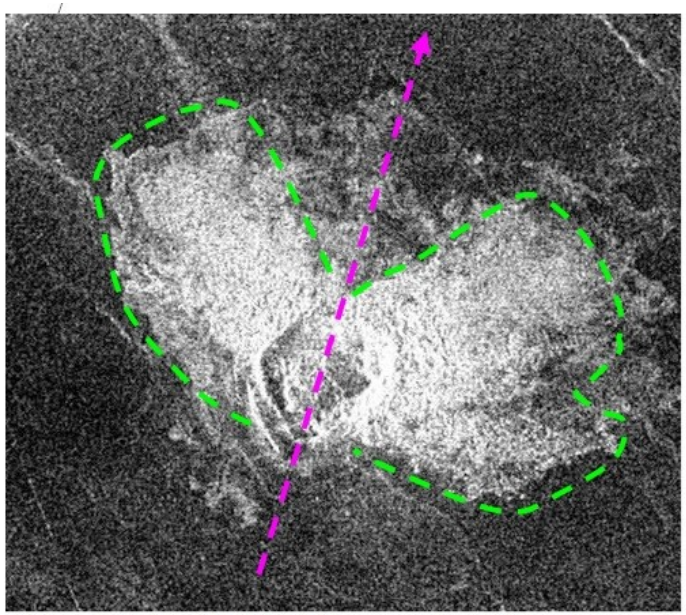
In the range of shock pressures at which most materials of geologic interest melt or begin to vaporize, we find that the volume of impact melt decreases by at most 20% for impacts from 90° down to 45°. Below 45°, however, the amount of melt in the target decreases rapidly with impact angle. Compared to the vertical case, the reduction in volume of melt is about 50% for impacts at 30° and more than 90% for a 15° imapct. These estimates do not include possible melting due to shear heating, which can contribute to the amount of melt production especially in very oblique impacts.



Elliptical Impact Crater on the Moon. The crater is approximately 1 km long and it is surrounded by a Butterfly-shaped Ejecta blanket. It was probably caused by a group of impactors. The main impactor probably already desintegrated when it reached the moon's Roche Limit



Oblique impact on Mars with a butterfly ejecta pattern



A 50 km wide radar image showing an 8 km diameter impact crater on Venus. The asymmetric distribution of the bright ejecta indicates that this crater was formed by an oblique impact, by a approx. 200 m object arriving from the south at a speed of maybe 20 km/s.

A simulated Impact at a shallow impact angle ≤ 15°

→ Note the two powerful „ejecta-wings“ (red) produced by the impact !