

THE WEATHERING AND EROSION OF NORTH AND SOUTH SLOPES.

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The experience of the writer in climbing the hills of southeastern Indiana, and especially those in the vicinity of Hanover and Madison, led to the opinion that, in certain valleys, there was a considerable variation in the inclination of the slopes.

During the last few months accurate measurements of the inclination of the slopes, of the depth and of the direction of trend, of four valleys or ravines were made with a view to ascertaining the amount of variation in the inclination of the slopes, and a reason for the variation where it was found.

The valleys or ravines, chosen for the measurements, are locally known as Butler, which is about one-half mile south of Hanover; Crowe, which borders the Hanover College campus on the south; Happy Valley, which borders the college campus on the north, and Clifty, which is located about two miles west of Madison.

The hills in the region of these valleys are capped with the so-called bluff limestone of the Niagara formation, the Clinton, and the Madison beds of the Ordovician. These rocks are comparatively uniform in texture and hardness throughout the region concerned. Butler, Crowe and Happy Valley ravines are less than a mile in length, and Clifty is but little more than two miles in length, from the mouth to the falls, which are found in each valley. The depth of these valleys, however, is approximately 260 feet, aneroid measurement. The valleys are eroded to the level of the Ohio River, into which the streams occupying them empty.

The great depth of the ravines, as compared to their length, is accounted for by the fact that the Ohio-Wabash divide in this region approaches in places to within a mile and a half of the Ohio River.

The streams which have formed the valleys, across the lower portions of which the sections were made, are all small, and, with the exception of Clifty, are just able to transport the materials brought into them and do not erode the sides to any extent. Hence, we have in these valleys exceptional conditions for the study of the weathering and erosion of slopes.

Two sections were made across each valley with the exception of

Butler, and in each case the sections were intended to be fair averages of the slopes. The following data were obtained as an average result of the sections made in each valley.

BUTLER RAVINE.

Direction of trend, north, 70 degrees west.
Inclination of south slope (i. e., slope facing south), 25 degrees.
Inclination of north slope, 28 degrees.
Depth, approximately, 260 feet.

CROWE RAVINE.

Direction of trend, north, 80 degrees west.
Inclination of south slope, 22 degrees.
Inclination of north slope, 26½ degrees.
Depth, 260 feet.

HAPPY VALLEY RAVINE.

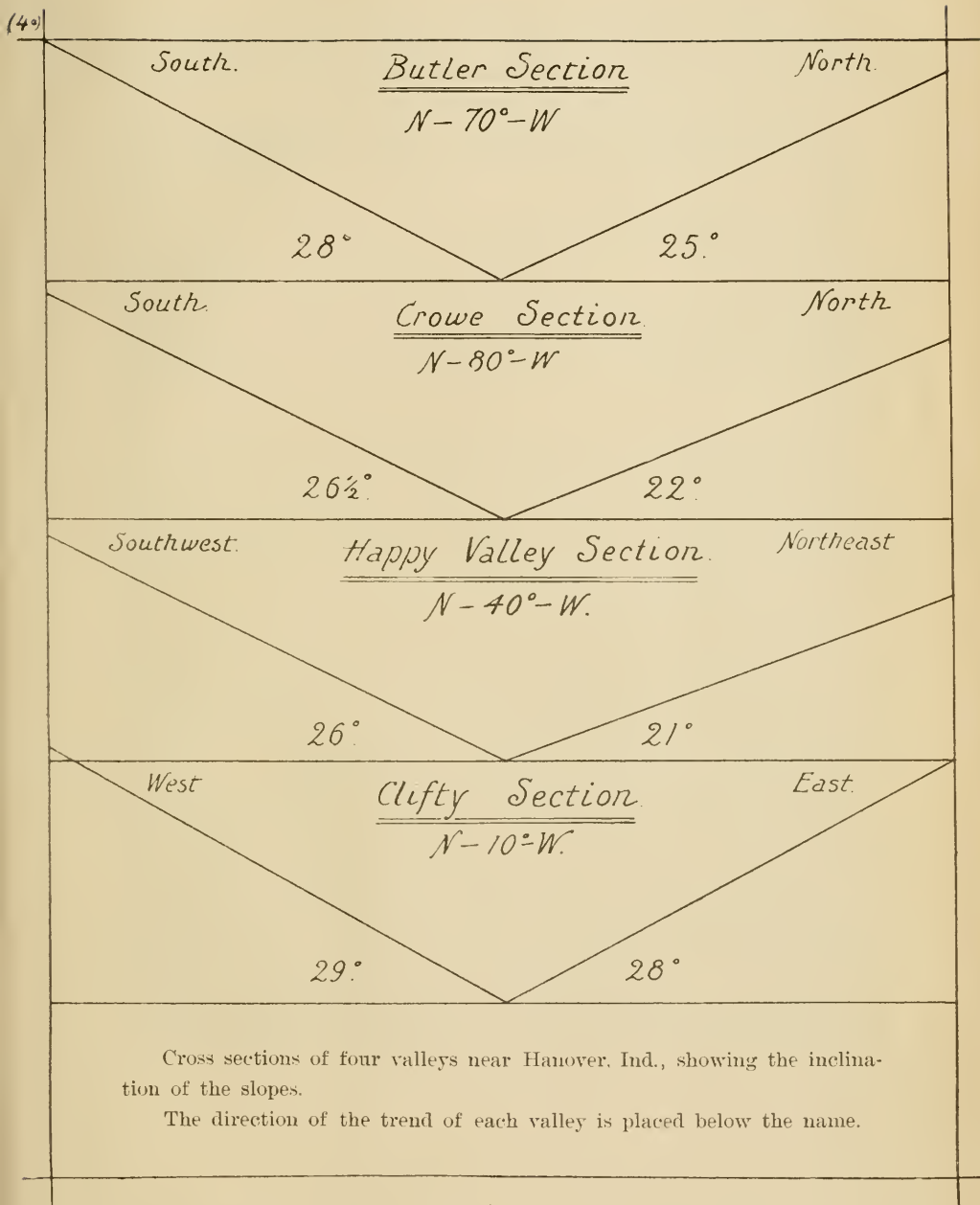
Direction of trend, north, 40 degrees west.
Inclination of southwest slope, 21 degrees.
Inclination of northeast slope, 26 degrees.
Depth, approximately, 255 feet.

CLIFTY VALLEY.

Direction of trend, north, 10 degrees west.
Inclination of west slope, 28 degrees.
Inclination of east slope, 29 degrees.
Depth, approximately, 270 feet.

(Reference to the accompanying figures will aid much in appreciating the variations in the slopes.)

These cross sections indicate a decided variation in the rate of weathering on the two slopes, in the cases under consideration, where the direction of valley trend is from east and west to southeast and northwest approximately, but that there is little variation where the valley trends approximately north and south. Sections taken of other valleys extending in a general north and south direction verify the latter statement.



The cause of the more rapid weathering of south slopes (i. e., those facing the south) is, no doubt, partially due to expansion and contraction. The massive rocks of the Niagara, Clinton and Madison beds of the Ordovician have been more rapidly broken to pieces on the south slopes than on the north, because of the much greater daily change of temperature on the south than on the north slopes. This is especially true during the winter season.

The chief agent, however, in producing the variations in the sections noted, is that of frost. The action of frost in producing such variation is three fold. First, the almost daily thawing and freezing of the moisture in the rocks of the south slopes during the winter produces a more rapid disintegration of these rocks, than would take place on the north slopes, where thawing occurs but few times comparatively during the winter season.

Again the surface soil of the slopes facing the south goes through the freezing and thawing process several scores of times during the winter, while that of the north slopes remains frozen almost continuously during the average wintry season. The "creeping of soils," resulting from frost action, is too well known to need explanation here, and must, to a large degree, account for the variations noted.

Again, the soil of the north slopes is frequently frozen, and even covered with snow or ice, while that of the south slopes is unfrozen. Hence, the erosive action of many winter rains is almost nothing on the north slopes, while it may be quite marked on the south slopes. This is an additional cause for the variation noted in the sections taken.

With the exception of the north slope of Crowe Ravine and the east slope of Clifty, the region considered is all wooded, while the unwooded slopes have been so but for a few years. What the effect of weathering and erosive agencies may be upon north and south slopes of land from which the forest trees have long been removed, has not been investigated, but from the greater abundance of loose stones on the south slopes of cleared and more or less neglected land, it is probable that the variation in the effects of weathering and erosion on the north and south slopes is even more striking than in the case of land covered with forest growth.