

Is the Central Valley of California an Elongated Impact Basin?

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Abstract

In general, impact craters are circular in shape, but occasionally, they exhibit non-circular forms. One such form is the elongated impact crater. I suggest that the Central Valley of California may be a larger version of an elongated impact crater, an elongated impact basin. Its elongated shape might be the result of a very low angle of impact of one or more celestial objects with the surface of the Earth. The ‘central’ peak (or uplift) of the original basin might be the Sutter Buttes, in the northern part of the Central Valley. In order to support these conclusions, images of lunar impact craters are compared to shaded relief maps of the Central Valley (and surrounding mountains) of California.

1 Introduction

In the state of California, the Central Valley extends from the far north of the state to just north of Los Angeles, Fig. 1b, a distance of approximately 450 miles [1]. The current belief is that the Central Valley was formed, solely, by terrestrial geological forces. But apparently, there has been no suggestion that its formation may have been the result of the impact of a celestial body, or bodies, with the surface of the Earth.

At the northern end of the Central Valley are the Sutter Buttes, Fig. 1b and Fig. 2b. They have been referred to as “the world’s smallest mountain range” and “a small circular complex of eroded volcanic lava domes” [2]. I believe they are neither.

I contend that it is more likely that the Sutter Buttes are, collectively, the remnants of the central peak (although not currently located at the center) of an elongated impact basin formed by the impact of a large object (or objects) with the surface of the Earth. The Central Valley would then be the floor of this basin, with the surrounding mountains forming its rim. (It is also possible that the impact originally left a circular impact basin that was, subsequently, deformed by terrestrial tectonic forces into its current shape. This might explain why the Sutter Buttes are presently located in the northern end of the valley, rather than at its center.)

To make the argument that the Central Valley is an elongated impact basin, a comparison with an elongated lunar impact crater will be made.

2 The Comparison

When a large object collides with a celestial body, it generally leaves a circularly shaped crater in the surface of that body, occasionally with an uplift of material, or central peak, near its center. The impacting body is typically a meteorite, or rarely, an asteroid or comet. Similar to an impact crater is an impact basin with the main difference being that a basin is larger in diameter and often more complex in structure than a crater [3].

Occasionally, the impression in the surface is not circular, but elliptical or elongated in shape. This elongated shape is thought to be the result of a low angle of impact of the object with the surface [4]. An example of an elongated impact crater is the lunar Schiller Crater, Fig. 1a. It has a width of 44 mi (71 km) and a length of 111 mi (179 km) [5].

The Central Valley of California, Fig. 1b, has a width of 40–60 mi (60–100 km) and a length of 450 mi (720 km) [1]. As can be seen in Fig. 1, apart from the differences in size, the Schiller Crater and the Central Valley have very similar forms. The similarities extend to features south of the main basins. The Schiller Crater has a small satellite crater connected to its southern end by a wide channel. The Central Valley has corresponding features extending from its southern end.

Additionally, a pair of narrow central ridges in the northern part of the Schiller Crater are located in the same general area, of the crater, as the Sutter Buttes appear in the Central Valley of California. Despite the differences in number and shape, the ridges and the buttes may have been formed by similar processes.

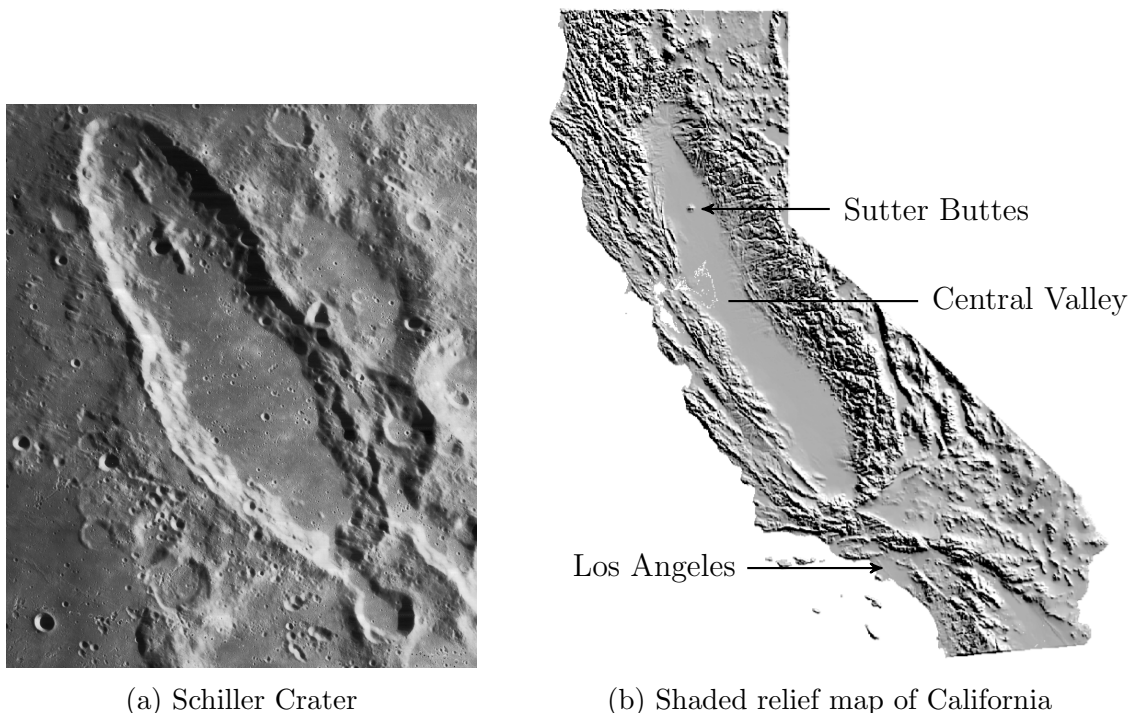


Figure 1: Comparison of Schiller Crater and Central Valley of California.

The floor of most impact craters (and basins) is, generally, lower in elevation than the surrounding (impacted) surface. In the case of the Central Valley, the surrounding surface, to

the west, is the Pacific Ocean. Consequently, if a gap or break formed in the western rim of the valley (the Coast Range), sea water from the Pacific would have entered the valley, creating an inland sea. This is, historically, what happened (<https://www.mikegravel.org/was-the-central-valley-a-sea>). Eventually, the basin accumulated enough sedimentary deposits to displace the sea water, leaving the floor of the valley (top of the sedimentary layers) slightly above sea level, as it remains today.

Another comparison might be made between the central peak of a circular lunar crater, Tycho Fig. 2a [6], and the Sutter Buttes, Fig. 2b. Both are located more or less centrally (the buttes, from left to right) in their respective basins.

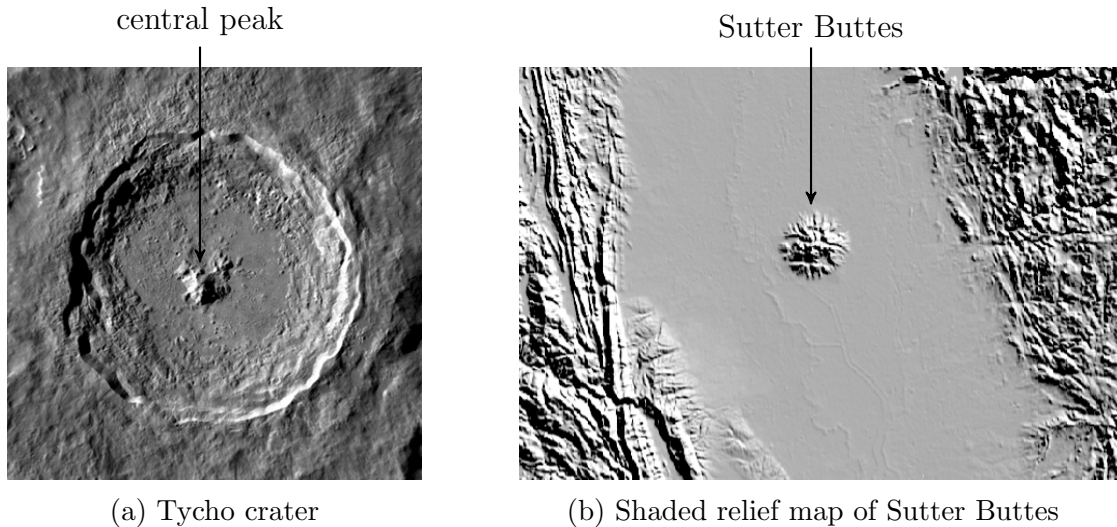


Figure 2: Comparison of central peak of lunar crater and Sutter Buttes.

3 Conclusions

Based on a visual comparison of the Schiller Crater and the Central Valley of California (and surrounding mountains), it would seem reasonable to conclude that the latter qualifies as an elongated impact basin, with the Sutter Buttes as its ‘central’ peak and the surrounding mountains as its rim. An additional study might be made of geological features, including mineral deposits, in the future. Formation of these features (and deposits) may have required greater energy input than tectonic or volcanic forces could have provided.

Since the Schiller Crater and the Central Valley show similar features south of their main basins, there may be analogous features hidden below the surface of the sedimentary layers of the Central Valley. For example, it would be interesting to speculate that features, similar to the central ridges in the northern end of the Schiller Crater, might also exist below the surface in the northern Central Valley near (or possibly incorporating) the Sutter Buttes.

4 Acknowledgments

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The SRTM 90m Digital Elevation Model (DEM) dataset [8] used to create the shaded relief maps was accessed, in QGIS, through the OpenTopography DEM Downloader plugin (<https://opentopography.org>).

References

- [1] Wikipedia contributors. Central valley (california) — Wikipedia, the free encyclopedia. [https://en.wikipedia.org/w/index.php?title=Central_Valley_\(California\)&oldid=1356631529](https://en.wikipedia.org/w/index.php?title=Central_Valley_(California)&oldid=1356631529), 2026. [Online; accessed 30-May-2026].
- [2] Wikipedia contributors. Sutter buttes — Wikipedia, the free encyclopedia. https://en.wikipedia.org/w/index.php?title=Sutter_Buttes&oldid=1355990049, 2026. [Online; accessed 28-May-2026].
- [3] Wikipedia contributors. Complex crater — Wikipedia, the free encyclopedia. https://en.wikipedia.org/w/index.php?title=Complex_crater&oldid=1334755480, 2026. [Online; accessed 30-May-2026].
- [4] Dirk Elbeshausen, Kai Wünnemann, and Gareth S. Collins. The transition from circular to elliptical impact craters. *Journal of Geophysical Research: Planets*, 118(11):2295–2309, 2013.
- [5] Wikipedia contributors. Schiller (crater) — Wikipedia, the free encyclopedia. [https://en.wikipedia.org/w/index.php?title=Schiller_\(crater\)&oldid=1352903092](https://en.wikipedia.org/w/index.php?title=Schiller_(crater)&oldid=1352903092), 2026. [Online; accessed 27-May-2026].
- [6] Wikipedia contributors. Tycho (lunar crater) — Wikipedia, the free encyclopedia. [https://en.wikipedia.org/w/index.php?title=Tycho_\(lunar_crater\)&oldid=1357994987](https://en.wikipedia.org/w/index.php?title=Tycho_(lunar_crater)&oldid=1357994987), 2026. [Online; accessed 6-June-2026].
- [7] QGIS Development Team. *QGIS Geographic Information System*. QGIS Association, 2026. <https://www.qgis.org>.
- [8] NASA Shuttle Radar Topography Mission (SRTM)(2013). Shuttle Radar Topography Mission (SRTM) Global. Distributed by OpenTopography. <https://doi.org/10.5069/G9445JDF>. Accessed 2026-06-04.