Intermontane Plateaus

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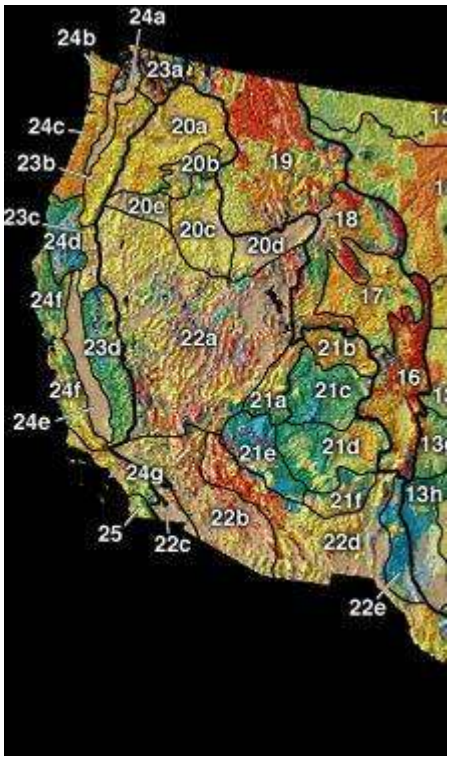
For purposes of description, the physical geography of the United States is split into several major physiographic divisions, one being the **Intermontane Plateaus**. Please refer to the Geography of the United States for the other areas.



Physiographic regions of the U.S. Interior
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[edit] Plateau Province

The Plateau province, just to the west of the southern Rocky Mountains, is characterized for the most part by large-textured forms. These have developed on a great thickness of nearly horizontal Palaeozoic, Mesozoic and Tertiary formations, and by a dry climate.

The province was uplifted and divided into great blocks by faults or monoclinal flexures and thus exposed to long-lasting denudation in a mid-Tertiary cycle of erosion. They were then broadly elevated again with renewed movement on some of the fault lines. The current erosion cycle was introduced in late Tertiary time during which the deep canyons of the region have been trenched. The results of the first cycle of erosion are seen in the widespread exposure of the resistant Carboniferous limestone as a broad platform in the south-western area of greater uplift through central Arizona where the higher formations were worn away. They are also seen in the development of a series of huge, south-facing, retreating escarpments of irregular outline on the edges of the higher formations farther north. Each escarpment stands forth where a resistant formation overlies a weaker one. Each escarpment is separated from the next higher one by a broad step of weaker strata. A wonderful series of these forms occurs in southern Utah, where in passing northward from the Carboniferous platform one ascends in succession the Chocolate Cliffs (Triassic sandstones), Vermilion and White Cliffs (Jurassic sandstones), the Gray Cliffs (Cretaceous sandstones, of remarkably cross-bedded structure, interpreted the dunes of an ancient desert), and finally the Pink Cliffs (Eocene strata of fluviatile and lacustrine origin) of the high, forested plateaus. Associated with these irregular escarpments are occasional rectilinear ridges, the work of extensive erosion on monoclinal structures. A good example of this is Echo Cliffs lying east of the Painted Desert.

With the renewal of uplift by which the earlier cycle of erosion was interrupted and the present cycle introduced, inequalities of surface due to renewed faulting were again introduced. These still appear as cliffs, of more nearly rectilinear front than the retreating escarpments formed in the previous cycle. These cliffs are peculiar in gradually passing from one formation to another, and in having a height dependent on the displacement of the fault rather than on the structures in the fault face. They are already somewhat battered and dissected by erosion. The most important line of cliffs of this class is associated with the western and southern boundary of the plateau province where it was uplifted from the lower ground. The few rivers of the region must have reached the quiescence of old age in the earlier cycle, but were revived by uplift to a vigorous youth in the current cycle. It is to this newly introduced cycle of physiographic evolution that the deep canyons of the Plateau province are due. Thus the Virgin River, a northern branch of the Colorado, has cut a vertical slit, 1000 ft. deep, hardly wider at the top than at the bottom, in the heavy Triassic sandstones of southern Utah. However the most famous example is the Grand Canyon of Arizona, eroded by the Colorado river across the uplifted platform of Carboniferous limestone.

During the current cycle of erosion, several of the faults, whose scarps had been worn away in the previous cycle, have been brought to light again as topographic features by the removal of the weak strata along one side of the fault line, leaving the harder strata on the other side in relief. Such scarps are known as fault-line scarps, in distinction from the original fault scarps. They are peculiar in having their altitude dependent on the depth of revived erosion, instead of the amount of faulting, and they are sometimes topographically reversed, in that the revived scarp overlooks a lowland worn on a weak formation in the upheaved fault-block. Another consequence of revived erosion is seen in the occurrence of great landslides, where the removal of weak (Permian) clays has sapped the face of the Vermilion Cliffs, so that huge slices of the cliff face have slid down and forward a mile or two, all shattered into a confused tumult of forms for a twenty or more of miles along the cliff base.

Volcanic features occur in abundance in the Plateau province. Some of the high plateaus in the north are capped with remnants of heavy lava flows of early eruption. A group of large volcanoes occurs on the limestone platform south of the Grand Canyon, culminating in Mt San Francisco (12,794 ft), a moderately dissected cone, and associated with many more recent smaller cones and freshlooking lava flows. Mt Taylor in western New Mexico is of similar age, but here dissection seems to have advanced farther, probably because of the weaker nature of the underlying rocks. The dissection has resulted in removing the smaller cones and exposing many lava conduits or pipes in the form of volcanic necks or buttes. The Henry Mountains in southwestern Utah are peculiar in owing their relief to the doming or blistering up of the plateau strata by the underground intrusion of large bodies or cisterns (laccolites) of lava, now more or less exposed by erosion.

[edit] Intermediate Area

The lava plains of the Columbia basin are among the most extensive volcanic outpourings in the world. They cover 200,000 m². or more in southeastern Washington, eastern Oregon and southwestern Idaho, and are known to be 4000 ft. deep in sonic river gorges. The lava completely buries the pre-existent land forms over most of its extent. Some of the flows are still so young as to preserve their scoriaceous surface. Here, the shore-line of the lava contours evenly around the spurs and enters, bay-like, into the valleys of the enclosing mountains, occasionally isolating an outlying mass. Other parts of the lava flood are much older and have been more or less deformed and eroded. Thus the uplifted, dislocated and dissected lava sheets of the Yellowstone National Park in the Rocky Mountains on the east (about the headwaters of the Snake river) are associated with the older lavas of the Columbian plains.

The Columbia river has entrenched itself in a canyon-like valley around the northern and Western side of the lava plains. Snake river has cut a deeper canyon farther southeast where the plains are higher and has disclosed the many lava sheets which build up the plains, occasionally revealing a buried mountain in which the superposed river has cut an even narrower canyon. One of the most remarkable features of this province is seen in the temporary course taken by the Columbia river across the plains, while its canyon was obstructed by Pleistocene glaciers that came from the Cascade Range on the northwest. The river followed the temporary course long enough to erode a deep gorge, known as Grande Coulee, along part of its length.

The lava plains are treeless and for the most part too dry for agriculture. However they support many cattle and horses. Along parts of their eastern border, where the rainfall is a little increased by the approach of the westerly winds to the Rocky Mountains, there is a belt of very deep, impalpably fine soil, supposed to be a dust deposit brought from the drier parts of the plains farther west.

The large province of the Basin ranges, an arid region throughout, even though it reaches the sea in southern California, involves some novel problems in its description. It is characterized by numerous disconnected mountain ranges trending north and south, from 30 to 100 miles in length, the higher ranges reaching altitudes of 8000 or 10,000 ft., separated by broad, intermontane desert plains or basins at altitudes varying from sea-level (or a little less) in the south-west, to 4000 or 5000 ft. farther inland. Many of the intermont plains, occurring mostly in the north, appear to be heavily aggraded with mountain waste. Others, mostly in the south, are The structure of the region previous to faulting was dependent on long antecedent processes of accumulation and deformation and the surface of the region then was dependent on the amount of erosion suffered in the prefaulting cycle. When the region was broken into fault blocks and the blocks were uplifted and tilted, the back slope of each block was a part of the previously eroded surface and the face of the block was a surface of fracture. The present form of the higher blocks is more or less affected by erosion since faulting, while many of the lower blocks have been buried under the waste of the higher ones. In the north, where dislocations have invaded the field of the horizontal Columbian lavas, as in southeastern Oregon and northeastern California, the blocks are monoclinal in structure as well as in attitude. Here, the amount of dissection is relatively moderate, for some of the fault faces are described

as ravined but not yet deeply dissected. Hence these dislocations appear to be of recent date. In Western Utah and through most of Nevada, many of the blocks exhibit deformed structures involving folds and faults of relatively ancient (Jurassic) date. In fact so ancient that the mountains formed by the folding were worn down to the lowland stage of old age before the block-faulting occurred. When this old-mountain lowland was broken into blocks and the blocks were tilted, their attitude, but not their structure, was monoclinal. In this new attitude, they have been so maturely re-dissected in the current new cycle of erosion as to have gained elaborately carved forms in which the initial form of the uplifted blocks can hardly be perceived. Some of them still retain along one side the highly significant feature of a relatively simple base-line, transecting hard and soft structures alike indicating the faulted margin of a tilted block. Here the less uplifted blocks are now heavily aggraded with waste from the dissected ranges. The waste takes the form of huge alluvial fans, formed chiefly by occasional boulder-bearing floods from the mountains. Each fan heads in a ravine at the mountain base and becomes laterally confluent with adjacent fans as it stretches several miles forward with decreasing slope and increasing fineness of material. In the southern part of the Basin Range province the ranges are well dissected and some of the intermont depressions have rock floors with gentle, centripetal slopes.

Only a small part of the Basin Range province is drained to the sea. A few intermont areas in the north-west part of the province have outlet westward by Klamath river through the Cascade range and by Pitt river (upper part of the Sacramento) through the Sierra Nevada. A few basins in the southeast have outlet by the Rio Grande to the Gulf of Mexico. A much larger but still narrow medial area is drained southwestward by the Colorado to the head of the Gulf of California, where this large and very turbid river has formed an extensive delta, north of which the former head of the gulf is now cut off from the sea and laid bare by evaporation as a plain below sea-level. It is here that an irrigation project, involving the diversion of some of the river water to the low plain, led to disaster in 1904, when the flooded river washed away the canal gates at the intake and overflowed the plain, drowning the newly established farms, compelling a railway to shift its track, and forming a lake (Salton Sea) which would require years of evaporation to remove. Many streams descend from the ravines only to wither away on the desert basin floors before uniting in a trunk river along the axis of a depression. Others succeed in uniting in the winter season, when evaporation is much reduced, and then their trunk flows for a several additional miles only to disappear by sinking (evaporating) farther on. A few of the large streams may, when in flood, spread out in a temporary shallow sheet qn a dead level of clay, or playa, in a basin center, but the sheet of water vanishes in the warm season and the stream shrinks far up its course, the absolutely barren clay floor of the playa, impassable when wet, becomes firm enough for crossing when dry. One of the southwestern basins, with its floor below sea-level, has a plain of salt in its center. A few of the basins are occupied by lakes without outlet, of which Great Salt Lake, in north-west Utah, is the largest. Several smaller lakes occur in the basins of western Nevada, immediately east of the Sierra Nevada. During Pleistocene times all these lacustrine basins were occupied by lakes of much greater depth and larger size. The outlines of the eastern (Lake Bonneville) and the western (Lake Lahontan) water bodies are well recorded by shore lines and deltas on the enclosing slopes, hundreds of feet above the

present lake surfaces. The abandoned shore lines have yielded evidence of past climatic changes second in importance only to those of the Pleistocene glaciated areas. The duration of the Pleistocene lakes was brief as compared with the time since the dislocation of the faulted blocks, as is shown by the small dimensions of the lacustrine beaches compared to the great volume of the ravine-heading fans on which the beaches often lie.