clearly indicated by color and by small rough clay-iron residuum when weathered. Fossils occurred most frequently in those deposits and one became aware of their discontinuity when trying to follow them in search of their contents. The sand troughs or rivers yielded the whole bones, *i. e.*, vertebræ with processes and even rarely whole skeletons. The bogs yielded fragmentary bones. These were found to have been gnawed, as a rule, and the gnawing had been done also where they now lie in the strata. Legs were found bitten off at the knees, as if the animal had mired and its buried parts thus escaped being devoured. Also numerous fragments of, evidently, a single animal would occur scattered about, the ends and thin parts of bones being gnawed off. For example, more than once a Coryphodon's large tooth was found with the surface, including the enamel, chiseled off by some corrugated tooth, probably that of some Tillodont mammal. Plates of turtles' plastron had likewise been nibbled all around their margins. In fact, worthless fragments composed the greater part of the fossils.

When one had become skilled in detecting the differences between those pieces fractured before, and those after, fossilization, many strange things began to be evident, such as fragments taken from the same stratum at some distance apart, proving to be those of one bone; and again fragments representing the same parts of several animals occurring in one spot, the other parts of all being absent. A lot of molar teeth and an odontoid process seem often to represent a head and neck. This all appeared to be incidental to the feasting that had preceded fossilization.

That crocodiles and turtles may have done the gnawing in part was suggested by their fossil remains, but that the chiseling process was theirs could not be maintained. In some cases, maceration had left the bones shapeless or thickly encrusted with iron. And this maceration as well as the chiseling might well argue the subaerial deposition of the bones.

I may mention also two geologically significant phenomena which require close observation to distinguish them. Original stratigraphic inequalities, amounting sometimes to local unconformability, might be passed unnoticed among the numerous similar looking inequalities due to unequal induration of the rock, the latter being intimately associated as to its cause with the physiographic changes now developing. And the color banding may be both original stratigraphic and secondarily modified. I remember one fine example of a large trough filled with a series of clay and sand strata, seen at a distance on the left of the trail ascending Tatman's butte to the Buffalo basin. But not having had time to examine it minutely, I scarcely dare assert that it might not be secondary cross-coloring. Close at hand one would not have noticed it, because the whole could not have been seen, and the slow thinning out of individual strata would be nothing unusual. Expeditions into badlands for the purpose of collecting fossils can not well take time in one season to gather and verify occurrences sufficient to prove the exact geologic nature of the deposit of part, much less the whole, of a basin, which, however, expeditions for that express purpose might do.

FREDERICK W. SARDESON.

UNIVERSITY OF MINNESOTA,
April 6, 1901.

AN UNUSUAL TYPE OF AURIFEROUS DEPOSIT.

ONE of the most unique deposits of gold-bearing material which the writer has ever seen has been worked during the past three or four years at the King Solomon mine. It is situated near the summit of Cañon mountain, in the basin of the South Fork of Salmon river, in the southwestern part of Siskiyou county, California.

The ore consisted of a body of semi-decomposed country-rock, including micaceous schist, slate and greenstone, heavily stained with the oxides of iron and manganese and containing fine particles of free gold disseminated through it. The deposit had a length of about 500 feet, an average width of 60 feet and mainly a workable depth of 50 feet, although a much narrower body of ore continues to greater depth. Mining operations have been conducted in several large open pits, beneath the floors of which have been excavated tunnels. The ore is shoveled from the loose crumbling slopes of the pits into

barrows, then wheeled and dumped through chutes in the floor, and hauled out of the tunnels in cars.

Along certain narrow streaks the ore was of good grade, carrying values as high as several hundred dollars to the ton; but it has been the policy of the company to work the deposit on a large scale and in a cheap manner; hence, everything has been removed which contained sufficient gold to pay a small profit. In this way the average yield per ton of the ore was, during the first few years, brought down to $7 and even $5 in gold and later this was further decreased to $3.50. From month to month the ore showed a remarkable uniformity in tenor, although but 40 to 70 tons were handled per day, and this was taken haphazard within the limits of what was determined to be the ore-body.

Running through the center of the deposit, and parallel with its major axis, there was a narrow dike of white acid porphyry, such as is commonly associated with gold-bearing veins of this region, and the entire ore-body has frequently been reported as a mineralized dike. However, the acid dike is not ore, but is thrown away as waste. On both sides the ore-body extended away from it to a distance of 20 to 50 feet and terminated irregularly in the mass of the decomposed rock, there being no well-marked walls or other evidences of common vein action. The grade of the ore was closely connected with the intensity of the iron stain and particularly with the quantity of brown manganese oxide present.

At first thought, this large deposit of red, soft, decomposed rock carrying free gold was considered the upper or oxidized portion of a zone of impregnation of auriferous sulphides such as are rather common in this northwestern California region; but a consultation with the superintendent of the mine, Mr. F. N. Fletcher, brought to light some facts which demonstrate that it is certainly of an entirely different character. It is unique among deposits of this country in the following two points:

1. It is absolutely free from any traces of pyrites changed to limonite such as are always found in panning the surface portion of other veins.

2. It does not present any evidence of passing in depth into a shear zone modified by solfataric action and impregnated with auriferous sulphides.

Upon first arrival at the mine, the writer was impressed by the marked resemblance in the tint and character of the deep red staining to those of certain accumulations of residual red clay found frequently in hollows in the surface of limestone formations, as, for instance, over the Galena limestone in the Mississippi basin. This suggested an explanation for the origin of the deposit which was subsequently worked out as follows:

The site of the King Solomon mine, which is at present the top of a mountain ridge, was once the bottom of a rather deep, broad basin eroded by subaerial agencies from a series of quartzites, black slates and limestone. This series was intersected by numerous narrow branching dikes of greenstone. Evidence that a small amount (say a trace) of gold was a primary constituent of this system of eruptives has been found in different parts of this country.

The carbonated meteoric waters circulating laterally and downward beneath the slopes of the basin, dissolved gold out of these greenstone dikes and carried it, along with iron and manganese salts (derived from pyrites in the quartzites and slates), to the center of the basin, where, just beneath the surface, these minerals were precipitated as free gold, ferrous carbonate or hydrous ferric oxide and some salt of manganese, perhaps the last in its present form of oxide. Precipitation was probably due, as in the case of limonite and wad in bogs, to the decreased circulation of the water at the center of the basin, and in part also to the water rising close to the surface and becoming subjected to the oxidizing influence of the atmosphere.

Subsequently, through great erosion of the region, the water level was depressed in the strata, the basin no longer existed, and the limonitic deposit worked downward, penetrating to unequal depths in different places. The porous schists and slaty rocks were deeply stained with the oxide and impregnated with gold, but the acid dike in the center of the deposit was largely impervious to the solution and escaped heavy mineralization.

In short, the King Solomon ore-body has had a mode of formation roughly analogous with that of the limonite ore deposits of the Great Valley of the Appalachian region, and of the limestone regions of southern Missouri. Such accumulations of ferruginous matter as the result of deposition from waters of ordinary surface temperature, and circulating within several hundred feet of the surface of the earth, are of common occurrence in many parts of the world, and may be found in other sections of northwestern California, but they are not often auriferous to an appreciable extent. It is its gold contents which make this King Solomon deposit so remarkable.

To the writer, the scientific interest of the preceding facts appears to be in their bearing on the question of the power of ordinary subsurface waters to dissolve and redeposit gold under conditions not favorable to the production of iron pyrites. We seem to have here a clear case where metallic gold has been put through the same process of solution, concentration and precipitation as has the staining material, the oxides of iron and manganese.

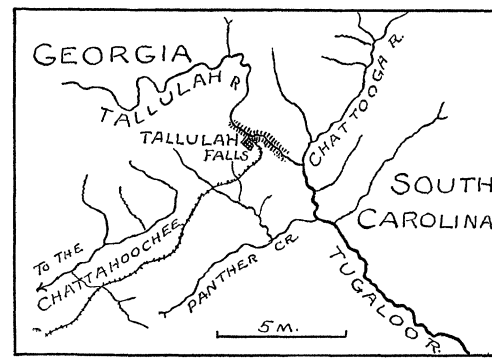
OSCAR H. HERSHEY.

BERKELEY, CALIF., Jan. 20, 1901.

CURRENT NOTES ON PHYSIOGRAPHY.

TALLULAH GORGE, GEORGIA.

THE studies of Hayes and Campbell on the southern Appalachians have made us familiar with the general features of a contested drainage area in northeastern Georgia, where the headwaters of the Savannah (Tugaloo) river are capturing those of the Chattahoochee. Some further details of the changes thus effected are described in a brief essay on 'the Geology of the Tallulah Gorge,' by S. P. Jones (Amer. Geol., XXVII., 1901, 67–75). The gorge is narrow, steep-sided, and over 500 feet deep; the river flows through it in a succession of cascades and rapids; it is evidently a young river course. The precise order of events in the development of the gorge does not appear to have been made out; indeed the author here cited does not seem entirely convinced of the process of capture as an efficient cause for the new order of things. Yet it is certainly significant that the gorge, unusual if not unique in sharpness of form among the southern Appalachians, should occur in immediate association



with a group of features whose systematic relations would seem to point unequivocally to the invasion of one river basin by the head branches of another.

In view of the open form and gradual descent of the Chattooga valley in contrast to the narrowness of the Tallulah gorge and the rapid descent of the river through it, one may reasonably conclude that the first was captured much earlier than the second. This makes it seem probable that the Tallulah formerly followed a course near the railroad line, and that its entrance into the Chattooga is the result of diversion by the headward growth of a creek on the line of the gorge; although a somewhat different opinion is expressed in the article here abstracted.

PREHISTORIC LANDSLIDES IN THE ALPS.

CERTAIN Alpine valleys contain huge accumulations of mountain waste, described as moraines by earlier observers, but now interpreted as landslides (see SCIENCE, II., 1895, 618). The latest special study on this subject is by J. Oberholzer ('Monographie einiger prähistorischer Bergstürze in den Glarner Alpen,' Beitr. Geol. Karte der Schweiz, n. f., IX. Lief., Bern, 1900). It discusses a number of large prehistoric slides in the neighborhood of Glarus, giving abundant details as to structure, source, path, volume, etc. A colored map, 1 : 20,000, shows the geological formations of the district in the slides as well as in the mountains. Some of the slides still bar their valleys and hold back lakes;