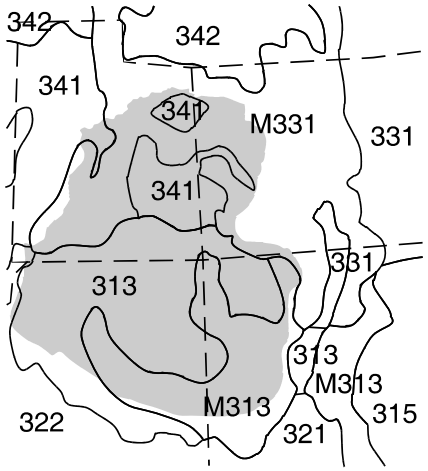
d29 Colorado Plateau < sedimentation ended by epeirogenic uplift >

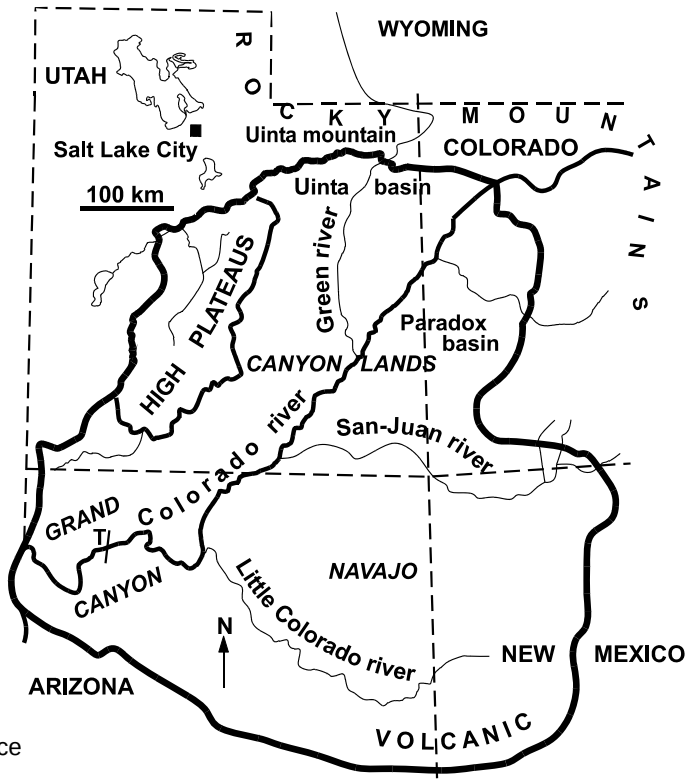
> ... the region is, of course, altogether valueless. It can be approached only from the south, and after entering it there is nothing to do but leave. Ours has been the first, and will doubtless be the last, party of whites to visit this profitless locality. It seems intended by nature that the Colorado River, along the greater portion of its lonely and majestic way, shall be forever unvisited and undisturbed.
>
> —Lt. Joseph C. Ives, Corps of Topographical Engineers, 1861.[1]

Today, sediment transport is out of the Colorado Plateau area (***Figure d29.1***). Canyon erosion is the most memorable scenic element of the Colorado Plateau that was raised, giving the Kaibab Plateau its 1,920 m elevation, by epeirogenic uplift (linked to or in part to each of Late Tertiary extensional tectonism in adjacent provinces, mid-Tertiary delamination of the Farallon flat slab, and Early Tertiary Laramide contraction) of still nearly horizontal sedimentary strata deposited during 500 million years when the area resided near sea level.[2] Whether the present stream systems are superimposed or have flow directions due to river capture among rejuvenated antecedent streams has yet to be resolved.[3] The incised river canyons historically have been (as was fortunate for Powell) without waterfalls. Rapids now, and those remembered, are due to piles of loose, large, boulders sporadically delivered out of side canyons by debris flows triggered there by rare desert cloud bursts.[4] In prehistoric times, waterfalls have existed where basalt lava flows poured into the Grand Canyon and dammed the river. Perched on ledges or beaches are remnants of these resistant volcanic rock-barrages. These, when $^{40}Ar/^{39}Ar$ dated, Karl E. Karlstrom finds show that the canyon since 1.2 million years ago has deepened 100-150 m west of the Toroweap fault and 2-3 times more so to its east. Such canyon incision at variable rates in response to differential uplift (facilitated by block faulting) began 5-6 million years ago.[5]

Figure d29.1 Map of the Colorado Plateau physiographic province.[6] T = Toroweap fault. The Colorado Plateau area has Dry Domain ecological subdivisions: [7]



313 Semi-Desert Province
315 Dry Steppe and Shrub Province
M313 Semi-Desert - Open Woodland - Coniferous Forest - Alpine Meadow Province
321 Semi-Desert Province
322 Semi-Desert and Desert Province
331 Dry Steppe Province
M331 Mountains Steppe - Open Woodland - Coniferous Forest - Alpine Meadow Province
341 Intermountain Semi-Desert and Desert Province
342 Intermountain Semi-Desert Province



In Utah, the southwest flowing Colorado river and its tributaries, the south flowing Green and west flowing San-Juan, have cut deep canyons that expose sections through Mesozoic strata.[8]

In Arizona, the west flowing Colorado river and the joining west-northwest flowing Little Colorado tributary, have cut deep canyons that expose sections through Paleozoic strata and, in the deepest part of the Colorado river Grand Canyon, Precambrian rocks (***Figure d29.2***).[9]

The epeirogenic uplift that elevated the Colorado Plateau area also warped-up toward it an eastward thinning wedge of soft fluvial Neogene sediments in the High Plain states of the Midwest. Badland dendritic erosion now exposes the elevated but still nearly horizontal bedding in these sediments that record a former aggrading fluviatile plain. Sedimentation during the Paleogene was from these regions *into* the Colorado Plateau area, which was then still at low elevation.[10]

Now exhumed in the uplifted Colorado Plateau, the Waterpocket Fold monocline (in Capitol Reef National Park) reveals that the end Cretaceous Sevier orogeny in the region had produced a broad low-lying basin with internal flexures and some normal faulting in otherwise flat-lying Paleozoic sedimentary strata. This mild effect of the Sevier orogeny is what distinguishes the Colorado plateau physiographic province from the Rocky Mountains where correlative continuations of these strata exist much folded and faulted by the Sevier orogeny.

Cin-Ty Lee in 2001 finds that the Colorado Plateau, an island of tectonic quiescence, could be so because in contrast to its surrounds it is underlain by a relatively a thick lithosphere depleted in iron and heat (both extracted early in its history by partial melting and lava eruptions of the resulting magmas 1600-2000 million years ago). The "depleted" mantle persists as a thick, stiff, thermal boundary layer between the crust and the convecting mantle below.[11] ❑

Figure d29.2 [12] **Grand Canyon north wall from the Chocolate Cliffs down mnemonic:**

"Sure, Memorable Kissing Takes Concentration. However, Sex Requires Timely Maneuvering Between Tempting Variables." —*White Angle Lodge receptionist*.[13]