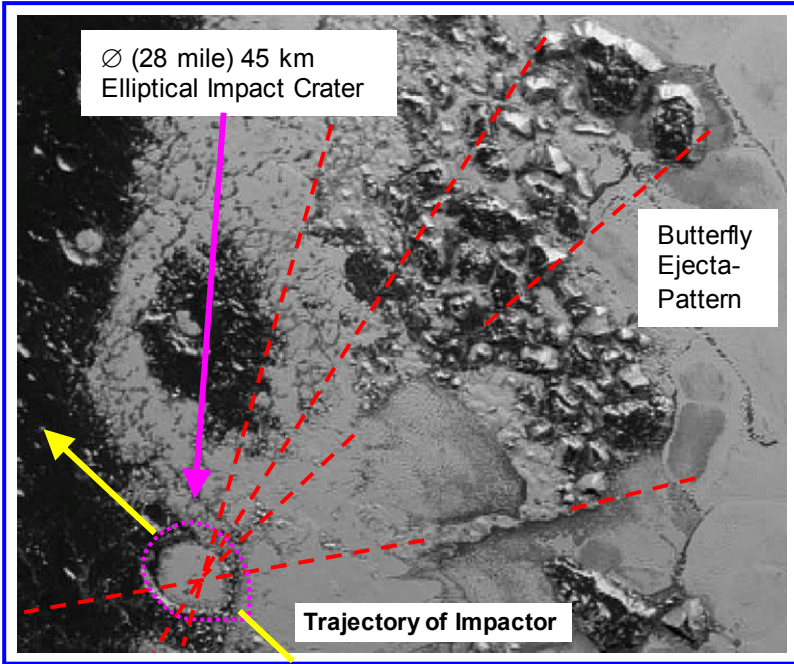


## 9 Sputnik Planum and the “heart-shaped” region on Pluto were formed by a complex global impact event

There are different geological formations around Sputnik Planum, which indicate an impact origin. Sputnik Planum itself seems to be the result of several big impacts which caused a large fracture and led to [expansion tectonics](#) and [volatiles](#) rising from the mantle to Pluto’s surface in this area



The mountain areas around [Sputnik Planum](#), e.g. [Hillary Montes](#) and [Norgay Montes](#), are the result of a multiple Impact event. With high probability the fragments of a burst comet or asteroid formed these mountains, when they impacted on [Pluto](#).

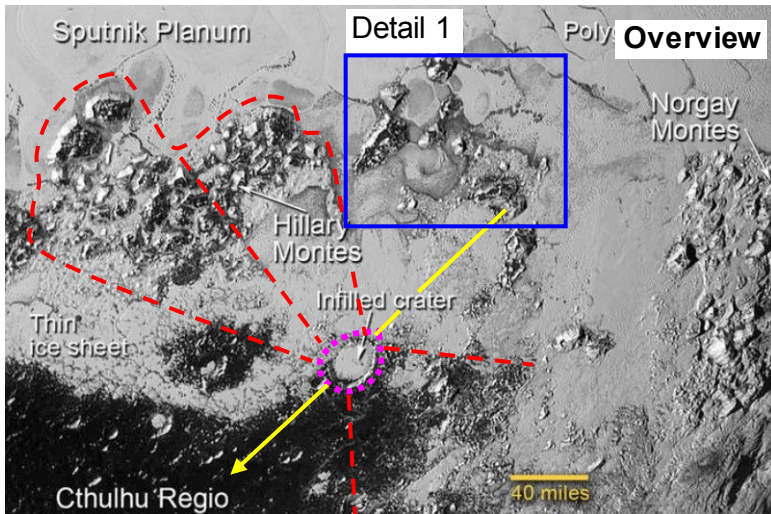
The image on the lefthand side shows clear trend-lines in the Hillary Montes region which all originate in an approx. 28mile (45km) wide crater, which is infilled with ice now. Hillary Montes at the border line of Sputnik Planum probably formed less than 100 million years ago as a result of this impact event. ( see also : [Pluto images from NASA](#) )  
 “This is one of the youngest surfaces we’ve ever seen in the solar system,” said Jeff Moore ( from the Geology, Geophysics and Imaging Team (GGI) / NASA )

“Because Pluto cannot be heated by gravitational interactions with a larger planetary body, some other process must be generating the mountainous landscape” said GGI deputy team leader John Spencer.

**And he is right ! The mountains were formed by a complex multiple impact event !**  
 The small 28 mile wide crater is only part of a much larger impact event !

From the slightly elliptical shape of this crater the trajectory of the impactor can be determined. The trajectory of the impactor and the arrangement and position of the butterfly-ejecta of this oblique impact crater give indication about the possible position of further impact craters and ejecta areas which all belong to this complex impact event.

The image below shows an overview of the surface features around the Hillary Montes where the small elliptical crater with butterfly-ejecta pattern is visible

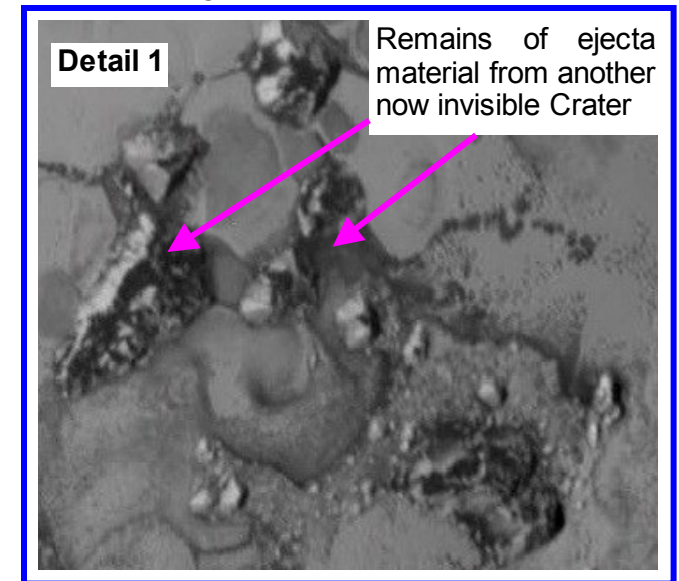


The area “Detail 1” ( marked in blue on the left image ) seems to contain remains of ejecta from a similar impact as the one described above ( shown on the two images on the lefthand side )

However most of the ejecta of this impact is not visible anymore, either because it is located under the “sea level” of the “Sputnik Planum Ocean” now, or because it may have melted in the aftermath of the impact.

But it seems that there are more traces of this “impact crater” are visible on the other side of the “frozen Sputnik Planum Ocean” !!

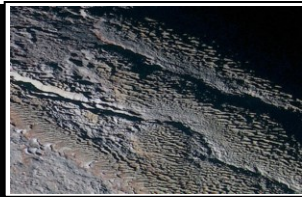
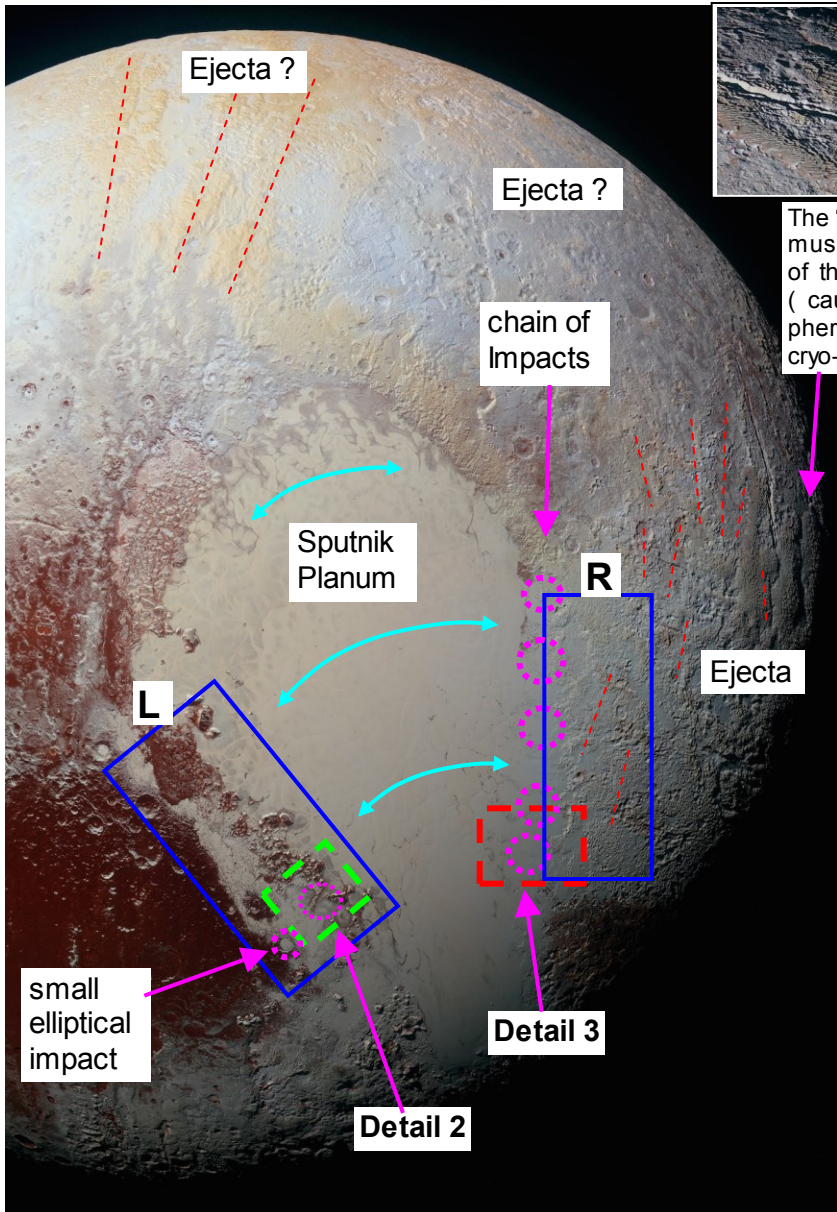
→ See next page



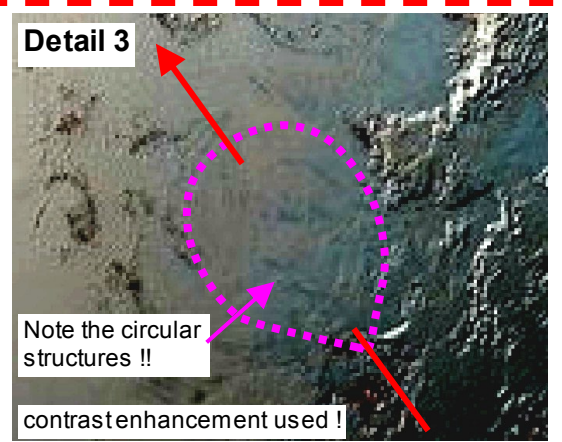
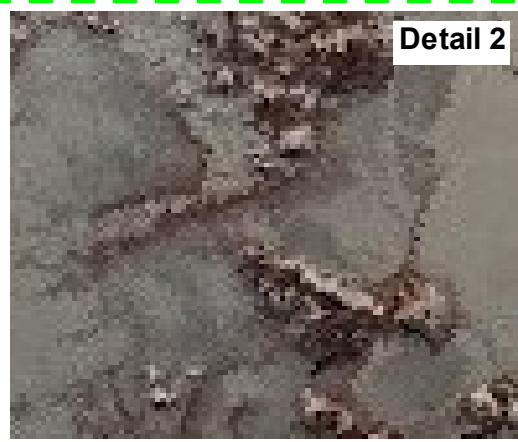
# A chain of impacts seems to have caused a large fracture in Pluto's crust, which then led to expansion tectonics

Along the linear sides in the East and West of Sputnik Planum there are structures visible which indicate the impact of several impactors. ( the two linear sides are marked with blue boxes ). On the west side ( marked with L ) the already mentioned small elliptical impact is visible. And on the east side ( marked with R ) structures are noticeable which indicate **4 to 5 large impact craters with diameters in the range of  $\varnothing$  70 to  $\varnothing$  100 km.**

These impact craters are all flooded and infilled with ice and only indirectly visible through circular structures in the ice (  $\rightarrow$  e.g. see Detail 3 ). It seems that these impact craters led to **expansion tectonics** which formed Sputnik Planum and led to the outflow of  $H_2O$ ,  $N_2$  and other volatiles from the mantle.



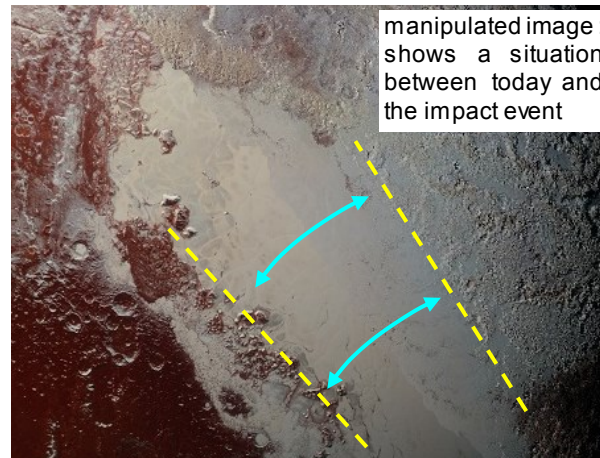
The "snakeskin area" must also be a result of the impact event. ( caused by atmospheric flow or by cryo-volcanism )



Note the circular structures !!

contrast enhancement used !

At the time of the impact the areas of detail 2 and detail 3 ( or L & R ) were one and the same area, before expansion tectonics set in and slowly moved the two sides ( yellow lines ) away from each other ( see below ! ). Remains of the crater structure are only visible in detail 3. The slightly later formed small elliptical impact on the west site probably overprinted the remains of the larger crater indicated in detail 2 & 3.



manipulated image : shows a situation between today and the impact event

