

GEOGRAPHIC AND TOPOGRAPHIC FEATURES

Contrasted Grand Canyons

West of the Continental Divide two great rivers, the Colorado and the Columbia, flow down to the sea. Both have trenched great areas of mountain and plateau with elaborate systems of canyons. In northwestern Wyoming, near Yellowstone and Grand Teton National Parks, the drainage basins of these rivers lie side by side, at the headwaters of the Green and the Snake. Separating at right angles, these streams skirt the borders of the Great Basin in widely divergent courses, and at their mouths they are twelve hundred miles apart.

Colorful and spectacular, the Grand Canyon of the Colorado and its numerous tributary canyons are famous the world over. Notably deeper and narrower, however, but dark and forbidding in aspect, the Grand Canyon of the Snake is sharply contrasted in nearly every feature; and this formidable country still remains almost unknown.

The black lavas and greenstones, in which the gorge of the Snake has been cut, present a gloomy and forbidding aspect, even in the clear air and the brilliant sunshine that commonly prevails in the area. Like the "terrors" of Death Valley, this to many is an attractive quality. In no sense therefore is this canyon a duplication of that of the Colorado, with its thousands of feet of brilliantly colored and sharply marked horizontal strata, nor is it to be regarded as an inferior example of this type.

On the contrary, the Grand Canyon of the Snake belongs to a different type. Only the two great volcanic formations are widespread and abundant, and the prevailing colors in both are dark shades that approach very closely to blackness. Sedimentary strata are almost wholly lacking. Even the stratification of the plateau lava is not prominent at a casual glance, and the irregular surface of the old submerged land, in the dark massive greenstone beneath, is inconspicuous. Many would fail to see it in the vast expanse of the landscape, if it were not in some way designated or pointed out.

SCENIC FEATURES AND TYPES

Diverse Types

Despite the somber and somewhat forbidding aspect of the canyon country, it possesses a surprising variety of physiographic and scenic

View of Snake River Canyon from Hat Point Ranger Station, showing the high ridge of the Seven Devils Range in the background and the Snake River in the foreground.



Southeast from Hat Point Ranger Station; glaciated rugged green-stone peaks of the Seven Devils at the horizon. Snake River Canyon in the immediate foreground, the bottom not visible. The high ridge at the farther rim separates the canyon from the upper valley of Squaw Creek, parallel to the Seven Devils Range.

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features, many of which are distinctly expressive of the characters of the bedrock and of stirring episodes in its history. Dominating the landscape in most of the area are the two widespread series of dark colored volcanic formations--the flat-lying bedded flows of the Columbia River lava and the massive metamorphic lavas and turfs of the ancient greenstone.

Across the deepest and narrowest part of the canyon, the lava plateau on the Oregon rim lies directly opposite the dark peaks of the Seven Devils in Idaho. The contrast is striking also twenty miles to the west, across a plateau deeply scored with canyons, where the Wallowa Mountain group rises like a rugged island from the ocean-like expanse of the lava. Also beneath the multiple flows of this lava at the west rim, the greater part of the gorge has been cut in the massive, indefinite greenstone, in which no notable structure finds expression in the surface forms.

At the bottom of the bedded lava sections of the old hilly and mountainous land surface have been exposed in the canyon wall, hence the contact of the contrasted types varies in altitude from place to place. At many places it is marked by a narrow but well defined bench, where a strip of the old land surface projects a little beyond the base of the overlying lava. On some places this bench serves locally as a convenient footing for trails in this difficult country.

Distinct remnants of the rolling old land, now elevated to altitudes of 6000 feet and higher and not under a cover of lava, are still preserved in both the Wallowas and the Seven Devils, where they present a notable contrast with the rugged, dissected country around them. In the Seven Devils these relics generally lie near the divides, and some have been changed by the scouring and carving action of the glaciers that once flourished there.

Early flows of the Columbia River lava had covered some of these old lands before they were uplifted with the rising mountain mass, and remnants of the flows, not entirely removed by erosion, are still found at altitudes of 6000 to 8000 feet and higher in both the Seven Devils and the Wallowas. Today these remnants of early flows, which belong perhaps near the bottom of the series, lie 2000 to 4000 feet above the top of the surrounding plateau lava, thus affording clear evidence of the magnitude of the uplift.

Among the most striking contrasts of form and most spectacular scenic effects are the glacial features at the higher altitudes, generally above 6000 feet. The ruggedness of the pinnacles and the serrate crest, the steepness of the walls in the cirques and the widened U-shaped valleys, and the beauty of the lakes in cirques and moraine basins, all stand in marked contrast with the features of both the old land remnants and the

almost universal ruggedness of the uplifted and dissected area. The beauty and picturesqueness of the scenery at the higher altitudes today are largely the result of glaciation.

Glaciation has not, however, affected the features of the canyon itself. A valley glacier extended six miles down the upper valley of Deep Creek, and its terminal moraine at Hoady Creek lies below the 5000 foot level; but this point is more than four miles from the mouth of Deep Creek in the depths of the canyon.

FEATURES OF THE CANYON

Various Names

Narrow and steeply V-shaped, the deepest portion of the Grand Canyon of the Snake is called locally the "Box Canyon." Where high cliffs face each other on opposite sides, as they do in places for considerable distances, this term is not inappropriate; but generally the walls consist rather of long, exceedingly steep slopes, varied and interrupted by innumerable cliffs. On the whole, therefore, the term "Box Canyon", as generally applied in canyon regions of the West, does not seem to be altogether a suitable name.

"Hells Canyon" is a name sometimes applied to this narrowest and most difficult portion, although this also is the name of a steep tributary gorge only two or three miles long. Within the area proposed for a national monument this Hells Canyon plunges down the Oregon side four miles below the suggested southern boundary at Thirtytwo Point Creek. A "miner's cabin" far up this canyon was noted on the topographic map twenty years ago. This suggests the thought that an early prospector may have named it. In later years the name has been brought out occasionally and applied to the most rugged and forbidding stretch of the Grand Canyon, where it parallels the Seven Devils Mountains. Possibly the name was also used in this way earlier. For so gloomy a gorge, with the dark Seven Devil glowering from its eastern rim, perhaps the name is not altogether inappropriate.

The black beetling cliffs, the steep rock slides and long talus-covered slopes, and the narrow black side canyons produce a mass effect of somber grandeur which, to the imaginative mind, suggests a setting of the Inferno. The same dark formation in the horns and pinnacles of the Seven Devils has given not only the name to the range itself, but also to the whole brood of black imps and the overtopping He Devil Peak at the north.

Relief and Pattern

Typical of the region, the Snake flows more than half its thousand miles in deep canyons. Its great tributaries, the Salmon, the Clearwater, and the Imnaha, flow almost their entire lengths in such chasms. The climax of the system, the Grand Canyon of the Snake, lies three-fourths of the way down its course, where for more than 100 miles it forms the boundary of Idaho and Oregon.

The most rugged and precipitous portion, rimmed at the east by the black horns of the Seven Devils, is cleft by the deepest canyon in the United States and perhaps in the continent. In the great canyon regions of the west probably no other area of comparable size is so rugged, has such strong relief and such prevailing abrupt slopes, and few can compare in diversity of scenic and physiographic types.

For many miles the canyon bottom lies below 1500 feet in altitude, and summits above 9000 feet stand on the eastern rim only five to seven miles away. Relief of 7500 to 8000 feet is found at numerous places less than six miles apart. He Devil Peak, 9337 feet high, rises more than 8000 feet above the bottom of the gorge at points only $5\frac{1}{2}$ miles distant—a descent of 1500 feet to the mile. (See profiles.)

Facing the pinnacles of the Seven Devils the deeply scored lava plateau at the west stands 7000 feet above sea level at Hat Point. Only $3\frac{1}{2}$ miles distant, at the mouth of Waterspout Creek, the bottom of the canyon lies 5700 feet below. This declivity of more than 1600 feet to the mile is the steepest observed in all this precipitous region.

Profiles Across the Canyon

The influence of land movements, perhaps in part in geologically recent time, is seen in the profiles, which show the character of the canyon and its relations to the lava plateau on the Oregon side and to the Seven Devils Mountains of Idaho. Some of these relationships have been marked by thin lines across the tops of the profiles.

The mountain crests and the sloping ridges are in general accordance with the plateau levels at the west. The uplifted and dissected highlands have been tilted away from the Seven Devils, much as the plateau lavas slope away from the Hallowa Mountains across the canyon in Oregon. Near the declining north end of the Seven Devils, profile No. 1 slopes westward about 100 feet to the mile. Nos. 2 to 6 show a fairly uniform tilt of 150 feet to the mile in the same direction. At No. 7 the slope increases to 200 feet and at No. 8 to 275 feet to the mile. These two enter the borders of the mineralized zone, where probably the intrusive granite lies nearer the surface than at places farther north.

Thus probably the present crest of the Seven Devils marks approximately the area of strong uplift, and perhaps the maximum elevation occurred at the south, where the granite intrusion rose highest and where erosion since has laid some of it bare. The fact that the highest altitudes are not now found at the south end of the range is perhaps to be explained by the lower resistance of the crumbling granite to the forces of weathering and erosion, as compared with the denser and tougher greenstone, which constitutes the serrate crest. The granite peaks immediately south of the proposed monument boundary are high and their slopes are steep, but the forms are more rounded than in the pinnacled greenstone crest at the north.

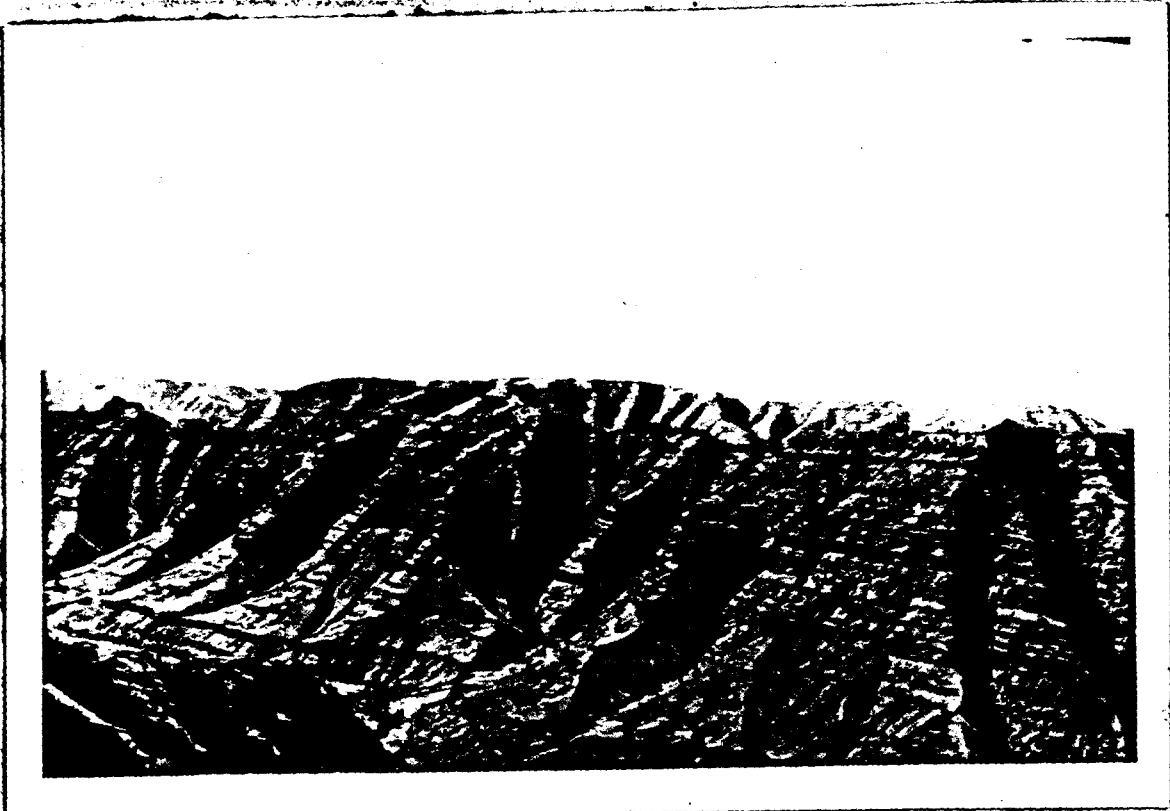
Difficult Country

Along the fifteen to twenty miles of the Seven Devils, the width of the canyon ranges from 7 to 10 miles. Above and below this mountain group it is a little wider, but still difficult and forbidding. In the fifty-mile stretch from the bridge, near Homestead, Oregon, down to Pittsburg Landing, Idaho, there is no crossing. Along most of this course there is no road or trail. In the narrowest portion the average gradient for 25 miles is more than $12\frac{1}{2}$ feet to the mile. In the next 200 miles upstream, the average gradient across the lower Snake River Plains is only two feet to the mile.

For 100 miles it is impossible to follow the river except for short distances. Travel parallel to the stream is possible only at the plateau rim on the Oregon side or across the high shoulders of the Seven Devils in Idaho. At a few places the river can be reached by following down the longer tributary gulches. The narrow road that follows down the Idaho shore from the interstate bridge penetrates to Eagle Bar, which is five miles down the narrow defile of the "Fox Canyon."

The side walls, which are cut at short intervals with steep little side canyons, rise abruptly for a thousand feet or more from the canyon bottom. At many places they rise 2000 feet and even 4000 feet with average slopes of 35 to 45 degrees. Vertical cliffs, scores of feet to many hundreds of feet in height, break the continuity of these slopes nearly everywhere, and great fallen blocks and slabs of stone form long steep aprons of impassable talus and slide-rock.

It is seldom possible from the bottom of the canyon to see points at the upper rims. The steep lower canyon walls, between the numerous interrupting side canyons, are broken by many vertical cliffs and jagged ledges of the bedrock, some of which generally limit the view from the river. Likewise from the rims there are few places that afford a view down the steep walls to the bottom. The heads of the steep tributary canyons have cut back into these upper slopes and have made them so rugged that few places are accessible at the tops of the precipitous canyon walls. Where a view to the bottom is possible it is generally due to a turn in the course of the canyon so that a diagonal view of the river upstream or downstream is permitted.



West from Fivemile Viewpoint, 5 miles south of Imnaha, Oregon,
across the canyon of Imnaha River. Horizontal lava flows in greater
thickness than at the rim of the Snake River Canyon, 6 miles east.
Lava probably flowed from numerous fissures in the flanks of the
Hallowa Mountains, which are partly in view in the distance.

Dendritic Drainage Pattern

Of the two great volcanic formations, the massive greenstone is distinctly the dominant factor in determining the character of the canyon. Successive flows of plateau lava on the upper west wall show only moderate differences of form and prominence, although the separate layers are distinctly visible. The greenstone formation, which constitutes most of the west wall, below the bedded lavas, all of the east wall, and almost the whole of the Seven Devils Mountains, is remarkably massive and uniform in character. In this great series of andesitic lava and tuff beds few traces of the original structure can now be recognized.

This greenstone primarily has determined the form of the steep-sided V-shaped canyon, gashed at the sides with innumerable short tributary gulches, and with abrupt slopes broken by numerous angular, jagged cliffs and ledges of the massive rock. In such uniformly resistant material the prevailing erosion pattern is naturally dendritic, branching upstream like a tree. In the higher reaches of the Seven Devils, this pattern and also the relics of the smoother uplifted old land have been carved by glaciation into scenic and picturesque forms of a different type.

The River

In contrast with the muddy Colorado, the Snake is a clear-water stream of turquoise blue. Owing to the character of the bedrock formations even the areas of vigorous erosion supply little mud and silt. Nevertheless, in the canyons the stream possesses enormous erosive power because of its swift current and its abundant supply of coarse talus and slide-rock and of bouldery wash from the steep tributary gulches.

Through most of the canyon the river channel is said to range generally between 200 and 300 feet in width, with perhaps an average about 250 feet. In a 27-mile stretch through the deepest and narrowest portion, the width scarcely anywhere exceeds one-half this average. At many places the river is less than 100 feet across. Notable examples are seen from the road at Buck Creek and at Thirtytwo Point Creek, two and three miles respectively above Eagle Bar. The constriction at each place is about half a mile long. Another is reported at Hell's Canyon, three miles below (north of) Eagle Bar.

An astonishing feature of the Grand Canyon of the Snake is the complete absence of waterfalls. For more than 100 miles, long stretches of swift current alternate with quiet pools and rapids, and even the rapids are not caused by interfering ledges of the bedrock. In all this distance the river has cut a channel of remarkably smooth gradient in the hard massive greenstone. The pools and rapids have been formed entirely by local obstructions of coarse bouldery debris, which has been

dumped into the narrow channel from the steep tributary canyons.

Notably rough and dangerous rapids exist at the mouth of Kinney Creek, $3\frac{1}{2}$ miles above (south of) the suggested national monument boundary; at Buck Creek, one mile above the suggested boundary; and at Thirtytwo Point Creek, on the proposed boundary. Others are reported at Deep Creek, 3 miles farther north; at Saddle Creek, on the proposed northern boundary; and at Squaw Creek, one mile north of this boundary.

Width at Big Bar

Big Bar is a surprisingly wide place in the canyon three to five miles south of the proposed monument boundary. It is traversed by the road to Eagle Bar and presents a sudden contrast with the narrow canyon above and below. It marks the location of the largest mass of limestone in the bedrock of the area.

Being softer than the enclosing greenstone and also slowly soluble in water, the limestone has been eroded away faster than the surrounding rock. Therefore, while the river carved only the narrow gorge in the greenstone, it has been able to widen as well as to deepen its canyon through the limestone.

In the process of widening the river has swung back and forth, and at a comparatively recent time it has changed its course from the east side to the west side of the open bar, where it is now undermining the limestone at the Oregon shore. The abandoned channel at the east side of the bar, now followed in part by the road, is nearly 100 feet above the river at the lower end of the bar. Also it is separated from the present channel by a ridge of stranded boulders which stands 150 feet above the river in places.

Canyon Across the Mountain

If the Grand Canyon of the Snake were filled today with firm rock, the obstruction would form a lake, but the rising water would not overflow in the direction nor anywhere near the place of the present canyon. Long before the water rose to this level it would overflow southwestward through the lake region of south-central Oregon and northward, by way of the Deschutes River, into the Columbia at The Dalles, nearly 300 miles below its present mouth.

It is quite obvious that the Snake River has never at any time flowed northward across this canyon country at its present altitude. The only rational explanation of its present course is found in its geologic history. Undoubtedly the drainage had established a course across this region before the ancestral range of the Seven Devils, the Wallows, and the Blue Mountains was first raised up across its course in Cretaceous time. The fact that the river still flows in this direction gives sure evidence that the birth and upbringing of this range was not a sudden or a swift event, but a gradual elevation, or a succession of smaller upthrusts, slow enough or at sufficiently long intervals to permit the river to continue its downward gradient across the area and to deepen its channel as the land was lifted up.

Similar conditions undoubtedly obtained when the worn-down range was rejuvenated in Tertiary time with the added obstructions due to the innumerable flows of the Columbia River lava. Many times the river must have been dammed locally by the lava; but the rising water quickly flowed across it, and there was time enough between flows for the river to intrench itself again. Thus the evidence is equally clear that the vast and numerous floods of basalt that have built up an aggregate thousands of feet in thickness did not follow one another in quick succession, but came at somewhat extended and doubtless irregular intervals apart.

Thus with successive upthrusts of the rising belt across its course in Cretaceous time and the added obstruction of lava flows with renewed uplift of the range in Tertiary time, the river, like a great saw, has continually deepened its channel across the rising land, until now the top of the canyon is higher than the land that lies athwart the alternative course toward the west and the north.

- GEOLOGY

Dominant Volcanic Formations

Only two types of bedrock, both of which are volcanic in origin, underlie considerable areas in the region of the Grand Canyon of the Snake. Interesting variations in surface features and in other respects also are due to the small amounts of limestone, the only sedimentary type, and to the granitic intrusions, which occupy somewhat larger areas than the limestone.

Associated with the firm bedrock are small local accumulations of superficial deposits, largely unconsolidated, which belong to the later stages of the area's history.

Greenstone:- A Permian Volcanic Series

The older of the two great formations and far the most widespread in the canyon and the Seven Devils Mountains is a dark metamorphic series of lavas and tuffs, chiefly andesitic in original character. Now they are altered into massive greenstone, a hard and resistant rock, which is so dark in color that it is almost black. Locally lighter shades are found, and also dark reds and purples. The greenstone formation is conspicuous in peaks, pinnacles, cliffs, and canyon walls, and the broken rock forms great expanses of coarse talus and slide-rock.

On the Idaho side this rock constitutes the canyon walls everywhere in this central Grand Canyon area and also the whole of the Seven Devils range, except the small group of granite peaks at the south end. The toughness and resistance of the formation are attested by the sharp horns of the Seven Devils, from the black top at the south to the towering He Devil, 9337 feet, at the north. On the Oregon side the same formation, rising to uneven heights, makes up more than half the canyon walls, be-

neath the overspreading plateau basalt. Some local areas of lighter color in the greenstone were originally rhyolite. The prominent Red Ledge, in such a rhyolite, has been stained with broad splashes of brilliant colors by the oxidation of ores that have been deposited in the rock.

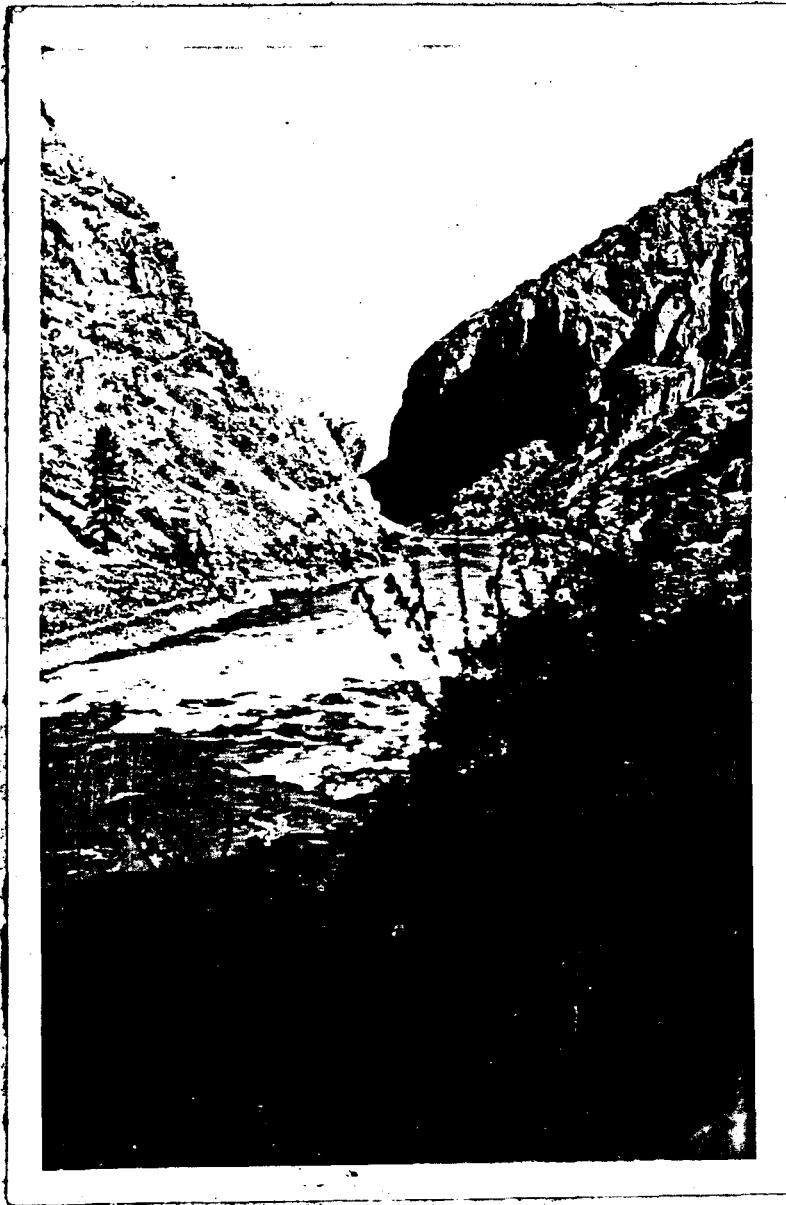
In the intense pressures and folding which these rocks have undergone they have lost almost entirely the old structure of the lava flows and the stratification of the tuffs and coarser fragmental volcanic materials. In the transformation they have become tough, massive, and highly resistant to erosion. The narrowness of the canyons, the exceeding steepness of their walls in the greenstones, as well as the innumerable cliffs, are expressions of this massive resistant character, as are also the pinnacled peaks and precipitous slopes along the serrate crest of the Seven Devils.

The ancient lavas and tuffs that are now greenstone constituted a series many thousands of feet thick, doubtless much thicker than the widespread Columbia River lava that now covers most of the greenstone area; but because of their steeply folded and metamorphic condition it will be exceedingly difficult, if not impossible, to measure their thickness.

Limestone:- A Permian Marine Formation

Somewhat prominent in a few places, but of very minor areal extent, are the small masses of limestone that are found at wide intervals in the greenstone. Also, in an area that is overwhelmingly igneous, in both the older and the newer formations, it is the only rock of sedimentary origin; moreover it is marine, and some of the local masses contain fairly well preserved fossils. The largest area of limestone in the immediate vicinity of the proposed national monument is found at Big Bar, three miles south of the suggested southern boundary. It is a bluish-gray rock and the layers, one to six feet thick, lie in nearly horizontal position on the Idaho side of the river. Strata nearly a thousand feet in aggregate thickness have been exposed, and the canyon has not yet been cut to the bottom of the series. On the Oregon side the beds are said to be folded and contorted. The solubility of limestone and its low resistance to erosion, in comparison with the enclosing greenstone, are prominently expressed at Big Bar by the marked local widening of the canyon. While it carved only the narrow gorge in the hard greenstone, the river has been able to widen as well as to deepen its canyon in the limestone.

Several disconnected smaller areas of limestone are known. The most conspicuous are the white crystalline ledges that form the crest of White Monument in the granite area two miles south of the proposed boundary. Here the gray limestone, caught in the intrusive granite, has been recrystallized and changed into marble, which in the dark landscape is conspicuously visible for many miles around. Some limestone areas about the ghost town of Helena have had ores of copper deposited in them, and numerous minerals have been formed by the contact metamorphism, including well crystallized garnets, epidote, and brilliantly colored copper minerals. These are abundant in the waste dumps and workings of the abandoned mines.



Down the canyon from Eagle Bar; fissured and jagged green-stone cliffs and ledges. Water level 1500 feet above sea. Rapids due to boulders dumped into the narrow channel from a small side canyon on the opposite shore. No road or trail down the "Box Canyon."

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Granite:- Cretaceous Intrusive Rock

Granitic rocks are deep-seated intrusives, which have cooled and solidified at depths thousands of feet below the surface. Wherever granite appears at the surface, therefore, it has been exposed by the removal of this cover by vast erosion to which the uplifted area has been subjected. In the great mountain mass of central Idaho about 13,000 square miles of granite have been uncovered. Similarly the westward spurs of these mountains, the Seven Devils, the Hallowas, and the Blue Mountains, have suffered immense losses by erosion from their uplifted summit areas, so that granite now appears in them at many places. This rock, therefore, serves as a record of important events in the geologic history of the region.

Gradations in the rock range from nearly white granite to darker granodiorite and diorite. All have the granular texture of granite and tend to crumble on exposure to severe temperature changes, as in the high mountains. The granite peaks are high and the slopes are steep, but the forms tend to become rounded and smooth at the surface, in contrast with the sharper pinnacles and angular, jagged cliffs of greenstone. These contrasts are well shown by the cluster of peaks that stand in a granite area of some 20 square miles at the south end of the Seven Devils, just south of the proposed monument boundary. They include White Mountain, Pyramid Peak, and the marble-crosted White Monument. Several fine glacial cirques near the head of Deep Creek and the beautiful cirque basin of Black Lake have been carved in the higher areas of this granite.

Smaller areas of granite that appear toward the southwest indicate that a greater extension of the intrusive rock in that direction lies buried at no great depth. The ore deposits of this region are also to be regarded as an effect of the granite intrusion, in fact a part of the intrusive process which extended into the invaded rock in places beyond the reach of the granite itself.

Basalt:- Tertiary Lava Chiefly Miocene in Age

Next to the greenstone, the Columbia River basalt is the most widespread and most conspicuous of the dark colored bedrocks in the immediate vicinity of the Grand Canyon of the Snake. This formation consists chiefly of grayish and brownish black flows of basaltic lava, with rarely interbedded layers of volcanic ash or coarser volcanic material, and in places sedimentary lake beds of considerable thickness. The flat-lying layers, in places gently arched and undulating, are generally from 20 to 60 feet in thickness. They have built up an aggregate thickness of thousands of feet over an area of 200,000 square miles in the States of Idaho, Washington, Oregon, California, and Nevada.

Many of the flows are dense, massive and have well defined columnar structure. Some are vesicular and therefore less resistant to weathering and erosion. Differences in density and in jointing into

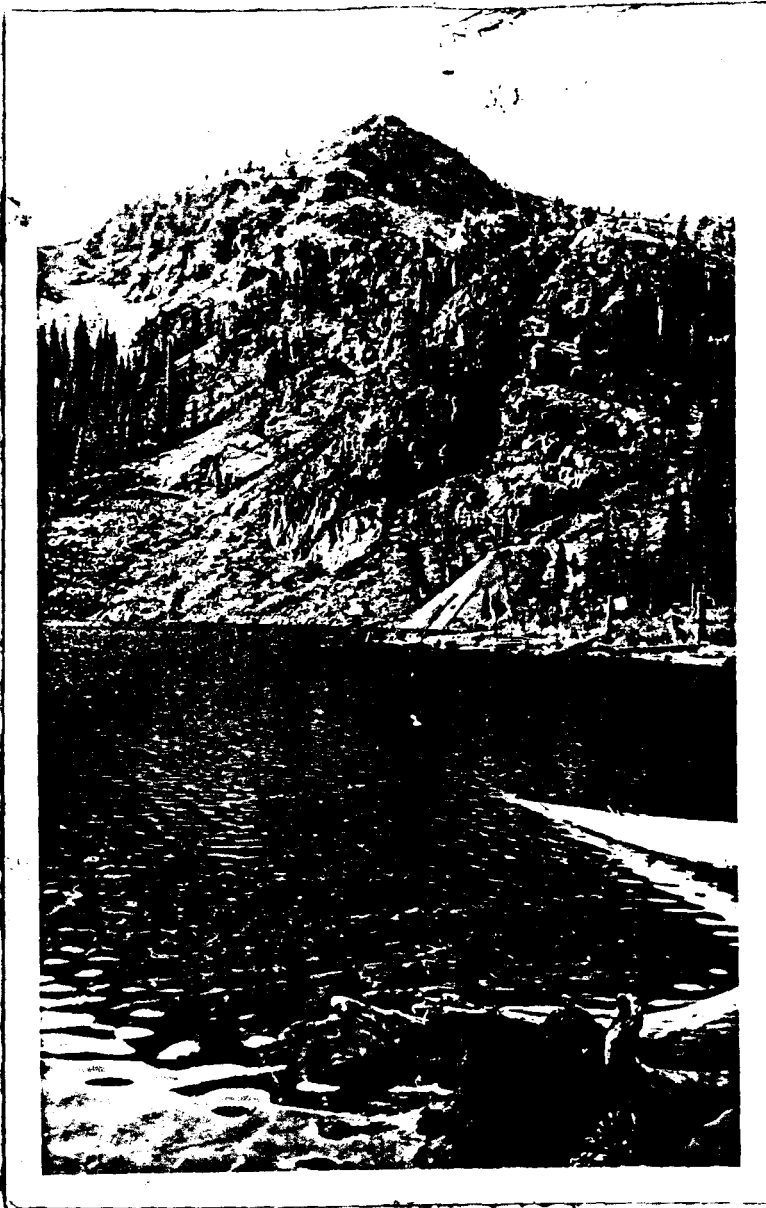
into larger or smaller columns cause variations in the strength and resistance of the rock, and these find expression in the weathered forms and the varied degree of prominence of the ledges where they are exposed along the canyons. In the west wall of the main canyon these flows form the upper slopes, from 1000 to 3000 feet or more in thickness, where they overlie the rolling, hilly, or even mountainous old land surface of the greenstone. On the Idaho side also they overlap the greenstone a little south of the granite peaks at the south end of the Seven Devils. From a point 16 miles upstream (south) from the suggested boundary of the monument the whole depth of the canyon is entrenched for 60 miles in these lavas. On the other hand, for more than 100 miles north, along the Oregon-Idaho boundary to the Washington line, the canyon almost everywhere is entrenched 1000 to 3000 feet or more into the greenstone formation beneath this blanket-ing plateau lava.

Owing to the prevailing grayish and brownish black colors of these two volcanic formations (the greenstone and the plateau lava), they generally are not readily distinguished from each other in the general view, except by the stratification of the flat-lying flows, in contrast with the massive character and almost complete absence of structure in the greenstone.

Surficial deposits: - Pleistocene and Recent.

Various unconsolidated superficial accumulations have been derived from the hard bedrock formations. They include the great areas of coarse rugged talus and slide-rock on the steep slopes of the lower canyon walls, the bars and fan-like aggregates of bouldery wash that has been dumped into the canyon from the steep tributary canyons, and the moraines and scattered glacial debris in the high mountains, chiefly above 6000 feet in altitude. A little alluvial material also has accumulated locally along many streams.

In the higher valley heads moraines at many places mark the limits of former glaciers. In a region so rugged, alluvial deposits naturally are scarce, although the coarse bouldery bars at the mouths of tributary canyons are to be classed in this group. While of little areal extent, they produce conspicuous effects in the constricted channel, where they provide the only obstructions, giving rise to the whole long series of pools and rapids, which alternate with stretches of swift smooth flow. The fan-like alluvial bars, where enough silt has accumulated to afford a little soil, in the more open upper and lower parts of the canyon, have been utilized at many places as ranch sites. Some of the ranches can be reached only by journeys over many miles of difficult trail.



Crumbling granite of Pyramid Peak (8354 feet) and the cirque walls above Black Lake (7200 feet), near the southeast corner of the proposed monument. Small waste dump from a mine drift near the lake at the right. Buildings and old mine in granite on the high bench at the right, 500 feet above the lake. Other workings, in the opposite direction, near the outlet of the lake, are in the greenstone, near the granite contact.

GEOLOGIC HISTORY

Late Carboniferous (Permian) time: - Volcanic activity; marine invasion.

The oldest rocks of the area, the great accumulation of dark greenstone and the included local lenses of limestone, were formed in Permian time, the closing period of the Paleozoic era. Detailed study of the area may discover also some similar materials that were formed in the following period, the Triassic, which introduced the succeeding Mesozoic era. Such formations are somewhat abundant in adjacent areas in northeastern Oregon. Records of the earlier Paleozoic and more ancient history, through immensely long periods of time, are lacking in the vicinity of the Grand Canyon of the Snake.

Two events in the ancient Permian time are recorded with remarkable clearness: (1) The vast accumulations of andesitic flows and tuffs are of volcanic origin, and probably they mark an immensely long series of recurrent fissure eruptions that spread over wide areas. The series is much thicker, but perhaps covered a less extensive area than the far later (Tertiary) eruptions that have produced the plateau-forming Columbia River Lava. (2) The limestone masses apparently are parts of one or more continuous beds, now shattered into fragments and dragged far apart. They mark one or more invasions of the sea into this interior region. Perhaps some of the lava was erupted in that ancient sea. Just how many separate strata of limestone, if more than one, are represented in the widely scattered fragments has not yet been determined and possibly can not be made out with certainty.

Triassic and Jurassic: - Land near the sea

Following the close of the Paleozoic, the Mesozoic era began with the Triassic period, during the latter part of which marine sediments again were formed in adjoining areas in Oregon, together with more volcanic tuffs and lavas. Therefore, for part of the time at least, the shore of the invading sea was not far away. That much of this region had been long subjected to erosion before the return of the sea is shown by the absence of earlier Triassic sediments and the erosional unconformity at the base of the later Triassic deposits.

Marine conditions in near-by areas continued through much if not all of the following Jurassic period, although the immediate area of the Snake River Canyon was dry land near the ancient shore.

Cretaceous: - Birth of the mountains; granitic intrusion

Like many other parts of the West, this region experienced the greatest disturbances in its known history in the latter part of the Mesozoic era, probably in Cretaceous time, although the movements may have begun before the close of the Jurassic. Great batholithic intrusions of granite and related rocks invaded the thick series of the greenstone.

(Permian) formation. These older lavas and tuffs were severely compressed and thrown into great folds. At the same time they were greatly changed (metamorphosed) into massive greenstone and extensively sheared and faulted in places. As part of these complex disturbances, mineral deposits were formed in these rocks, and the mountain areas were lifted thousands of feet above the sea, which so recently had covered them.

As a westward spur of the great mountainous area of central Idaho, the Blue and Wallowa mountains of Oregon and the Seven Devils of Idaho were formed at this time of profound earth movements, and doubtless they were connected in a continuous range. With long-continued uplift the mountain masses were subjected to more and more severe erosion. With higher altitude, steeper slopes, and greater precipitation the drainage carved gorges and canyons in the higher lands, and more open valleys were established across the lower areas. The summit regions particularly lost many thousands of feet, but on the whole the movements of elevation long exceeded the accelerated erosion, and the mountains thus formed, with various modifications in their later history, have persisted to this day.

Tertiary: - Mountains rejuvenated; plateau lavas; canyons.

The intense erosion of the high areas wore them down as the rate of elevation decreased, or perhaps ceased altogether. Through the late stages of Cretaceous, which closed the Mesozoic era, and the early part of Tertiary time, in the Cenozoic era, these vigorous young mountains were largely reduced to rolling hills. Only subdued mountain remnants persisted at higher levels in the Seven Devils, the Wallowas, and the Blue Mountains.

Then in early Tertiary time, perhaps late Eocene, the elevation of the mountains was renewed and the vast eruptions of the Columbia River lava began. These events are closely related to each other, and the numerous fissures through which the lava flowed out upon the surface doubtless were opened by the upthrusting movements that rejuvenated the mountains. With oft-repeated flows and continued or frequently renewed uplift of the mountains, the lava flows were gradually tilted up around the rising areas, and erosion removed from the higher surfaces all but small remnants of the earlier flows.

By the end of Tertiary time, before glaciers had modified the newly uplifted mountains, the area already was deeply dissected by the streams, very nearly as it is today, although continued or repeated uplift doubtless persisted through much of the intervening time.

Pleistocene and Recent: - Glaciation; deepening of canyons.

With the coming of glaciation, in the Pleistocene epoch, the summit areas and portions of the old rolling uplands, now at high plateau levels in the mountains, were heavily capped with ice, which carved them into new



Black Lake (7200 feet), east from Purgatory Saddle, 7931 feet,
and across the even old (Eocene) dissected upland. Looking down
Black Lake Fork; winding canyon in dark greenstone; cirque lake
basin in the border of the granite.

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and picturesque forms. Geologically the amount of work done by the glaciers was small in comparison with that of the streams, but it brought a new ruggedness and diversity to peaks and crests and added many beautiful cirques, lakes and widened steep-sided U-shaped valleys in the upper reaches of the drainage.

Further deepening of the canyons, which is still in vigorous progress, continued to exume portions of the old buried lands and to trench them with new gorges, where formerly they had long been concealed beneath the blanket of the Columbia River lava.

The time that has elapsed since the close of the Pleistocene, or Glacial, epoch is exceedingly short, as geologic history is measured, amounting to perhaps some 25,000 years, in comparison with about 2,000,000 years since the beginning of the Pleistocene. Erosion continues at an exceedingly vigorous rate in all this rugged region, but only a small fraction of the results expressed in the surface features today have been produced in the brief interval since the close of the Glacial epoch.

The persistent and almost uniform narrowness of the river channel throughout the 27 miles of deepest and narrowest canyon beside the Seven Devils range, together with the steep gradient that still continues in this section, attests the vigorous action of the deepening process today. Possibly the elevation of this great resistant barrier across the course of the Snake also continues at the present time or lately has been upthrust again.

MINERAL DEPOSITS AND MINING

Active early mining

The rather widely scattered mineral deposits of the region are closely associated with the intrusive granite, which invaded the greenstone formation, with its minor areas of limestone, in Cretaceous time. The Columbia River lava spread over the country later, so no ore deposits were formed in it.

The deep erosion, which uncovered a small area of granite in the high Seven Devils Mountains, also made available the ore deposits in the older formation near the contact with granite. Ores of copper are particularly widespread in the greenstone; also gold and silver ores have been found, both separately and in combination with the ores of copper.

In the 1880's and early 1890's many mines were operated in a small way, even in the most rugged portions of the mountains and at the bottom of the canyon. Greatly enriched shallow deposits made it profitable to haul the ores out great distances by pack animals and wagons, before the smelter at Landore was built. In those days the camps at Cuprum, Landore, and Helena, near the southern border of the proposed monument, were populous and prosperous. Landore and Helena have long been abandoned.

With the exhaustion of the locally enriched ores the activity declined, except for short-lived desultory operations; some of which continued to spring up at intervals in the first two decades of this century.

In the Seven Devils Mountains of Idaho most of the mines and prospects lie in and about the granitic rocks, which are exposed in the area of about 20 square miles and extend about 5 miles southward from the proposed monument boundary. Eight to 15 miles to the southwest, copper mining was formerly active in the canyon, chiefly in the vicinity of Homestead, Oregon. The last operations there were suspended in 1922. The railroad, which formerly extended to Homestead, has since been abandoned and the track removed back to Robinette, 12 miles up the canyon.

Relations to the proposed monument

Within the area of the proposed monument only a little desultory prospecting has been done, and that many years ago; except at the Red Ledge, where an extensive deposit of low-grade copper ore has been explored with the diamond drill. The road down the canyon on the Idaho shore, from the bridge near Homestead, Oregon, to Eagle Bar was built by the mining company, with the view to connecting with the mine through a tunnel, which was not completed. Apart from the inaccessibility of the prospect and the low grade of its ore, it has suffered from unseemly promotional notoriety and prolonged litigation.

The Red Ledge is said to be covered by about 80 mineral claims, patented and unpatented, and mining may yet be undertaken there at some time in the future. This type of deposit calls for high capitalization and large-scale operations, chiefly in great open pits and cuts. The mine and its structures would be visible from Sheep Rock, a viewpoint 2-1/2 miles south and 4000 feet above the mine, on a shoulder of the Seven Devils Mountains. The spectacular Red Ledge doubtless still would remain an attractive feature from this point, and the activity of mining might add rather than detract from it. The area is not visible from any other accessible point. From the bottom of the canyon at Eagle Bar the mine would be completely concealed, but this place perhaps affords the only practicable location for the mill and the town. The joint use of the road would present a problem.

Also in Deep Creek Canyon, about a mile above (southeast of) the Red Ledge prospect is a somewhat similar but smaller area of mineralization. The surface "showings" attracted attention a generation ago, but the prospect is considered of no interest now.

At Carbonate Hill, on the crest of the Seven Devils, 4 miles north of the proposed southeastern corner, the occurrence of gold has attracted the attention of prospectors, and a portion of the mineralized



North from Purgatory Saddle (7931 feet), down the glaciated U-shaped upper valley of Granite Creek. The glaciated black saw-tooth crest of the Seven Devils at the right, parallel to the valley. Emerald Lake occupies a glacial basin; 700 feet beyond it Granite Creek plunges into a narrow V-shaped gorge.

area may lie west of the divide, within the proposed monument. There are said to be no patented claims, and prospecting has not been active there since about 1910.

Most of the mineralized areas of greenstone and the intrusive granite occur within a belt several miles wide, which lies across the steep south flanks of the Hallowa Mountains and the south end of the Seven Devils, in a direction about N 60-70° E.

A little fine placer gold is found in the gravels and sands of Snake River, but the "pay streaks" that have been discovered were exhausted many years ago. The coarse bouldery accumulations that obstruct the swift current in places and form pools and rapids in the wild "Box Canyon" offer no inducement to the prospector, and there is no prospect that placer mining can ever be practiced along this portion of the river.

POTENTIAL WATER POWER

The Grand Canyon of the Snake, with its steep gradient, its narrow channel carved in the firm, massive greenstone, and numerous sites suitable for high dams, affords great possibilities for the development of water power. "The flow is well sustained, the gradient is steep, the cross-section is comparatively narrow, and the geologic formation throughout the greater part of the canyon would probably make good foundations for a dam of any height. On the other hand, construction would be difficult and undoubtedly expensive, for the working quarters would be cramped, and material would have to be transported long distances . . . In developing many of the sites a railroad to transport materials will be necessary, . . . and the unit cost per horsepower will be high." (U.S. Geological Survey Water-Supply Paper 657, p.247)

Also the cost of transmission lines would be high. Furthermore, readily accessible sites with great potential power possibilities still remain in the more open valleys of both the Snake and the Columbia. It seems a safe conclusion that the power possibilities of the Grand Canyon of the Snake will continue for many years to have only the mildest theoretical interest.

BIBLIOGRAPHY

Campbell, Arthur, Fortieth Annual Report of the Mining Industry of Idaho, for the year 1938.

Contains historical notes and data on the present status of mining in the Seven Devils district.

Gilluly, James, Copper deposits near Keating, Oregon: U. S. Geol. Survey Bull. 630, 1933

Geology and mineral resources of the Baker quadrangle, Oregon: U. S. Geol. Survey Bull. 879, 1937

These bulletins cover recent work in the region and give valuable information about adjacent areas in Oregon.

Hoyt, W. G., Power resources of Snake River between Huntington, Oregon, and Lewiston, Idaho: U. S. Geol. Survey Water-Supply Paper, 520, pp. 27-51, 1925.

Water Utilization in the Snake River Basin: U. S. Geol. Survey Water-Supply Paper 657, 1935.

Geographic features are described; power and water resources are covered comprehensively, with notes on the bedrock formations, especially at dam-sites.

Lindgren, Waldemar, The gold and silver veins of Silver City, DeLamar, and other mining districts in Idaho: U. S. Geol. Survey, 20th Ann. Report, Pt. III, pp. 65-256, 1900.

The gold belt of the Blue Mountains of Oregon: U. S. Geol. Survey 22d Ann. Report, Pt. II, pp. 551-776, 1901.

Valuable reconnaissance geology and more detailed discussion of ore deposits and mining activities, covering portions of the Grand Canyon of the Snake and adjacent areas.

Livingston, D. C., and

Laney, F. B., The copper deposits of the Seven Devils and adjacent districts: Idaho Bureau of Mines and Geol. Bull. 1, 1920.

Detailed reconnaissance with particularly valuable discussion of geologic history and topographic development.

Koore, Earnard H., Nonmetallic mineral resources of Eastern Oregon: U. S. Geol. Survey Bull. 975, 1937.

Covers the geology of a portion of the little known Wallowa Mountains.

Neuberger, Richard L., Hells Canyon, the biggest of all! Harpers Magazine, April 1939.

Popular discussion of scenic features and recreational possibilities.

Ross, Clyde P., Geology of the Snake River basin with reference to hydrology; U. S. Geol. Survey Water-Supply Paper 657, pp.23-35, 1935.

Summarizes the geology of the Snake River Basin.

The geology of part of the Wallowa Mountains: State of Oregon, Dept. of Geol. and Mineral Industries, Bull. 3, 1938.

This report, long delayed in publication, makes valuable contributions to the little-known geology of the Wallowas.

Smith, Warren DuFre, Physical and economic geography of Oregon, Chapter XIII, The Wallowa Mountains and County: Commonwealth Review of University of Oregon, vol. 10, No. 4, pp. 158-194, 1928.

A popular geographic description with geologic background.

Geologic reconnaissance of the central portion of the Wallowa Mountains, Oregon: State of Oregon, Dept. of Geol. and Mineral Industries. Map with text on back, 1933.

A further valuable contribution to the geology of the Wallowas, supplementing the reports of Gilluly, Ross, and Moore.

The Canyon of the Snake River. Personal communication and unpublished manuscript, January 1939.

Discussion of geologic history and topographic development.

State of Oregon, Oregon metal mines handbook, Northeastern Oregon, east half. Dept. of Geol. and Mineral Industries, Bull. 14-A, 1939.

Summarizes the geology of the mining districts and describes the geology and ore deposits of the mines and mineral claims.

U. S. Forest Service, Map of Nez Perce National Forest, Idaho
Map of Weiser National Forest, Idaho
Map of Wallowa National Forest, Oregon

Both in the field and in the preparation of the report these maps have been invaluable.

U. S. Geol. Survey, Plan and profile of Snake River, Lewiston,
Idaho, to Huntington, Oregon, 17 sheets, 1923.

Seven Devils Mining District, Idaho-Oregon,
advance sheet, 1920.

He Devil quadrangle, Idaho-Oregon, advance
sheet, 1922.

The 10 plans and 7 profiles, on the scale of 2 inches to
the mile, give invaluable data on the river and its channel
and the bottom of the canyon. They supplement in large
measure the incomplete advance sheets listed.

White, Fred M., Grand Canyon of the Snake River: Portland Ore-
gonian, Apr. 5, 1931.

PREPARATORY NOTE

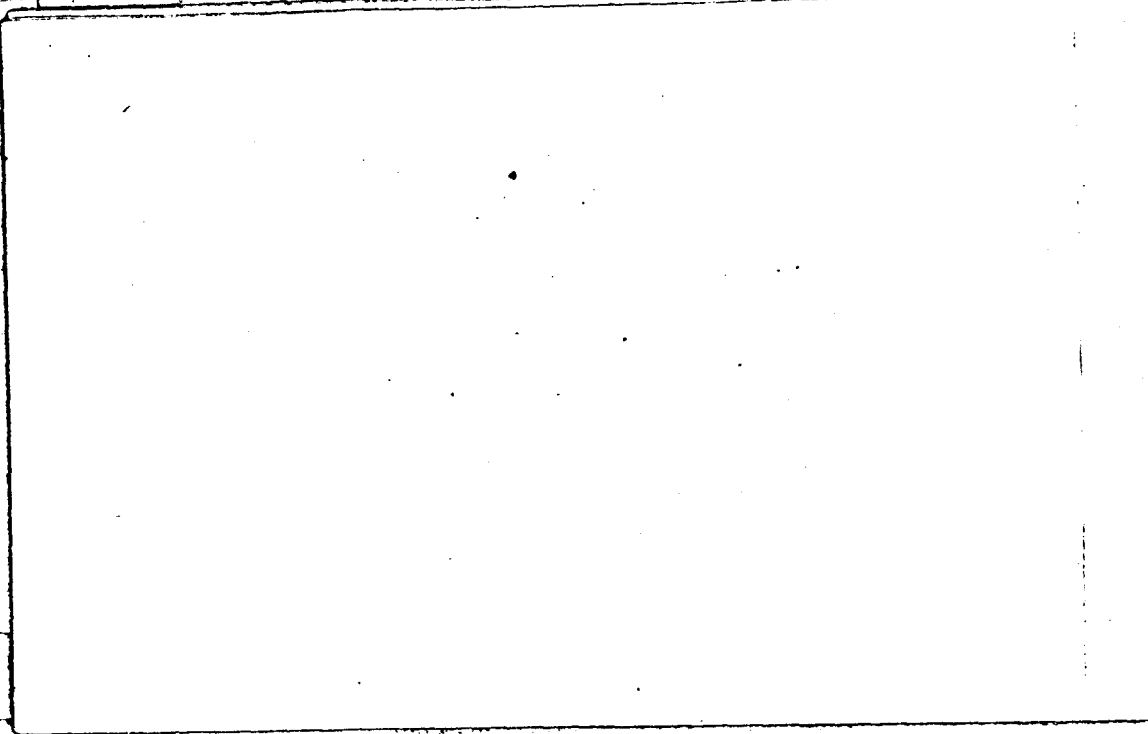
Considerable areas of this rich geologic and physiographic province have been investigated by geologists only in the most hurried reconnaissance many years ago, in connection with preliminary studies of mining districts in Idaho and Oregon. Hence the compilation of the geologic map and cross-section and the account of the geologic and scenic history of the canyon has required a search through many scattered and fragmentary records.

Various reconnaissance maps, sketches, and reports have been drawn upon, and the effort has been made to interpret the earlier work in terms of the more detailed later studies in neighboring territory. The map, therefore, presents only an approximate picture of the geology, and it is to be regarded as of sketch value only. Undoubtedly many errors exist in the details of the geologic boundaries.

Lindgren's fine reconnaissance work in Idaho and Oregon, during the closing years of the last century, still remains the only source for the geology of large sections of this canyon country. The later work of Livingston and Laney in Idaho and the recent (1930's) investigations of Ross, Moore, Smith, and Cilluly in Oregon, impinge upon the area from opposite sides and afford valuable clues to the interpretation of the canyon itself.

Geographically, the two incomplete advance topographic sheets in the Seven Devils area and the 17 plan and profile sheets of the river, through the Grand Canyon, furnish the indispensable base. Valuable supplementary data have been obtained from Hoyt's Water-Supply studies and the maps of the Forest Service.

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PANORAMA FROM HAT POINT, OREGON, 7000 FEET ALTITUDE

1. Plateau of stratified Columbia River lava, altitude 7000 feet; looking northeast along the rim of the Grand Canyon of the Snake.

2. View east across the canyon. Bedded lava of the upper rim at the left and in the middle foreground; the rest of the area is massive greenstone, with a dendritic drainage pattern. The mouth of Saddle Creek in the foreground marks the proposed north boundary. The declining north end of the Seven Devils is on the horizon at the right.

3. Southeast across the canyon; typical dark greenstone country. At the horizon, the rugged peaks of the Seven Devils, above 9000 feet; just beneath them, on the high shoulder (7500 feet) is a relic of old upland about Dry Diggins and upper Squaw Creek.

4. Southeast across upper Saddle Creek, just within the proposed north boundary. The canyon lies beyond the nearer dark ridge. At the horizon, the rounded granite peaks at the south end of the Seven Devils. On the nearer ridge, isolated and almost inaccessible, the peaks are Black Mountain (left), 6881 feet, and Bear Mountain, 6909 feet.

SUMMARY

As widely separated as the poles, although only 800 miles apart in direct line, are the two Grand Canyons. Both are spectacular, stream-cut gorges worthy of the title, but otherwise they are widely dissimilar, essentially opposite, in almost every detail - geologic, physiographic, and scenic.

The colorful Grand Canyon of the Colorado has long been famous; the deeper and narrower Grand Canyon of the Snake, dark and forbidding, isolated and almost inaccessible, still remains unknown. Set over against the brilliant series of sedimentary strata at the south, gashed by the winding muddy Colorado, are the vast accumulations of brownish-black volcanic rocks, trenched in nearly straight course by the clear turquoise-blue water of the Snake.

At the Colorado volcanic rocks are negligible, at the gorge of the Snake sedimentary strata are almost entirely lacking. At the south the strata "leap to the eye" in sharply defined color and manifold expression in scenic detail; at the north the dark ancient lavas, transformed into dense greenish-black "greenstone", have lost their bedded structure; the flows of the fresher plateau basalt are still distinct, but so much alike in their somber brownish blackness that they are inconspicuous in the broad general view.

The abrupt and gloomy canyon walls of the Snake are cut mainly in the massive greenstone, except about one-third to one-half the height at the west side, which shows the bedded flows of the plateau lava. The whole east wall is greenstone to the pinnacled crest of the Seven Devils Mountains, except for a small group of granite peaks at the south end of the range. The mountains stand in sharp contrast with the plateau rim of the Columbia River basalt at the west. Across the canyon and twenty miles from it, the Wallowa Mountains of Oregon rise like a rugged island above the ocean-like expanse of the lava plateau.

In Cretaceous time a mountain range arose across the Snake River, and again it was rejuvenated in Tertiary time, with the added obstruction of innumerable far-spreading flows of lava; but the river was not diverted from its course. Like a great saw, it cut its canyon across the rising range and through the accumulating thousands of feet of plateau lava.

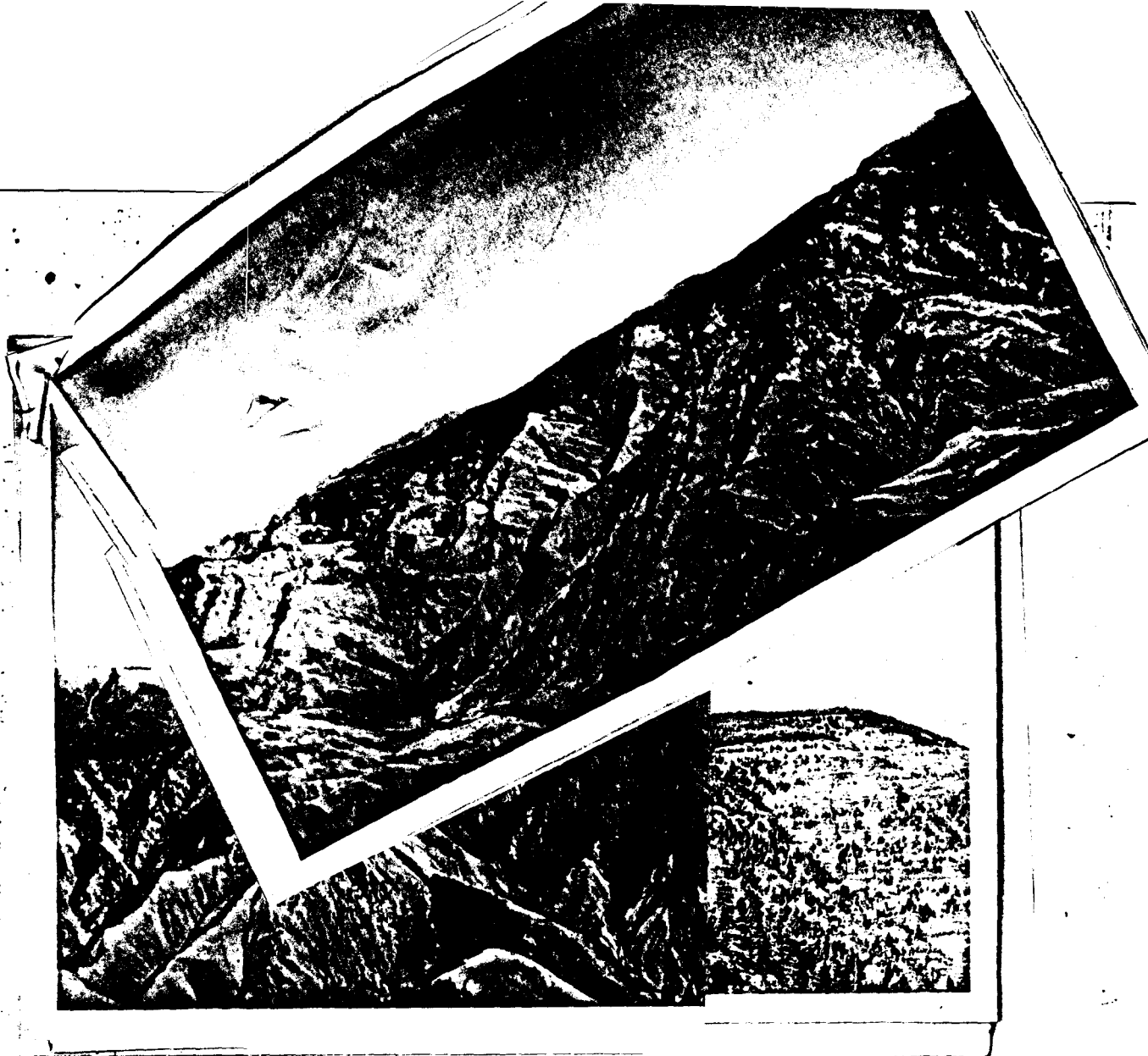
Later glaciation has diversified and added many spectacular features to the summit areas of both the Wallowas and the Seven Devils.

In contrast with the muddy Colorado, the Snake is a clear-water stream of turquoise blue. In the massive green-stones it has cut a remarkably smooth channel. No waterfall breaks the continuity of its swift flow. Throughout a 27 mile stretch in the narrowest and deepest portion, the channel, elsewhere in the canyon 200 to 300 feet wide, is amazingly narrow. At many places it is less than 100 feet across. Coarse bouldery debris from steep side canyons has obstructed this channel in places and formed pools and rapids. Many rapids are rough, spectacular, and dangerous; but none is due to obstructing ledges of the bedrock.

Mineral deposits--copper, silver, and gold--are scattered about the granite area at the south end of the Seven Devils Mountains and southwestward across the canyon, in a belt that extends also across the south flanks of the Mallova Mountains in Oregon. In the 1830's and 1890's and in places during the first decade of this century, there was much prospecting and small-scale mining. More ambitious ventures were undertaken at a few places. The shallow enriched deposits were worked out at many places and the ores packed out on horses down many miles of difficult trail.

Except a few desultory gravel washings for gold, these operations were conducted outside of the area suggested for a monument, although some old abandoned mines are near the southern and southeastern borders. So far as known, only a little prospecting has been done in the proposed area, and that was years ago. An outstanding prospect that may some day develop into a mine is the spectacular and inaccessible Red Ledge, where a large deposit of low-grade copper ore has been explored extensively. The road to Eagle Bar was built with the expectation of tunneling through Haley Ridge to Red Ledge. If a mine is ever opened here the operations will be visible from Sheep Rock, on a high shoulder of the Seven Devils $2\frac{1}{2}$ miles south and 4000 feet above the Red Ledge. Along with the colorful Ledge probably the great open cuts would be an added attraction to most visitors.

Great possibilities exist for the development of water power in the canyon, but the excessive cost of development and transmission to any possible or imaginable market seems practically to exclude this canyon from consideration as a source of power.



PANORAMA FROM HAT POINT LOOKOUT, OREGON

1. Northeast across the lava plateau, 7000 feet altitude, toward the canyon of the Imnaha River, 6 miles distant. Horizontal lava flows appear at the canyon rim, in the foreground.

2. North along the rim of the canyon; horizontal flows of the lava plateau are seen at the left and in the middle foreground. In this direction, north of the Seven Devils Mountains of Idaho, the two sides of the canyon are approximately at the same altitude.

3. East across the canyon. Snake River is visible in the left foreground, $3\frac{1}{2}$ miles away and more than a mile (5700 feet) vertically below. Uniform dark greenstone formation; dendritic drainage pattern.

4. Southeast across the canyon. Dark greenstone country; dendritic drainage pattern. Squaw Creek canyon beyond the nearer high ridge. The rugged greenstone peaks of the Seven Devils, above 9000 feet, on the horizon at the right.

CONCLUSIONS

1. The Grand Canyon of the Snake River possesses in a marked degree the scenic qualities and scientific values that commend it for establishment as a national monument. As such it would undoubtedly measure up to the highest standards of the Service.

2. It is not to be compared with the Grand Canyon of the Colorado. It belongs to a wholly different type, of which it is the outstanding example in the nation and doubtless also in the continent.

3. The lack of scenic color and brilliance is compensated by a fascinating and challenging austerity and ruggedness. Also the brown barrenness of the arid canyon is capped with the dark green of coniferous forests on the more humid plateau and the high shoulders of the Seven Devils Mountains.

4. As the preeminent example of a wholly "different" type, geologically, physiographically, and scenically, in marked contrast with the Grand Canyon of the Colorado, it is, in my estimation, entirely worthy of recognition, not only as a national monument, but as a national park.

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Left from B.S.
April 1975

FILE COPY

GRAND CANYON OF THE SNAKE RIVER

Idaho-Oregon

Geology and Scenic Features

Mineral Deposits and Mining

Potential Water Power

By

J. Volney Lewis
Regional Geologist
Region Four

December 1939

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