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Strata between Ford and Winterset

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it is only the outside which is changed, to the depth of from two to four centimeters, or more, the interior still often preserving the rock in its original character, so that no doubt arises concerning its composition and structure previous to its embedding in the granite. The contact zones are in all respects identical with the contact belts of other localities where acid eruptives have pushed up against the same kind of rocks.

Chemical analyses of the unaltered inclusions, the metamorphosed shells and the surrounding granites show that the altered shells have an acidity intermediate between the inclusions and the granites.

These proofs of eruptive origin of the Maryland granites are quite similar to those which Barrois* has formulated from granites of Rostréne.

(4) *Microscopical Examinations.*—Aside from the ordinary microscopical characters indicative of cooling from fusion, certain of the granites under consideration show some additional phenomena pointing to the same end. These are large grains of micropegmatitic intergrowths of quartz and feldspar rounded through magmatic corrosion apparently and having the characteristic embayments so commonly associated with cases of this kind.

STRATA BETWEEN FORD AND WINTERSET.

BY J. L. TILTON, INDIANOLA.

[The following article was accompanied by a series of diagrams representing the size, location, and relative position of the various out-crops.]

Middle river rises on the eastern slopes of the divide in Adair and Guthrie counties. It flows just south of Winterset, in Madison county, then northeasterly to the northeast corner of Warren county, where it takes an easterly direction for four miles and flows into the Des Moines river, about eight miles below the city of Des Moines. Consequently, a line drawn along Middle river from its mouth to Winterset, a distance of about fifty miles, passes from close to the lower strata of what White calls the "Middle Coal Measures," across the entire series of both the "Middle" and "Upper Coal Measures." In the sections found along this line we may ascertain the local thickness of the different strata, some facts in regard to the continuity of the different strata and of the different seams of coal, also the position of the border between the "Middle" and "Upper Coal Measures;" or between the "Lower" and "Upper Coal Measures," following the classification that will probably be accepted.

In the diagram before you the different out-crops are so drawn by a scale as to represent the relative thickness of each of the strata, their distances apart and location. These diagrams are so placed side by side as to represent the continuation of the strata.

The explanation accompanying each stratum describes the surface appearance at the out-crop, regardless of what the texture of the stratum may be where atmospheric agencies have had less chance to work than at the exposure; yet, comparing the out-crops of the same stratum in sections adjacent to each other, we see in various places a change in structure not to be wholly explained by the action of atmos-

*Ann. de la Soc. geol. du Nord, t. XII, p. 106. 1885.

pheric agencies. The composition of the strata themselves is different. Here are not only numerous places where solid sandstone graduates into shale or into sand, but also places where sandstone graduates into clay, and places where the same strata differ in thickness. If the relation of the strata is correctly represented, six different seams of coal are here represented, all but one cut by erosion and varying in thickness, one, especially, a foot and a half thick thinning completely out in a mile and a half, its place being taken by a foot and ten inches of sandstone.

The change in the strata due to the decomposition of the sandstones is readily understood; the surface water percolating through the soil leaches out the iron oxide in the stone thus allowing the stone to crumble to pieces. The change from sandstone to clay in this particular locality seems to be due to differences in the direction and velocity of currents, while the same changes of elevation in the earth's crust that submerged the swamps and raised them above the water, also aided in varying the margins of the sand deposits.

Close to the western boundary of Warren county the river strikes against the hills which are here more precipitous than to the eastward. About three miles southeast of Winterset we find the section represented by the left diagram. The sandstone stratum lowest in this diagram I judge to belong to the "Middle Coal Measures," and to mark the division between the "Middle" and "Upper Coal." This stratum of sandstone you noticed continued in adjoining out-crops. The ledge of marble shale twenty feet in length is clearly a continuation of corresponding strata measured by White at Winterset three miles further on.

Near the mouth of the river indications of coal are much more abundant than further up the river. The last diagram on the right presents a section found one-fourth mile east of a bridge near Clarkson, though the strata were traced by out-crops along the bluff from this point to Ford, four miles further on. In the side of this bluff are to be found numerous entries near Ford, in one of which at a distance of fifty feet from the face of the bluff, three and one-half feet of pure coal was measured, the out-crop in the face of the bluff being two and a half feet.

ANALYSIS OF WATER FOR RAILWAY ENGINES.

BY C. O. BATES, CEDAR RAPIDS.

The following is one of a hundred analyses made along the Burlington, Cedar Rapids & Northern Railway. Nearly all the samples are from the State of Iowa. The analysis is supposed to explain itself so far as the results of such an analysis are concerned.