Paleozoic ← → Present

41. LIVERMORE GEOLOGY[1] (bold numeric keys in the text refer to the attached map assembled from USGS NGMDB Quadrangles)

The Livermore Valley is a roughly circular sedimentary basin about four miles in diameter located at an interesting nexus of geologic events.

300 million years ago, give or take, a range of mountains pushed up through a shallow equatorial sea at the western edge of the ancient continent of *Pangea* in the current location of Livermore, Colorado, extending north-south from what is now central Wyoming to New Mexico and east into Oklahoma.[2]

These mountains are known to us today as the Ancestral Rockies – ancestral, because they were mostly long eroded away before the modern Rocky Mountains were thrust up again a mere 65 million years ago – around the time of the extinction of the dinosaurs.

Some of the material that eroded from the Ancestral Rockies was deposited in extensive pink to red sediments called the Fountain Formation. This formation is well known up and down the Front Range at places like the *Garden of the Gods* at Colorado Springs, *Red Rocks Park* west of Denver and the *Flatirons* at Boulder. Generally, where the Fountain Formation lies adjacent to the Rocky Mountains, it has been bent and broken by the up-thrust of the modern Rockies.

In the ages after the Ancestral Rockies were converted by erosion into the Fountain Formation, the shore of a shallow sea to the east advanced and receded repeatedly, leaving the alternate layers (exposed at Owl Canyon **12**) of red sandstone and the gray limestone quarried at Colorado Lien **11**.

Extending north from the Wyoming border and south from Livermore, as in other areas of the Front Range, the Fountain and subsequent formations are deformed and broken by the up-thrust of the modern Rocky Mountains.

However, in and northeast of the Livermore Valley these red sediments and overlying later deposits are horizontal and largely undisturbed, except as carved by wind and water – Red Mountain **I**, Steamboat Rock **II**, Table Rock **III**, Deadman Butte **IV** fka *Maggie's Tit*[3] and the ridge running east/west separating the Rabbit Creek and Lone Pine drainages **V**. At the western edge of this ridge (visible to the north of the Red Feather Lakes Road), the Fountain Formation meets the granite of the mountains without obvious deformation **X**.

Although the real geological picture is fuzzier and more complicated than the one painted here, the undisturbed character of the Fountain Formation where it contacts the granite hills immediately north and west of the valley makes it tempting to think of these hills, including those that Phantom Canyon **3** has carved through, as remnants of the Ancestral Rockies (and they may be), whereas the mountains to the south of the valley are more like the modern Rockies.

Not that the Livermore Valley has been isolated from geologic upheaval – to the contrary, basement blocks beneath the valley floor have moved up and down along fault lines in whack-a-mole fashion, and some may even have rotated on their axes, like Campbell Mountain **13** to the east. Sections of the valley floor have shifted and tilted enough in recent geologic times to change the direction of some stream flows (I have been shown evidence of their recent redirection in aerial photographs).

Major geologic motion is responsible for the folding of Grayback Ridge **10** which emerges in the center of the valley and grows more prominent as it trends northeast, crossing the path of US 287.[4]

The remnants of the Fountain Formation are clearly visible north of Old Schoolhouse Road (just east of the old schoolhouse) **XI** and as the ridge separating the Lone Pine and Rabbit Creek drainages. The tops of this ridge and other hills in the valley are covered in very roughly rounded water-washed boulders **7** (more about that to follow).

The valley and surrounding areas are crisscrossed with numerous faults. Some of the streams have adopted fault lines as their courses of least resistance.

Not surprisingly, the soils at the north and west sides of the valley tend to be heavy yellow silt-clays weathered from the adjacent granite minerals, and/or laid down by wind from bygone glaciers and/or weathered volcanic ash deposits, whereas the soils on the east side of the valley are very sandy, water-borne deposits, reflecting their origin in the red sediments to the northeast in the Stonewall Creek watershed. The Valley's streams are bordered by gravel deposits overlain by rich alluvial soils that now support the valley's best hay meadows.

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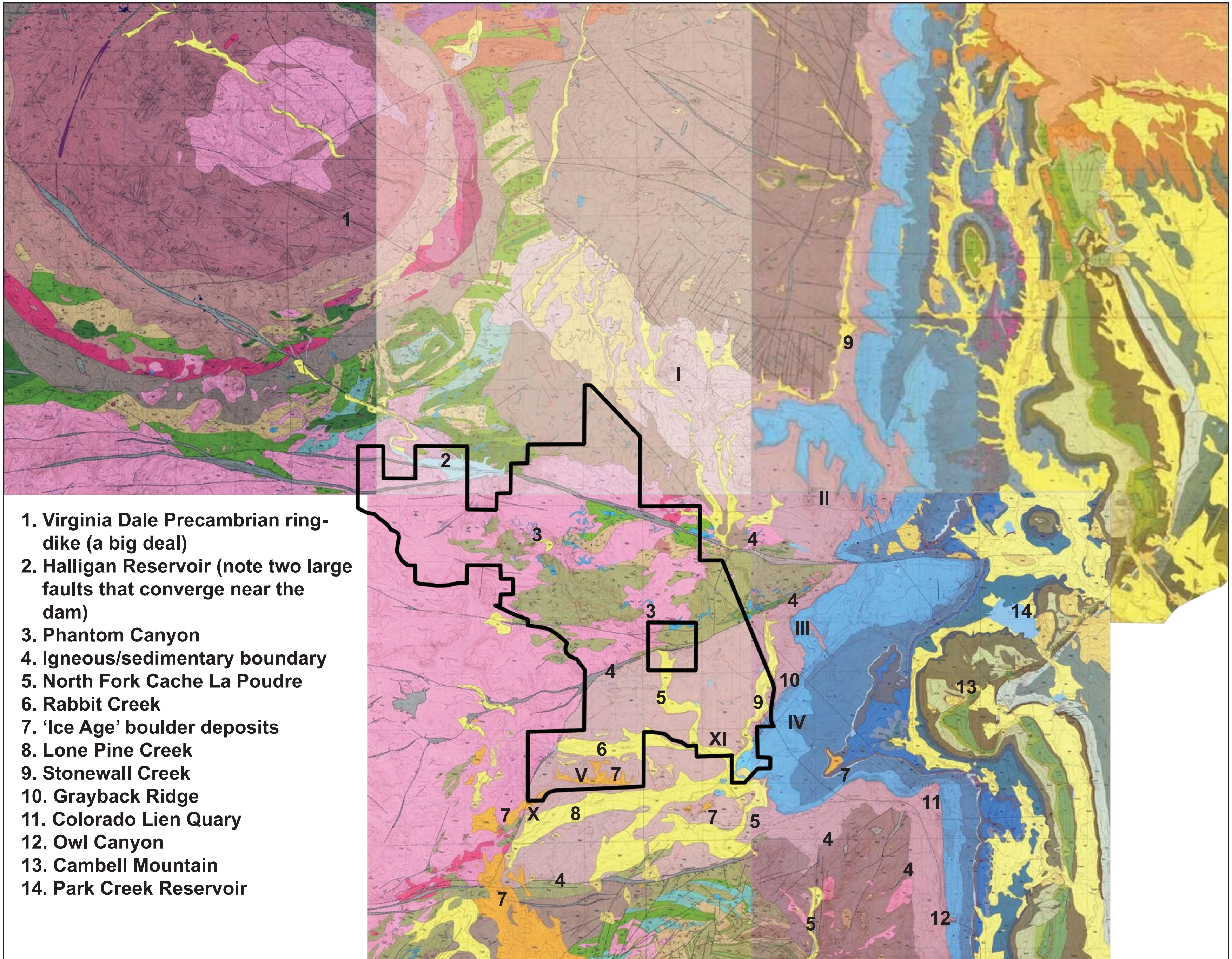
[1] The Livermore area is an endlessly fascinating geography, underlain by an equally fascinating geology. As a 'Junior Woodchuck' geologist, I recognize that I have taken liberties here – intentional ones in the interest of brevity and simplicity, and others resulting from my incomplete understanding. Whatever mixture of understanding and confusion I do have has been acquired informally over the years from personal observation and other sources: written, verbal, expert and mythical.

[2] Ever wonder what was underneath all those earthquakes in Oklahoma?

[3] Back in the day, *Maggie* is said to have been a local cowboys' favorite in one of the bawdy houses. DL Roberts remembers his grandfather, George Roberts, telling him that the name *Deadman Butte* commemorated a freighter in the early days who was run up to the top by Indians and killed. DL remembers the off-color name for the formation as *Squaw Tit* – sometimes local history just isn't PC, no matter how you cut it.

[4] The tortured overthrust structure of Grayback Ridge appears to predate the Fountain Formation and could derive from forces associated with the up-thrust of the original Ancestral Rockies.



1. Virginia Dale Precambrian ring-dike (a big deal)
2. Halligan Reservoir (note two large faults that converge near the dam)
3. Phantom Canyon
4. Igneous/sedimentary boundary
5. North Fork Cache La Poudre
6. Rabbit Creek
7. ‘Ice Age’ boulder deposits
8. Lone Pine Creek
9. Stonewall Creek
10. Grayback Ridge
11. Colorado Lien Quary
12. Owl Canyon
13. Cambell Mountain
14. Park Creek Reservoir

USGS NGMDB Quadrangles

Graphics and layout by Nina Judson