aggregate length of its tunnels is more than six miles, and the yield of marketable mica above 40,000 pounds.

In preparing the blocks of mica, splitting and cutting to the forms and sizes demanded by the markets, there is a waste of nine-tenths to nineteen-twentieths, even in a good mine.

The feldspar, which constitutes the larger part of the mass of these veins, is often found converted into beds of the finest kaolin; and, curiously enough, this was one of the first and most valuable exports to England in the early part of the seventeenth century, "packed" by the Indians out of the Unaka (Smoky) Mountains, and sold under the name "unakeh" (white). This kaolin, like the mica, will doubtless soon come again into demand, after lying forgotten for generations.

These are only a few of the more prominent characteristics of these very interesting veins. I have not referred to their singular richness in rare minerals, as samarskite, uraninite, gummite, allanite, etc., nor to many curious and unexplained relations between the marketable character of the mica,—size, color, purity, fissility, etc.,—and the special matrix in which the blocks are imbedded. I do not know a better region for the study of the structure and origin of veins in general.

THE GOLD GRAVELS OF NORTH CAROLINA—THEIR STRUCTURE AND ORIGIN.

BY W. C. KERR, STATE GEOLOGIST, RALEIGH, NORTH CAROLINA.

When Agassiz and his party of geologists commenced their exploration of the interior of Brazil and the Amazon region, one of the first and, to the last, one of the most novel and striking phenomena which met them everywhere was the great depth of decomposed or partially decayed rock *in situ*, which mantles, and for the most part conceals, the underlying strata. The same facts strike all geological observers from the North who happen to penetrate the middle and southern latitudes of the Atlantic States. In North Carolina, *e. g.*, the entire middle and western regions, outside of the Quaternary clays, sands, and gravels of the East,—that is, all that portion of the State occupied by the Archæan and Mesozoic rocks,—show everywhere this peculiarity, so new to those accustomed to glaciated surfaces. Not only do the hills and slopes, the mountain chains and

spurs, present everywhere to the eye this superficial covering, but even the more level tracts and the valleys. The railroad cuts give very good exposures of this covering, and furnish, everywhere, abundant opportunities for the study of its structure and history. Some of the more obtrusive facts are these: the thickness of this covering varies from a few feet to 30 or 40, and often 60 and 75, and even 100 feet, and bears an obvious relation to the character of the underlying rock, being least where this is most refractory, and *vice versa;* the rock is generally nearest the surface in the crests of the hills. The upper portion of this earthy envelop for several feet beneath the soil is homogeneous and structureless; but lines of structure soon make their appearance, becoming more pronounced with the depth. These lines of structure are commonly coincident with bands and ribbons of differently colored earths, which, on closer inspection, show differences in their materials also, these differences becoming more and more strongly marked as they are traced downward, until they pass by insensible gradations into the solid rock beneath. The obvious and necessary conclusion from these observations gives itself, viz., that the rocks of the region are and have long been undergoing a slow chemical decomposition and disintegration from the action of atmospheric forces, this decay being too rapid, however, to be overtaken by the abrasive and transporting power of these same agencies.

So far the general and obvious facts, plain to be read by the man that runs. A little closer inspection reveals another set of facts. It is easily discovered that these mantles of earth and half-decayed rocks are not strictly *in situ*, but have been subjected to some sort and degree of movement, and that the materials have undergone at least a

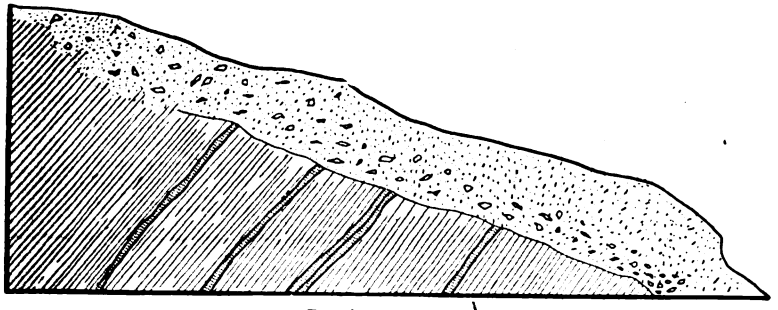

Fig. I.

partial rearrangement in certain situations and under certain conditions. In general on the summits of the hills there has been no change, but

descending the slope, however gentle, a tendency to a sorting and arrangement of materials appears, and this becomes more observable with the distance. At first the fragments of quartz and other hard rocks are sharply angular, and are distributed equally and irregularly through the mass, or in lines corresponding to the bedding of the rocks. Descending a few rods the rock fragments have "settled" somewhat; they are found more thickly strewn towards the bottom, and are less angular. Descending still further all the coarser fragments are found accumulated in a layer of cobbles or pebbles, with only the interstices filled with earth and gravel.

Combining sections of this covering taken from different points, from the hilltop to the bottom of the slope, which commonly terminates in a ravine or valley, or the bed of a stream, we have the appearance shown in Figure 1.

The obvious interpretation of these facts is that there has been a movement or flux of the earthy mass in the direction of the slope. And this notion is confirmed by an occasional observation which is represented in Figure 2.

The difficulty at once arises how to account for a flow of such materials with such results. The ordinary action of flowing water is, of course, excluded. The mere action of gravitation will not account for the phenomena,—slipping or sliding down hill. This, doubtless, often happens on very steep declivities, but such cases are quite exceptional and are easily distinguished. The movements we are considering have taken place at every degree of inclination, from one degree and less upwards, and occasionally on a level, *or even up hill.*

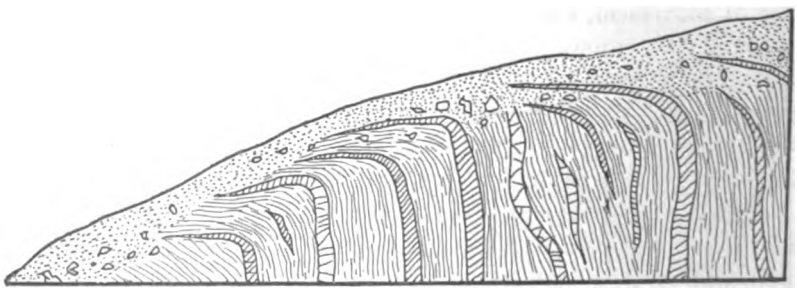

FIG. 2.

After puzzling over these phenomena for half a dozen years, and wondering that there is no explanation in the books, or even any discussion of the subject or note of the facts, not even in Ger-

kie's *Great Ice Age*, it occurred to me that the only possible solution must be sought in the action of frost. The alternate freezing and thawing of such a mass of earth must needs produce just the effects we have been considering. The earth, saturated with water, in the process of consolidation under the action of cold would, of course, expand just as if it were all water, and in thawing there would be a slight movement of the parts and particles of the mass *inter se*, and of course a settling of the heavier fragments; in other words, the movement would be the same in kind (though not in amount) as that of a glacier. These masses may be considered earth glaciers, and I have ventured to denominate this group of phenomena, and these peculiar superficial accumulations, *frost drift*. Now the ordinary glacial phenomena are wanting in North Carolina, with, perhaps, the exception of a few morainal ridges in the gorges of the higher mountains. But during the glacial period, of course, the cold must have been intense enough to account for the depth and extent of action which the theory of *frost drift* supposes.

I was led to these results from the particular study of the gold deposits of the State. They have all been formed in this way. There are probably five hundred square miles of gold drifts in North Carolina. They are found through a range of four hundred miles east and west, from the lower waters of the Roanoke, near Weldon,

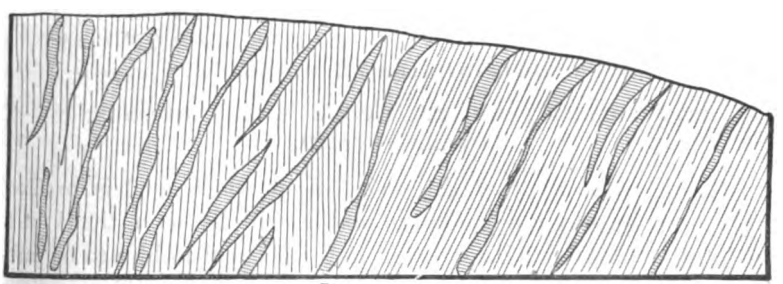

Fig. 3.

to the extreme western border, the county of Cherokee, and they belong to all the different subdivisions of the Archæan rocks of the State. The two most extensive deposits are found in the middle region, on the Yadkin and Catawba rivers, among the low ranges and spurs of the mountains. The schistose and slaty rocks, highly inclined and much contorted and dislocated, are in many places penetrated by innumerable small veins and seams of gold-bearing quartz. (See Fig. 3.) In the disintegration and breaking down of these rocks, and the movements of the débris in the manner described, it

is evident that the gold particles, with the heavier crystalline minerals, will be found accumulated near the bottom of the drifts, on or near the surface of the bed-rock, or "slate," as the miners call it. The gold mining of modern times began sixty years ago in this region from the accidental discovery of a twenty-eight pound nugget by a boy in one of the streams of this region. Most of the simple and effective appliances now in use everywhere for the separation of gold from such deposits—the long tom, the sluice, the riffle-box, etc.—were devised and used in this region, and were carried hence to California when, twenty-five years later, the trained miners of this region emigrated in a body to that newer and richer field. Since that emigration there has been but little placer mining done in North Carolina. Still this sort of mining has never entirely ceased, and in some sections, and by a few families, it has been followed continuously to the present. The richest deposits within reach of water have been worked over, but there are large areas still untouched, because inaccessible to water without considerable outlay for ditching, canalling, and fluming, to which neither the capital nor the enterprise of the region is equal.

SUPPLEMENT I. TO A CATALOGUE OF OFFICIAL REPORTS UPON GEOLOGICAL SURVEYS OF THE UNITED STATES AND TERRITORIES, AND OF BRITISH NORTH AMERICA.

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In this supplementary list no titles to which an * is prefixed have been seen by the compiler; and he will be most thankful to have any omissions or inaccuracies in the list sent to him to be published as a second supplement in the next volume of the *Transactions*. The author is indebted to Messrs. Robert Clarke, of Cincinnati; Thomas Macfarland, of Towanda; Professor F. W. Simonds, of Chapel Hill; and Professor J. J. Stevenson, of New York, for valuable assistance.

Cedar Point Iron Company, Baltimore,
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Alabama.

Geological Survey of Alabama. Report of Progress for 1877 and 1878; by Eugene A. Smith, State Geologist. Montgomery, 1879. 8vo., 139 pp., and 4 maps.