

SOME EVIDENCE INDICATING THE IMPORTANCE OF FROST
ACTION IN WIDENING VALLEYS.

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At several points along the lower reaches of Clifty gorge in Jefferson county, Clifty Creek in its first attempts at valley widening has eroded the sides of the valley to such an extent as to cause more or less extensive landslide areas. In the case of several of these, the naked soil and rock are exposed for a horizontal distance of several hundred feet, and vertically several scores of feet. About one-half mile from the Madison and Hanover road across the mouth of the valley, there is such an erosion area on the slope facing west. Near the south end of this exposure a large mass of the original rock extends out into the valley, as may be seen by referring to the figure.

The formation into which the stream is cutting at this point is that of the Lorraine shales of the Ordovician. At this horizon the Lorraine is composed of alternating layers of limestone from one to three inches in thickness and comparatively soft blue shale comprising at least 75 per cent of the whole. At the point "A" in the figure, the stream at every flood stage undercuts the steep slope and removes all debris consisting of broken lime stone and shale resulting from the weathering of the exposure. The projection at "B" is composed of the same material as that at "A", and is from its position especially exposed to the action of the stream at flood stage and thruout its course in the two mile gorge the stream gradient is high.

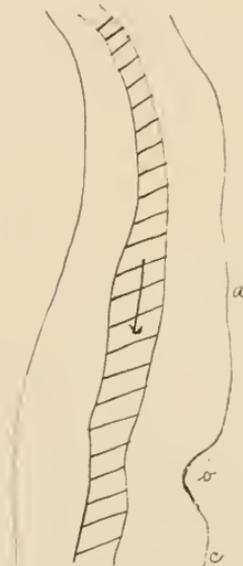
Why has this projection "B" been able to endure while a similar material both upstream and down has been carried away? In the judgment of the writer, it is due to the fact that a spring emerges from the hillside above, the waters of which flow over the projecting rocks at "B", and not only prevents freezing, but keeps them uniformly at the same temperature and moisture. The part "B" which stands out some twelve or fourteen feet beyond the part "A" and at least six feet beyond the part "C" which is completely protected from the force of the flood waters by the projection, is kept well covered by the spring waters at all times. The difference in the rate of valley widening here which is quite marked, is probably due to two, if not three processes. First and foremost is frost action. The alternate freezing and thawing which occurs many times during the winter, loosens annually large quantities of material from the steep slope at "A" which is entirely unprotected by vegetation. The Spring floods periodically remove this. Some material of this sort, however, is loosened and accumulated during the summer and autumn. Hence another cause of weathering must be sought, that does not take place at "B". Alternate expansion and contraction due to change in temperature is responsible for part of this work, but in the writers judgment, alternate wetting and drying, which takes place many times during the summer, may be equally as efficacious.

At two other points in Jefferson County, a similar protective influence of the waters of springs has been noticed. In these cases the formations protected were resistant Devonian limestones, and the mass of the projecting area was not nearly so great as in the case of the less resistant

Lorraine shales described above. These were sufficiently striking, however, to indicate that all such weathering agencies as the above, probably have much more to do with the widening of valleys in native rock formation than has been generally conceded.



Photo showing character of materials at a and b.



Rough Sketch of Bed of Clifty Creek Showing Special Feature of b.