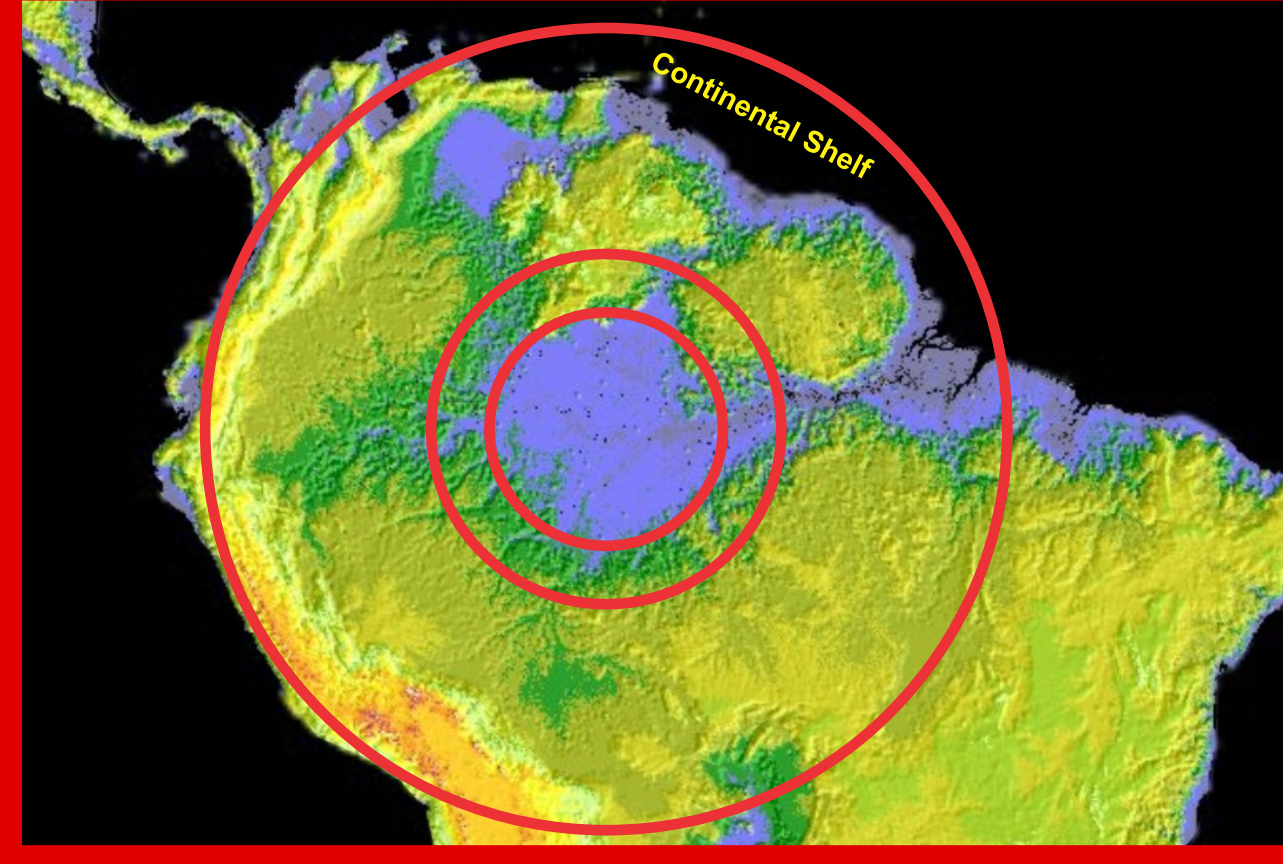


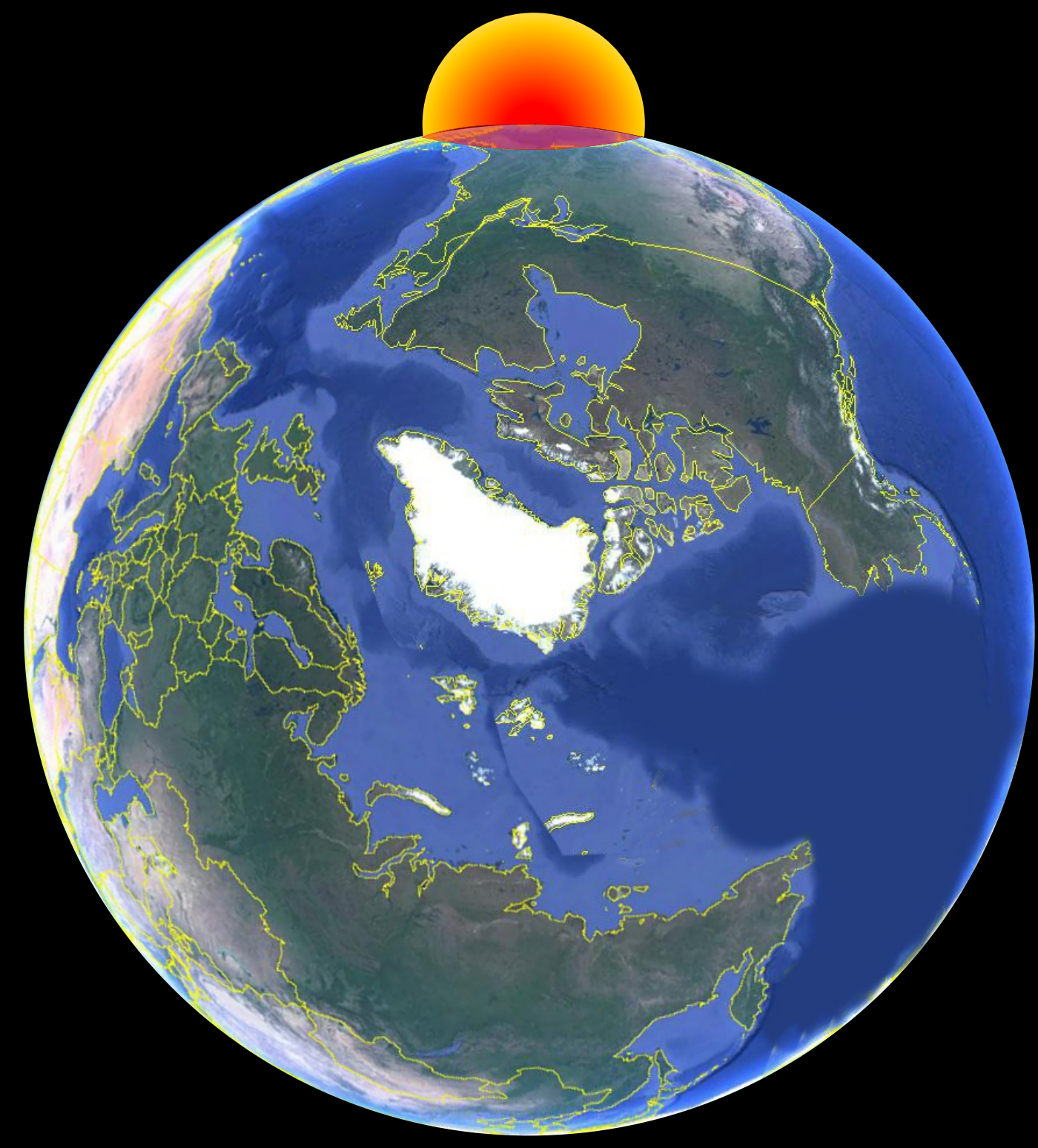
# P33D-2191

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# Is Chicxulub too small to be the source of the K/Pg boundary layer and the cause of the dinosaur extinction event and would the Amazon Basin considered as an impact feature fit the evidence better?



## Chicxulub is Too Small



**CHICXULUB:**  
12 km Asteroid, 20km/sec  
A small  
local event

1.2% of the planet  
boiled or burned

It is recognized that  
Chicxulub is too small  
to directly cause an  
extinction event

The K/Pg Boundary Layer's Ir content  
shows that an impact was involved, but  
not which impact.

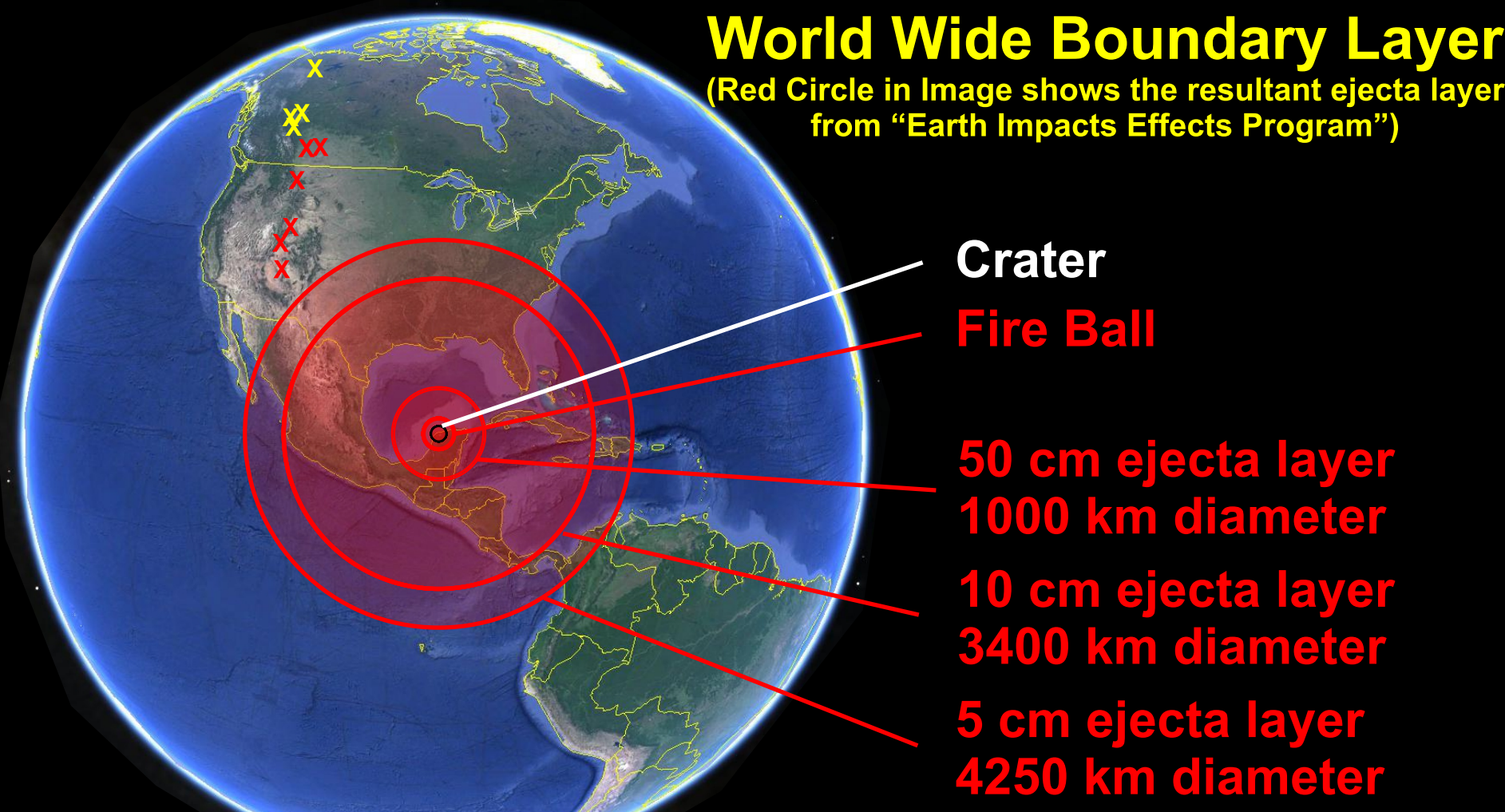
If Chicxulub is the only K/Pg impact, then  
it is necessary to explain the extinction  
event by one or more of the following:

Global warming; sulphur from volcanoes;  
sulphur from the Deccan Traps; ocean  
acidification; ash in the atmosphere; dust  
blocking photosynthesis.

K/Pg Extinction can not be  
explained by Chicxulub alone

## The K/Pg Boundary Layer Impossible for Chicxulub

**World Wide Boundary Layer  
is too thick**

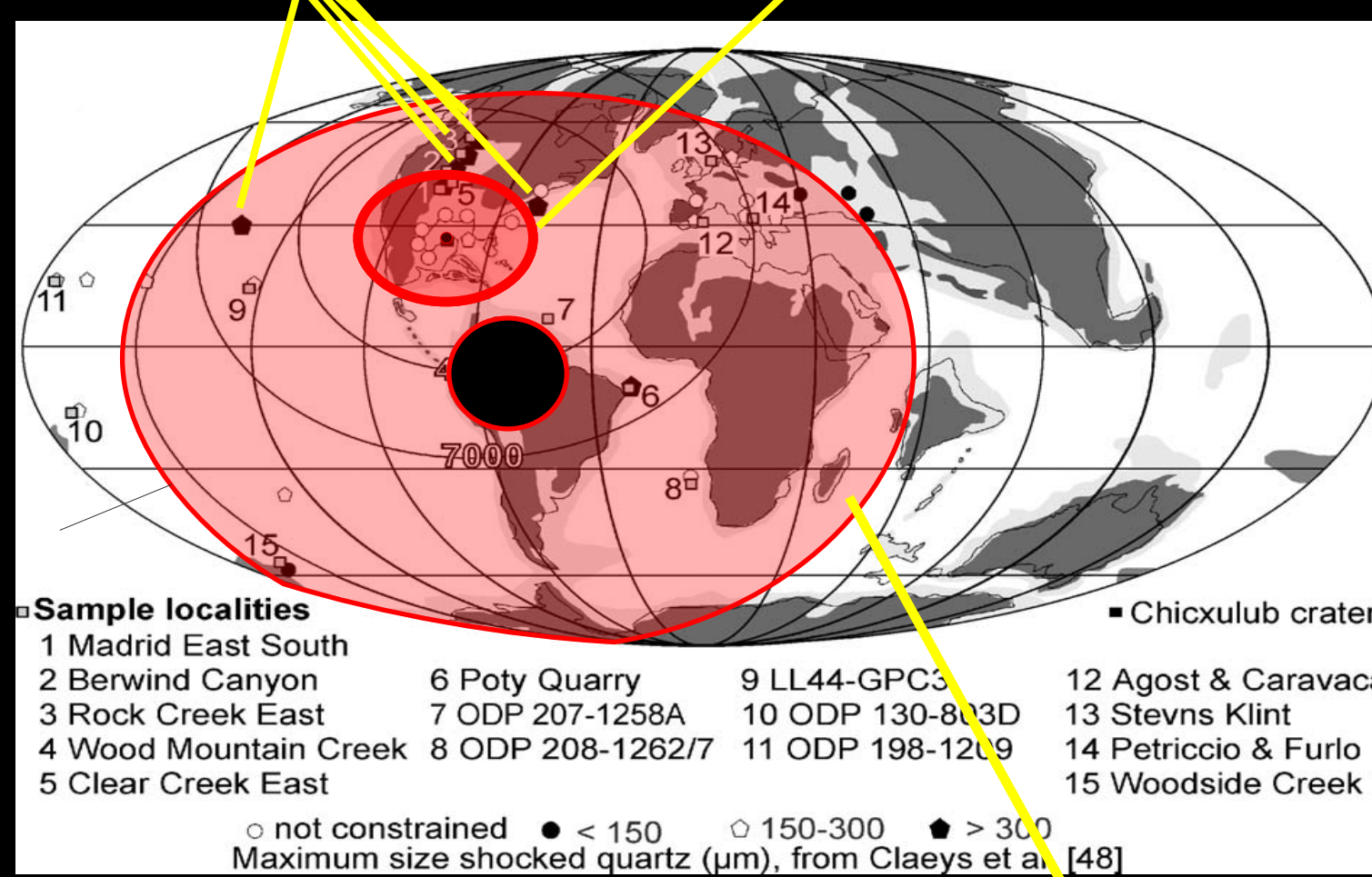


The K/Pg Boundary Layer is ~10 cm in Italy, Spain.  
Chicxulub's max extent of 10 cm layer is 3400 km diameter

**World Wide Shocked Crystals  
requires higher speed,  
larger impact than Chicxulub**

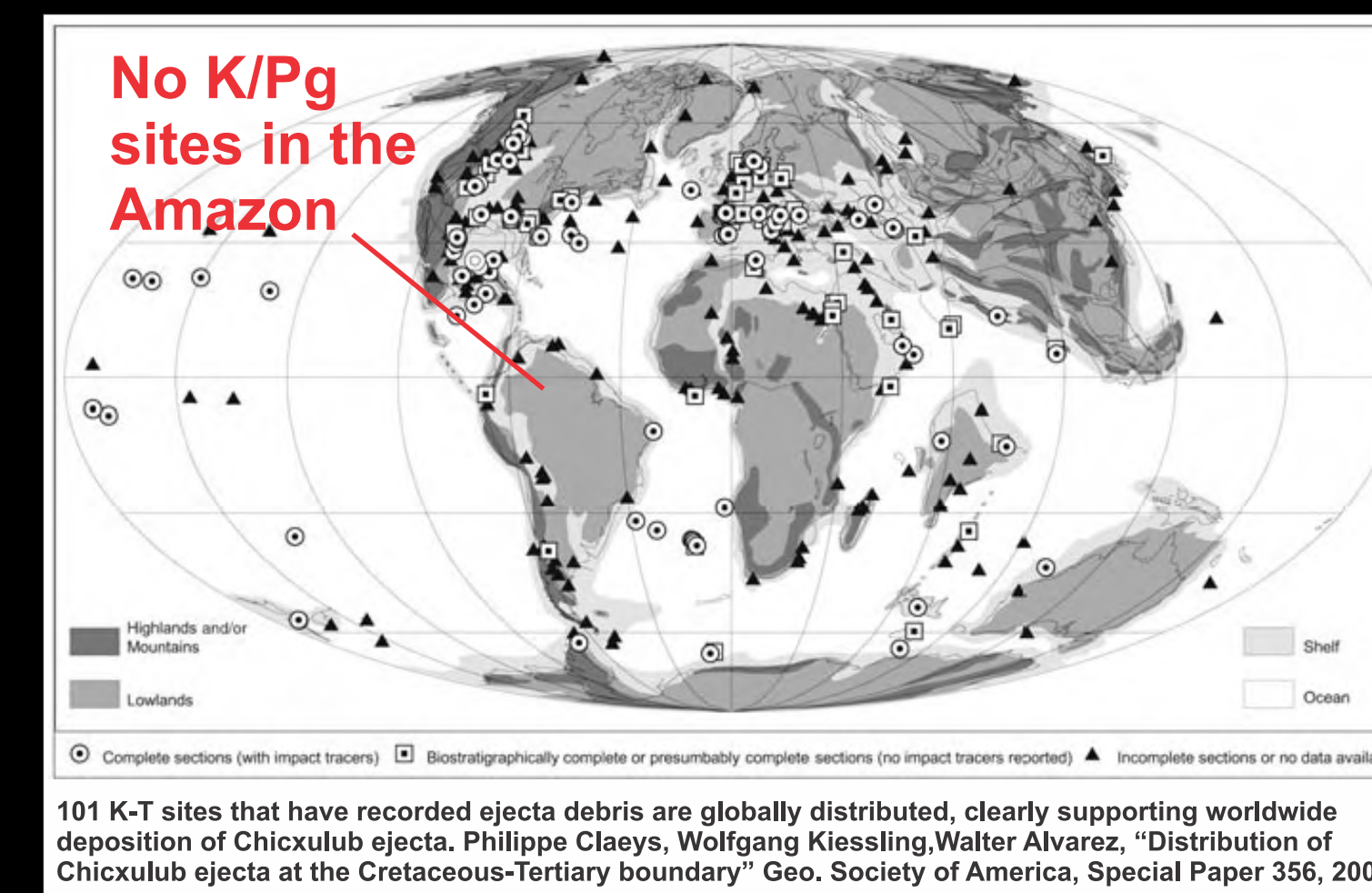
Shocked Quartz  
over 300 microns  
Impossible with Chicxulub,  
Expected from Amazon.

Maximum extent of  
200+ micron  
mean size particles  
from Chicxulub impact  
2000 km radius



Maximum extent of  
200+ micron mean size particles  
from Amazon impact  
9000 km radius

**Missing K/Pg Boundary Layer**

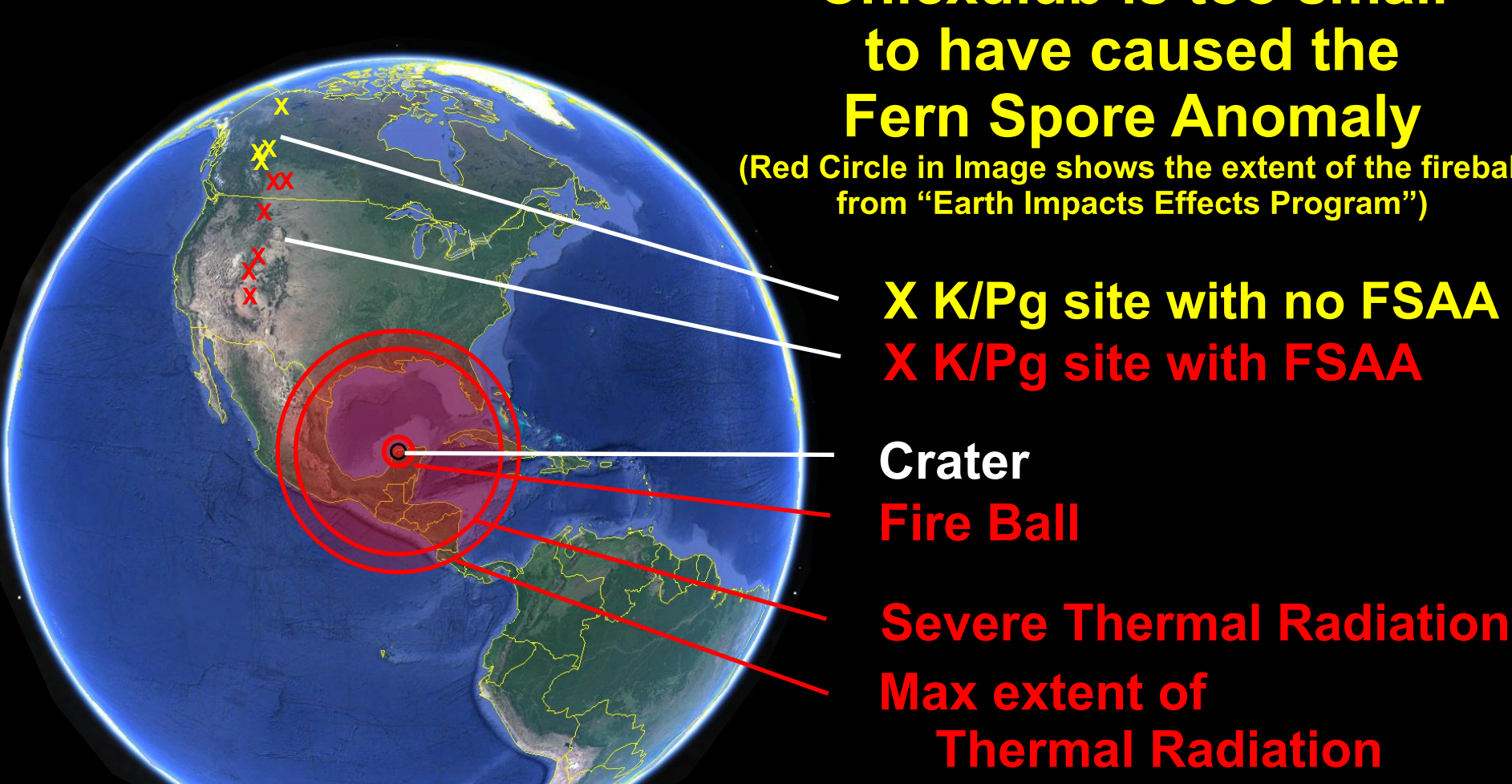


Chicxulub HAS a K/Pg boundary layer  
The Amazon does NOT have a K/Pg boundary layer

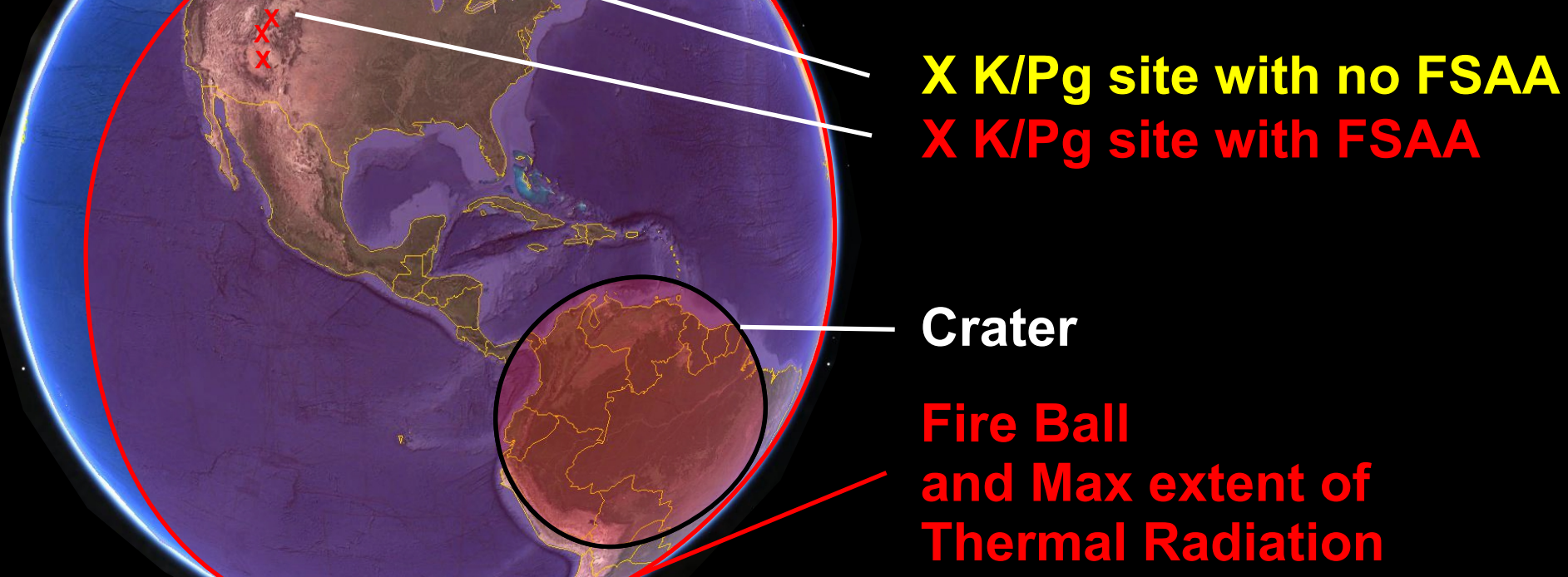
## The Amazon Basin would explain it better

**Fern Spore Anomaly  
Requires fireball over 3500 km**

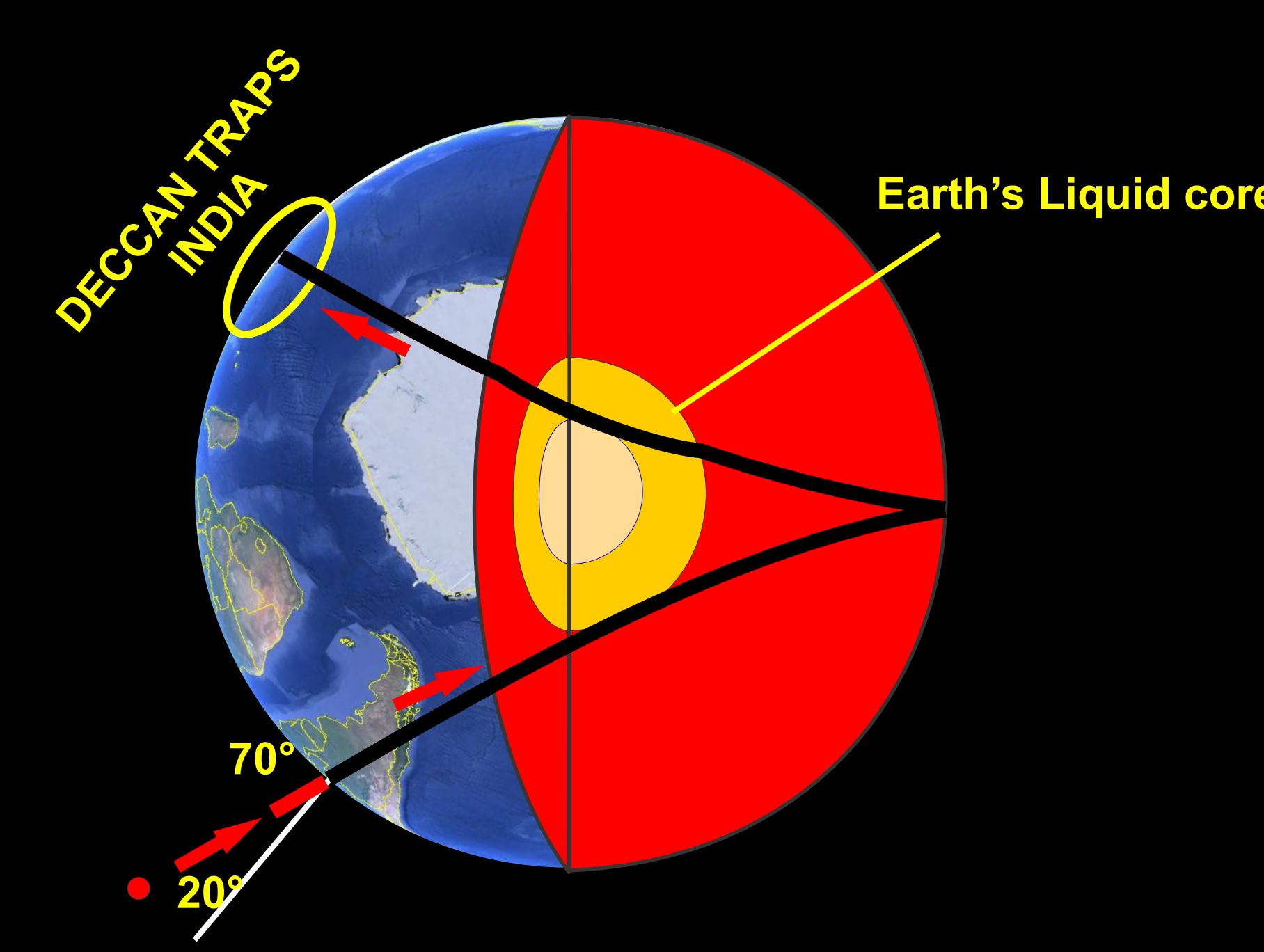
Southern North America has a "Fern Spore Abundance  
Anomaly" assumed to be related to widespread burning of  
forests from heat from the impact and ejecta. (Fleming and  
Nichols, 1990)



The Amazon is precisely  
the right size  
to have caused the  
Fern Spore Anomaly



**Deccan Traps in India would  
result from an Amazon Impact**

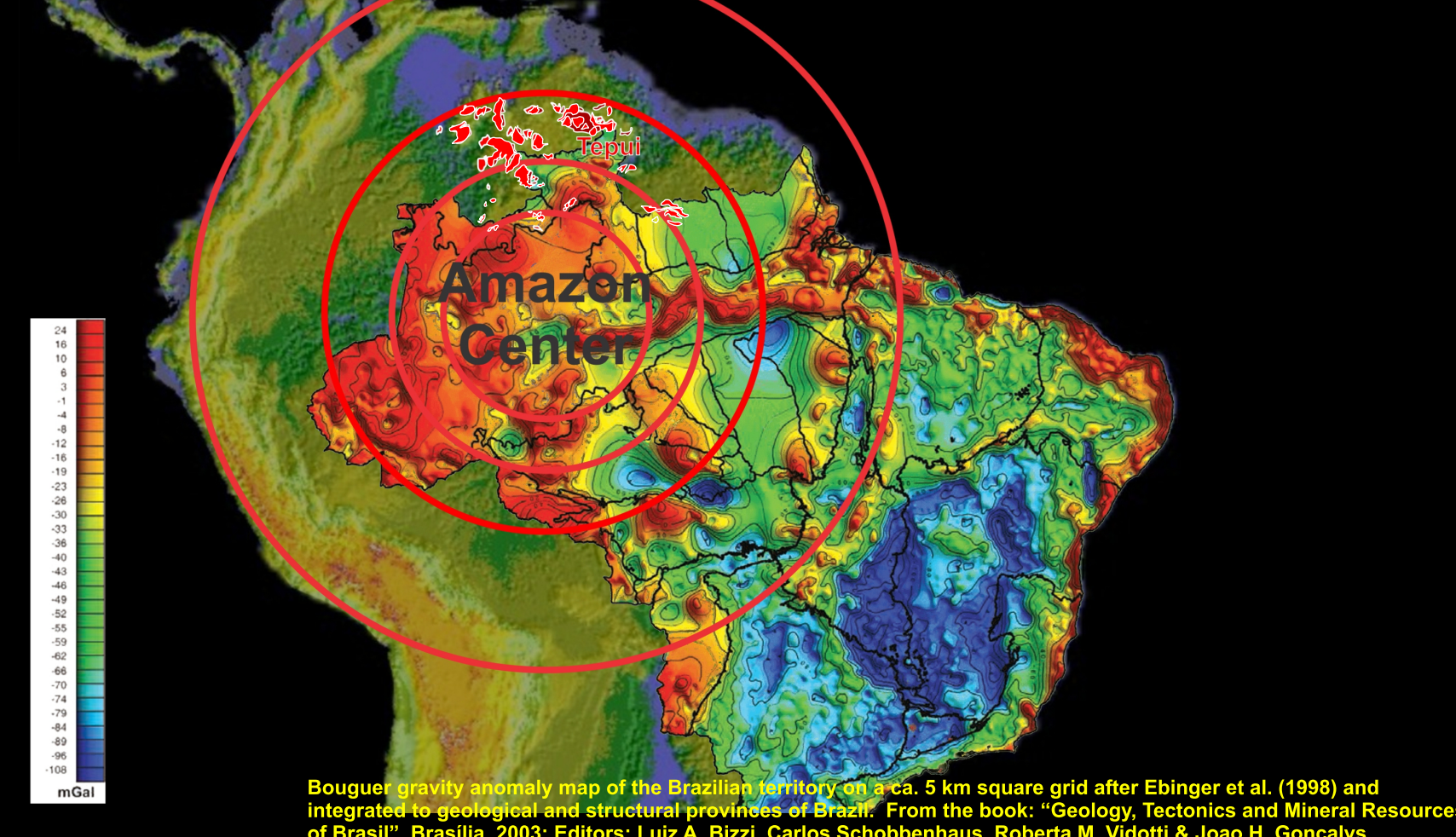


70° Comet Impact: The Shock wave travels through Earth  
and reflects back from the other side. It is partly focused by  
the liquid core of the planet, hitting India, lifting and  
shattering the lithosphere, causing massive earthquakes,  
and massive flows of lava from the mantle onto the surface,  
forming the Deccan Traps.

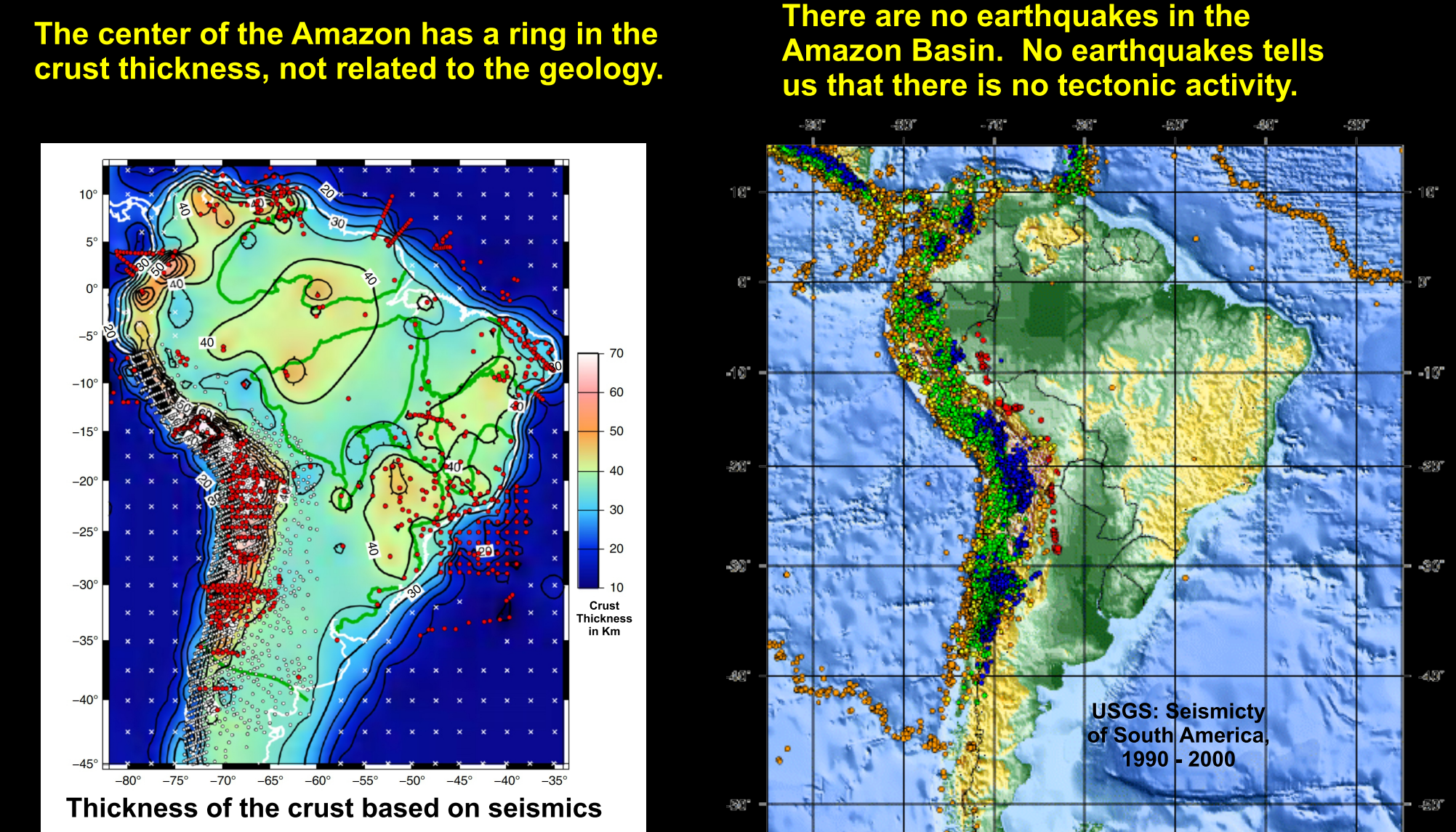
Chicxulub's impact would have minimal effect on India.

## The Amazon's geology and geophysics fit an impact origin

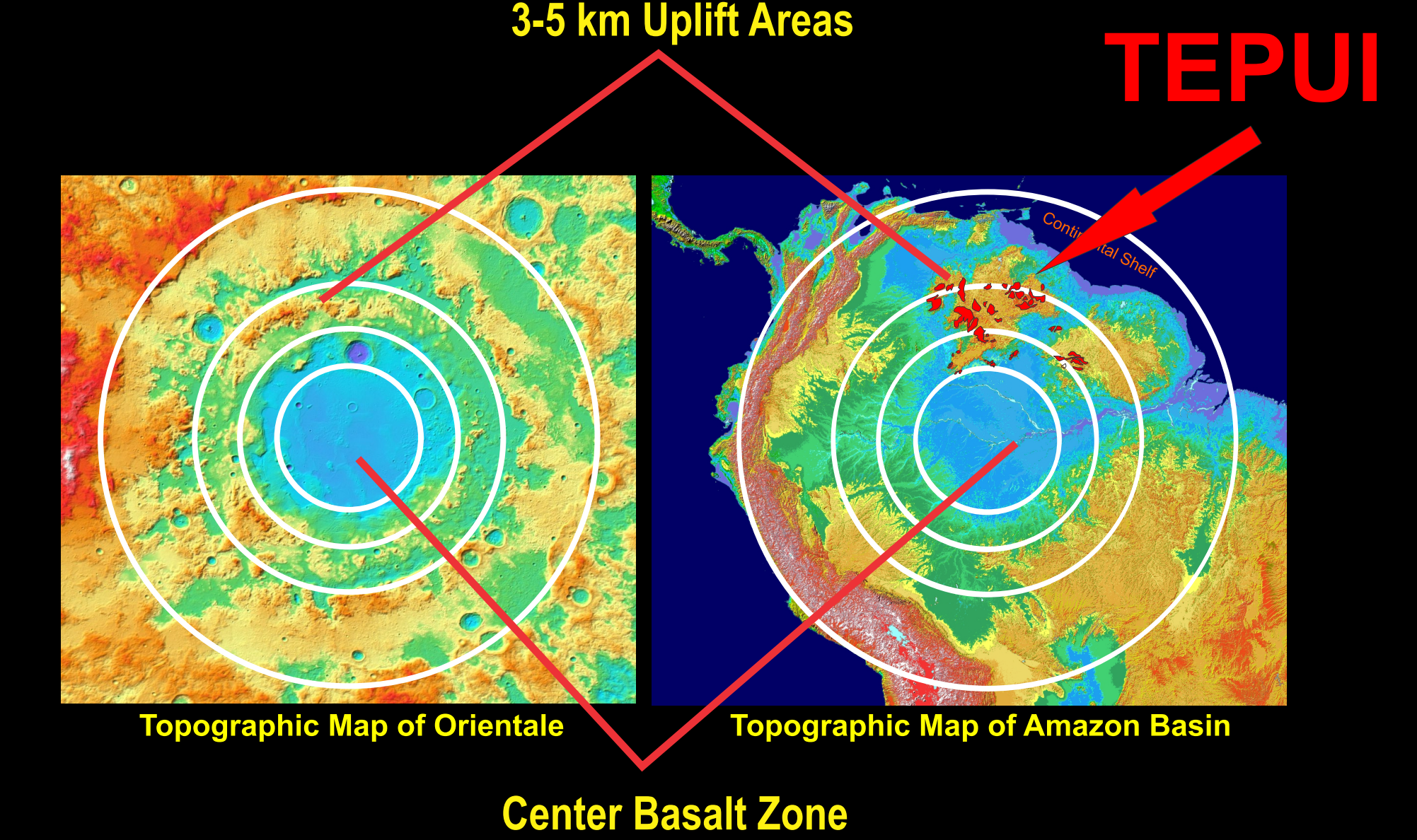
**Bouguer Gravity Map  
shows circular ring structure**



**Crustal Thickness and stability  
indicate impact origin**



**Oriente and Amazon  
have the same ring pattern**



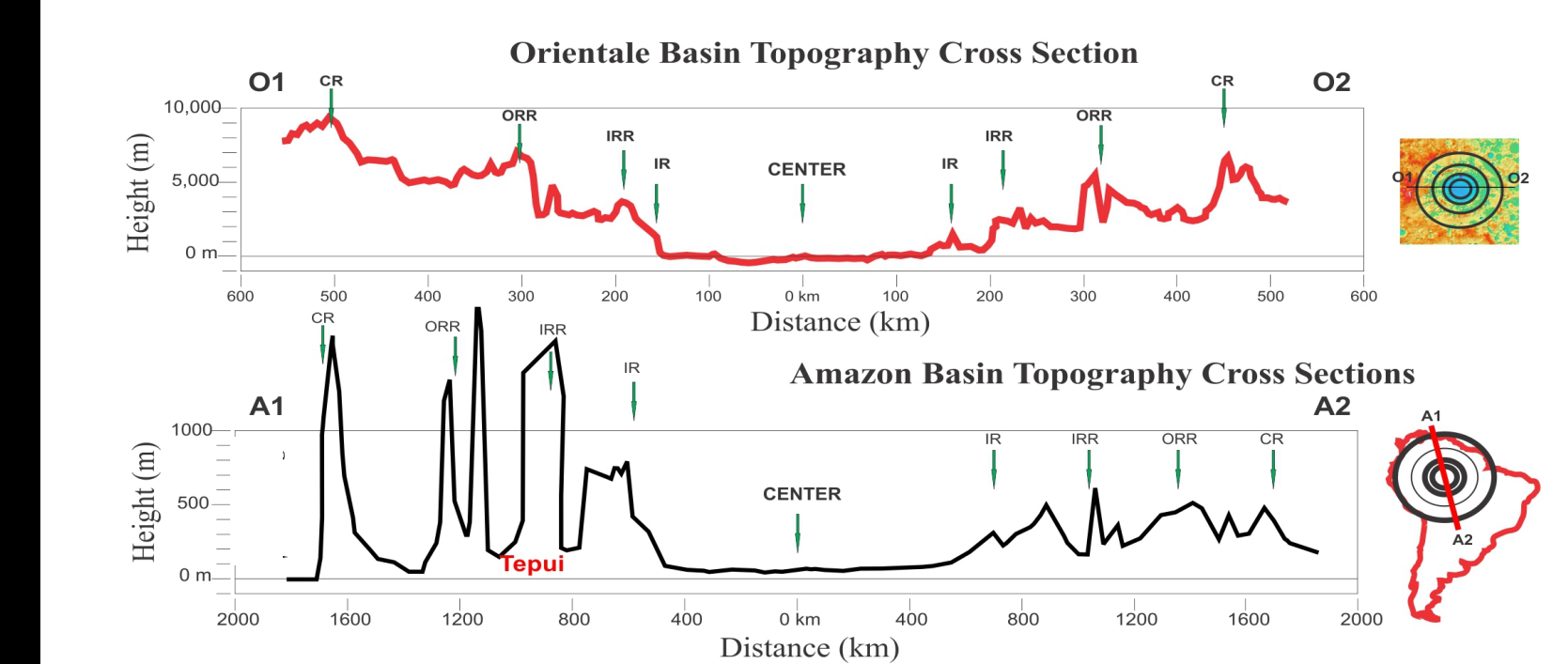
**Tepui: 3km high thrust features in a ring  
corresponding to raised areas in Oriente**



"Tepui" are mesas and highlands of the north east. They are between 1 to 3 km  
height, formed of hard sandstone, severely shattered, weathering in sharp edges.  
They are estimated to have been thrust up 65 my ago.

## The Amazon's geology and geophysics fit an impact origin

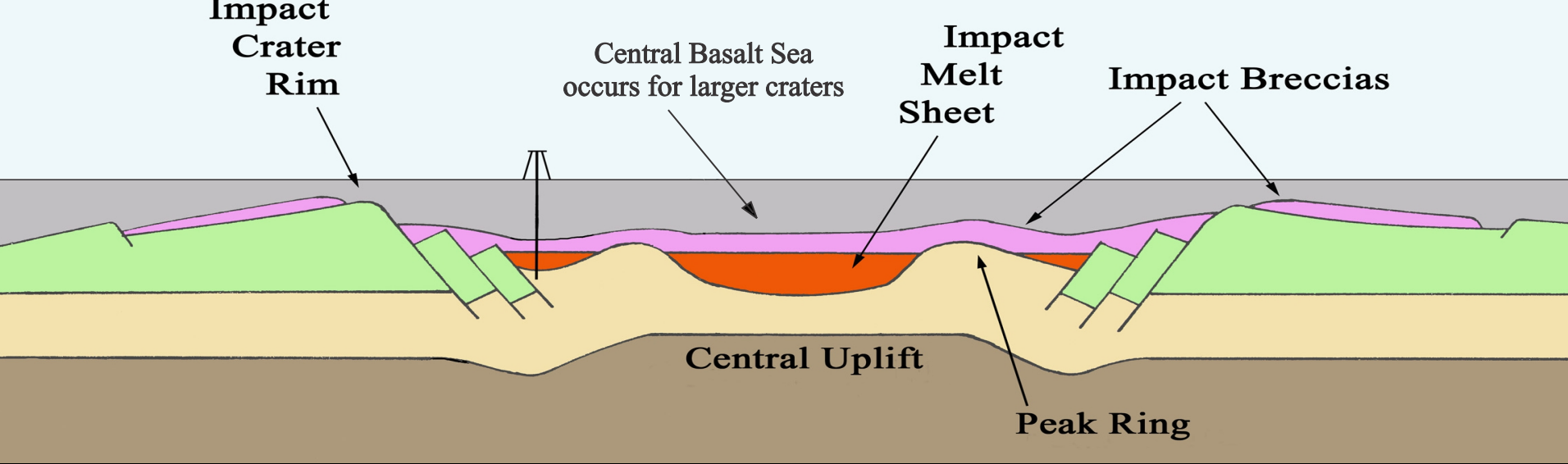
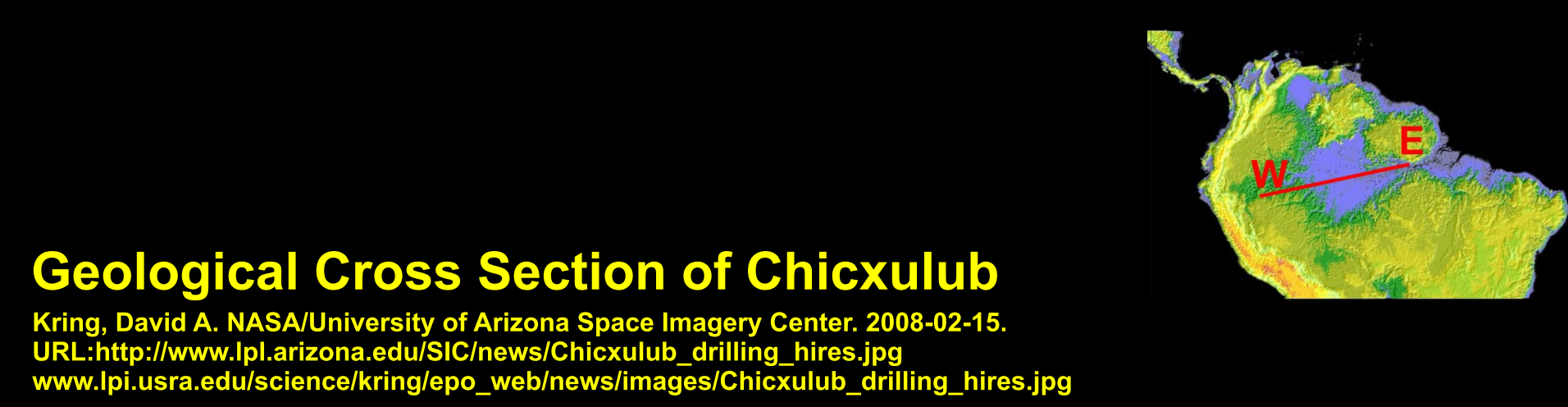
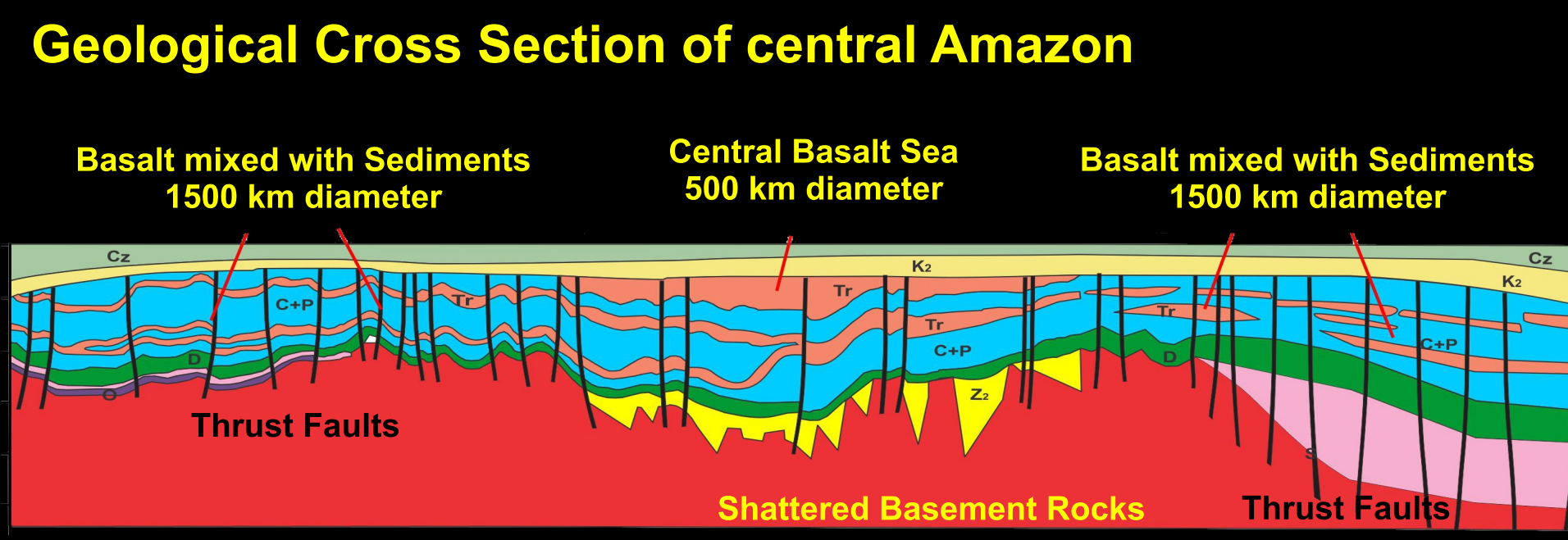
**Oriente and Amazon  
have matching topography**



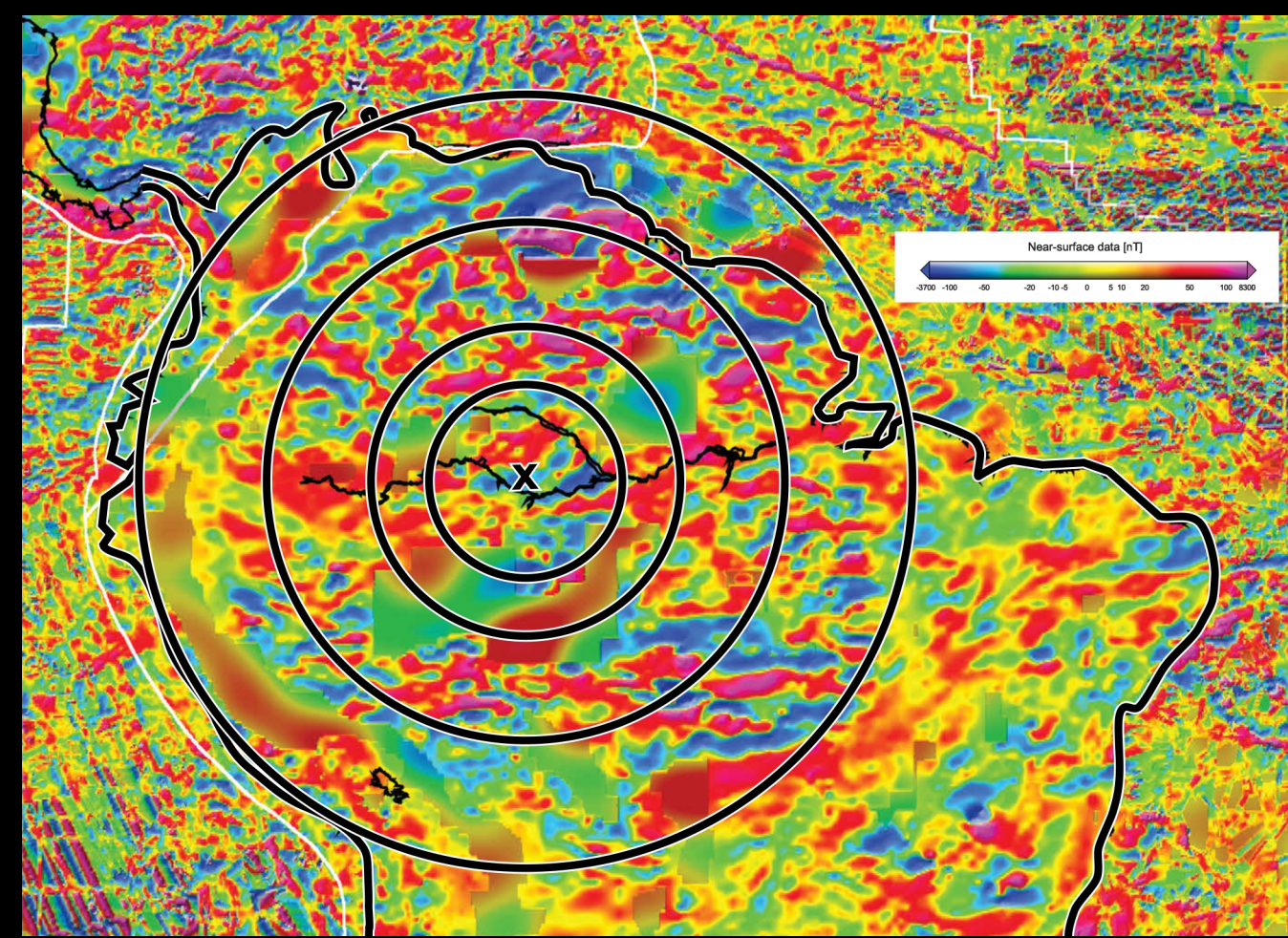
A comparison of Topography of Oriente Basin & Amazon Basin shows the  
same pattern for both, except that the Amazon is much flatter, as expected  
with a comet impact into softer hotter mantle for the Amazon vs an asteroid  
impact into the harder, colder Lunar surface for Oriente.

The Amazon is buried under 1 km of sediments, and has lost 2-3 km of relief  
due to erosion and been compressed about 400 km on the west coast. The  
vertical exaggeration for the Amazon is 10X greater to help see the relief.

**The Amazon  
geological cross section  
is similar to Chicxulub**

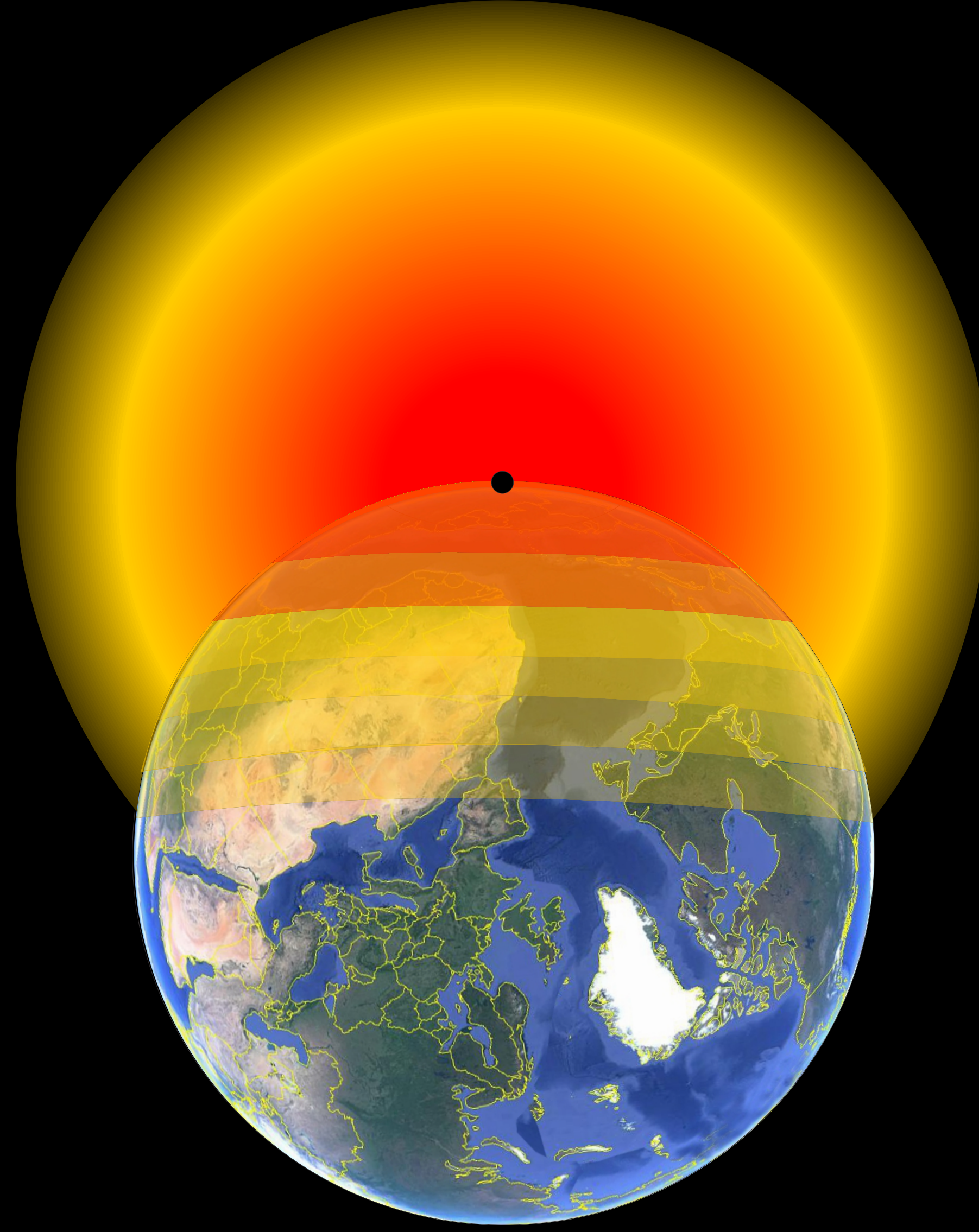


**World Magnetic Anomaly Map  
shows a clear circular pattern**



Magnetic Anomaly Map of the World, 2007; CGMW & Geological Survey of Finland

## The Amazon Basin Fits all the evidence



**AMAZON BASIN:**  
380 km Comet, 70km/sec  
A Planet  
Devastation event

1/3 to 1/2 of the planet  
boiled or burned

Fallout, Heat and  
Shock Waves would  
kill almost all large animals  
in the remainder of the planet

Deccan Traps are a result  
of the impact shock waves

An Extinction Event  
would clearly result.

## References and Notes

Calculations from the "Earth Impacts Effects Program":

"Global climate change driven by soot at the K-Pg boundary as the cause of the mass extinction"

"Triggering of the largest Deccan eruptions by the Chicxulub impact"

"Decade volcanism, the Chicxulub impact, and the end-Cretaceous mass extinction: Coincidence?

"New evidence concerning the age and biotic effects of the Chicxulub impact in NE Mexico"

"Large igneous provinces and mass extinctions: An update"

"Cretaceous Extinctions: Multiple Causes"

"Chicxulub was 300,000 years before the extinction"

Impacts, volcanism and mass extinction: random coincidence or cause and effect?

Models of Chicxulub ejecta formation and transport from the impact event suggest that basement material, which is the source for shocked quartz and zircon grains, is ejected at velocities > 2 km/s and would be unable to reach global distribution (Burgener and Morgan, 2006)

Calculations from the "Earth Impacts Effects Program":

Estimated Chicxulub Parameters:

Estimated Amazon Parameters:

Projectile Diameter: 12 km

Projectile Density: 3,000 kg/m<sup>3</sup>

Impact Velocity: 20 km/s

Impact Angle: 90 degrees

Target Density: 2,700 kg/m<sup>3</sup>

Crater: 154 km diameter

Fireball: 325 km diameter

Severe Thermal Radiation: 2,400 km diameter

Max Thermal Radiation: 2,800 km diameter

Area covered by Max Radiation: 6.15 million km<sup>2</sup>

Portion of Earth effected: 6.15/510.1 = 1.2%

NOTE: the diameter of Earth is 12,700 km. The circumference is 40,000 km

The fireball and radiation travel out from the impact, and can not effect areas blocked by the shadow of the planet. Therefore the effects can not exceed 1/2 of the planet, which is 10,000 km distance from impact. Also, the "Earth Impacts Effects Program" does not include curvature effects: Realistic thermal radiation effects are less, about 8,000 km radius, due to the radiation not curving around the planet.

Extra notes on images above.

Chicxulub impact speed was too low to send ejecta around the planet:  
"During the excavation stage of cratering the so-called ejecta curtain material is ejected at particle velocities of up to ~ 2 km/s to form the proximal ejecta deposits, and for Chicxulub these deposits should extend up to ~ 400 km from the impact site. This ejection mechanism cannot explain the presence of shocked quartz in the global K-P layer as velocities of 9+ km/s are required to eject quartz to the other side of the planet. The only plausible explanation is that these ejecta were accelerated to high speeds within the expanding vapor plume." Morgan et al, 2006

The Amazon impact could form a 10 cm layer around the planet:  
According to the "Earth Impacts Effects Program" the world wide layer from an impact the size of the Amazon would be many kilometers to meters thick over the entire planet. But it does not allow for the expected extensive loss of ejecta to higher than escape velocity ejecta. An impact from a high speed comet will eject a mass equal to or larger than the original impacting body at escape speeds, minimizing the potential layer thickness.

Chicxulub has a K/Pg Boundary Layer:  
"CSDP core Yacopoli-1 was drilled to a depth of 1,511 m within the Chicxulub crater. A 100-m-thick suevite breccia (894-794 m) identifies the Chicxulub impact event. Above the suevite breccia is a dolomitic limestone with planktic foraminiferal assemblages indicative of Plummerella hantkeninoides zone CF1, which spans the last 300 ky of the Maastrichtian. An erosional surface 50 cm above the breccia/dolomite contact marks the K/T boundary and a hiatus.... The Chicxulub site thus records a thick layer that predates the K/T boundary impact and mass extinction." Sinnesbeck et al, 2004

The Amazon Basin has no K/Pg Boundary Layer:  
The geological cross section of the Amazon shows a thick layer of undisturbed Cretaceous sediments under a thick layer of Tertiary sediments. Thousands of drill cores have been taken for oil and gas exploration, but no K/Pg boundary layer has been reported.

The Ir content in the K/Pg boundary layer can not determine the size of the impactor:  
The amount of Ir distributed around the planet depends on the size and concentration of Ir in the impactor, and how much of the impactor remains in the atmosphere after the impact. A fast low density comet is likely to have a significant part of the original impactor reflected back into space at above escape velocity, so little will remain in the atmosphere.

Comments on the geology and geophysics

The Geological Cross section matches the recent work on Oriente (Johnson et al, Science, Oct 27, 2016) with 3km high thrust faulted mountains in the north, forming the Tepui of today, and forming large numbers of near vertical faults in the Basin.

The center would be expected to be fall back breccia - a random rubble in the basement rocks. The metamorphosed layers above the bed rock are the splash waves that have mantle and original sediments mixed, appearing as basaltic sills today. The first layer of more recent sediments is sterile - no fossils. Only one dinosaur tooth was found in one core, earning the layer a dating of Cretaceous. But the sediments are 0.5 km thick and have no fossil plants or animals in a part of the world where it is unimaginable today to have no fossils. Apparently the Amazon was empty of life for millions of years.

The outer ring shows today as the Andes Mountains on the west and as the Atlantic Ocean on the east. It is possible that the impact's thrust faults on the east broke South America from Africa and started the continental drift westward.

The Bouguer Gravity anomaly from near surface measurements shows the ring structure. The gravity anomaly from satellite measurements does not. This is due to the surface measurements reflecting the lithosphere, whereas the satellite measurements show the gravity from the lithosphere and mantle. The lack of a gravity anomaly in the satellite measurements is likely due to the movement of South America over 65 million years of Plate Tectonic movement. Asteroid impacts are surface crustal events. As plate Tectonics moves the lithosphere, the gravity and magnetic anomalies move with the impact crater. A 380 km comet is mainly interacting with the mantle, not the thin lithosphere. When the mantle moves, the deeper portion of a gravity anomaly will be obscured. No deep gravity anomaly should be seen, but the near surface anomaly clearly reflects circular patterns.