

Report No. 148

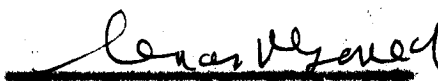
Inspected: July 10, 1937

THIRD GEOLOGICAL REPORT

ON

HOT SPRINGS NATIONAL PARK

Submitted: July 13, 1937

  
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Report No. 128

Dated: July 10, 1907

**THIRD GEOLOGICAL REPORT ON HOT SPRINGS NATIONAL PARK  
ARIZONA**

**BY: CHARLES F. COULD**

My first report on Hot Springs National Park, No. 52, was submitted June 22, 1901, from an inspection made June 12-14, 1901, and dealt with general geological conditions at Hot Springs. The greater part of the report dealt with the slumping along a road on West Mountain. A memorandum covering this subject was submitted to Regional Officer Miller on June 12, 1901.

A second report, No. 119, dated March 12, 1907, was made from an inspection made February 28 and 29, 1907. On this inspection I was accompanied by Messrs. Samuel, Ditch, Hirt and Stierlich.

In my memorandum of June 10, 1901, after outlining the conditions on West Mountain, I say:

"It will be necessary to take remedial measures to remedy this condition of slumping and creeping soil conditions intensifying, and still larger amounts of soil and loose rock, eventually covering large forest trees, will continue to be carried down into the road. I consider it a major problem.

"In my judgment the drainage of the entire road system on the south slope of West Mountain is insufficient.

"I know of no better method of checking the slumping and slides along the roadside than by building a retaining wall. Many walls have been built along the roads on Hot Springs Mountain, across the valleys. In these cases they were straight masonry walls and rather unsightly. Planting of bougainvillea, viburnum, and other similar shrubs and vines have been used to cover the walls.

"My suggestion would be that the wall along the road in question on the south slope of Hot Mountain be built of rough stone, each succeeding layer being set back, with plenty of space for planting shrubbery. There is an abundance of suitable rough stone for this work in some of the scree-like gullies in the vicinity of Hot Springs. I believe that this method of constructing a retaining wall will prove satisfactory."

In my second report, No. 110, after discussing geological conditions, I charge on the subject as follows:

"The slumping on Hot Mountain, which is occurring in the detritus above the Stanley Shale, is the result, chiefly, of two factors, namely, gravity pull, and the lubrication of the detritus by water."

"Nature is now attempting to re-establish the angle of repose which has been destroyed by man."

"To me, it appears very probable that this slumping might have been prevented, at least in a large measure, by the construction of a retaining wall, or by other mechanical means, at the time when the road was first built, and before there had been any movement of material in the slope above. On Hot Springs Mountain, across the valley where geological conditions are quite similar, walls were built at the time of the construction of the road and little slumping had occurred. Even at the time of my first visit, such a wall would doubtless have prevented a considerable amount of slumping. But water from the January rains has so affected the slope that cracks parallel to the road are now opening up all along the mountainside above the road. Some of them are 200 feet above the road."

"Water from future rains will continue to pour into these cracks, loosening the detritus and increasing the sliding of the material down onto the road. As long as the laws of gravity continue to operate, and while water from rainfall continues to seep and lubricate the material, this detritus will continue to slump downhill, and this will not stop until either a natural or an artificial equilibrium has been established."

"The curing of the slumping is an engineering rather than a geological problem."

"My comments on the situation may be summarized as follows:

"The slumping on West Mountain is being caused by gravity and by water which loosens the debris.

"The angle of repose, or angle of rest, which had been established through long periods of time, has been disturbed.

"Nature is now attempting to re-establish this equilibrium, and will continue to do so.

"To check the slumping some mechanical means should be employed.

"Competent engineers, experienced in problems of this kind, should suggest the best remedy.

"Slumping could probably have been prevented by proper means at the time when the road was built, and before the debris had started slumping.

"It now has assumed major proportions, and will probably be an expensive proposition.

"Any method of control adopted should include a careful study of the entire drainage system of the slide on the mountain."

On my last inspection, July 10-11, the results of which are tabulated in this report, I found that little attempt had been made to remedy the situation on West Mountain. Figure 1 shows the slumping on the road on July 11, 1907. However, according to Superintendent Libbey, the Bureau of Public Roads which has had charge of the construction of the road, has been making plans to remedy the slumping. As explained to me by Superintendent Libbey, these plans include (1) the widening of the road on the down-hill side, (2) the installation of concrete cribbing not into the upper part of the present roadway, (3) the building of a five-foot gutter in front of the cribbing, (4) the building of a turreted, rock retaining wall in front of the cribbing, with openings provided for the plantings

of shrubs and vines, and (5) a series of drains of perforated, corrugated tile in the bank above the wall, and under and through the cribbing, to take care of surplus rainfall and water percolating through the soil.

It will be noted that this plan does not differ materially from the one which I suggested a year ago.

One effect of the installation of this cribbing and retaining wall will be to permit a portion of the rock and debris from above to come to rest behind the wall, and in a sense tend to restore Nature's "angle of repose", which was destroyed when the road was built.

My judgment is that when this wall has been installed it should go far toward solving the problem. Only time can tell whether or not it will be 100% effective.

Measures are also being taken to correct the drainage situation as suggested in my first memorandum. Considerable yet remains to be done along this line, but progress is being made.

Since the time of my first official visit to Hot Springs National Park in June, 1936, great improvement has been made in the museum, which is housed on the ground floor of the headquarters building. I consider it to be one of the best museums in any National Park with which I am acquainted.

The room is well lighted, the cases are attractive, and the exhibits well arranged and provided with explanatory labels written in non-technical language. There are eleven exhibit cases and a relief map of Hot Springs National Park and vicinity.

The outstanding exhibits from the geological standpoint are in the two cases first seen by the visitor as he enters the room. The first case illustrates the geological history of the Hot Springs region. By means of cross sections one is shown the original deposition of the formations, the folding and crumpling of the rocks that took place when the mountains were first elevated, the erosion or wearing down of the rocks, the subsequent elevation, and the later erosion which has produced the present topography. These processes are described by appropriate labels.

In the second case a very clever attempt has been made to explain the mechanism of the Hot Springs. Constantly ascending bubbles through a glass tube from a subterranean heated source, presents a graphic illustration of underground conditions as they are believed to exist.

There are two cases dealing with Indians, and three with the history of the Park, while others contain exhibits of rocks, minerals, fossils, plants, animals and hot water biology. Superintendent Libbey and Park Naturalist Lix deserve much credit for the arrangement of this outstanding museum.