## Auriferous Gravel in Placer County.

Dr. J. M. Willey, at the last meeting of the California Academy of- Sciences, read the following remarks on some points of interest in connection with the deposits of auriferous gravel in Placer county, Cal.:

Having had occasion in August last to visit the celebrated mining region, which centers in Forest Hill, I went with, expectation of finding confirmation of the usual theory concerning the formation of this gravel deposit.

It is hardly necessary to say that the gravel beds of the central counties of California are supposed to present sufficient evidence of the existence of a system of large but extinct rivers, and that the course of these ancient rivers is believed to have been oblique, and often at right angles to that of the present streams, and to their tributaries flowing through the various canons -which have their sources on the western slopes of the Sierra Nevada range.

Although it is possible that such a mode of explanation may account for even so widely spread a deposit of gold-bearing gravel as exists in Placer and adjoining counties, I think there are certain features in this deposit difficult to reconcile with the theory of the ancient river system, and that a close study of the subject reveals a problem of a very complicated though interesting nature. The first thing which arrests the attention, after looking at the large excavations, which hydraulic power has worn in the gravel banks, in some places leaving precipices from one to two hundred feet deep, is the profusion of boulders of pure quartz which cover the worked out portions of the ground. These boulders lie on the bed-rock in some places many feet in depth.

At Forest Hill and Michigan Bluffs the eye is dazzled in the sunlight reflected from heaps of round quartz, some masses of which will measure several cubic yards.

The smaller boulders are in general washed away, but I looked with surprise at one portion of an worked bank at Michigan Bluffs, observing that it was composed almost entirely of quartz fragments from pebble size upwards, all having the usual rounded or ovoid form.

There will be little doubt I think that we have here the origin of the gold, which occurs so plentifully in connection with the gravel of this section of country, but the question remains as to how the attrition has been performed which liberates it.

"What tremendous powers have, in the first place, dislocated from their original casings the gold-bearing quartz ledges, and in the next, ground to so perfect a smoothness and rotundity the hardest specimens of white, blue and rose-colored quartz fragments?

Mere fluvial action, however violent, will not at all account for the first condition even if it does for the second. Granite, in the Placer county gravel beds, occurs only in boulders associated with the quartz and that sparingly, the bed-rock being universally a slate; and in this respect the difference between the placer diggings of Idaho Territory and those of central California is very remarkable. In Idaho the bed-rock is everywhere granite, and the ledges which have supplied the gold are often distinctly traceable, good diggings being found below them, as in Granite Gulch near Placerville, and none at all above.

To what then shall we refer the disruption in California of that primitive relationship of rocks which we find still remaining in Idaho?

Perhaps volcanic action may account for it, and in connection with this view I wish to present to the notice of the society a specimen of the peculiar substance called cement. This substance occurs very abundantly in distinct, and sometimes alternate, stratification with the gravel in most of the Placer County mines; in fact, in all of them which I had an opportunity of visiting. It does not, so far as I could see, mix with the gravel, but is often of such a depth and hardness as to seriously embarrass the operations

of the miner. Being entirely barren it has sometimes to be blasted with powder or nitroglycerine before the hydraulic stream will act upon it, and then adds greatly to the cost of hydraulic operations.

As will be observed it is a grayish white, and so homogeneous, apparently, in its nature, that the miners generally, though very ignorantly, call it pipeclay. Although this whitish color is the usual tint, I have observed it in some situations to be of various shades of brown.

Now, is this substance a volcanic ash, and if not, what is it?

I think the answer to this question carries with it a solution of much of the difficulty in accounting for the condition of things in central California. Admitting that this cement is a true product of volcanic eruption, the large extent of surface covered by it, and its frequent great depth would lead us to infer an enormous amount of volcanic activity, perhaps in connection with the elevation of the neighboring peaks of the Sierra Nevada range.

Mr. Hanks kindly afforded me a microscopic examination of the present specimen, and it appears to resolve itself into the three elements of granite—quartz, mica, and feldspar. This is not an usual condition of volcanic ash, and if my impression is correct, it is, with the addition of sulphur, exactly the analysis of the ash ejected in the recent eruption of Vesuvius.

But even considering it as settled that cement is a volcanic ash solidified by time and pressure, we have still two things to account for, one, the almost total disappearance of the granite, the other the leuigation of the quartz.

After due consideration of the effects of prolonged action of the surf on both salt and fresh water beaches, in the production of such gravel and boulders as we see in Placer county, I doubt whether the ancient river system can be taken into the question or is so clearly traceable. There is one other mode of explanation of most, if not all, the phenomena alluded to, which I think deserves attention. I refer to the grinding and comminuting power of glacial action.

Of all the forces of nature which effect transformation of the surface of the earth the progress of glaciers is among the most potent. Every year brings new proofs of the extent and importance of the changes effected by glacier movement, and perhaps investigation may show that there was a time in which, from the western slopes of the Sierra Nevada range proceeded by masses, of a magnitude and weight sufficient to have crushed out and destroyed the original relationships of rock over which they travelled, and to have had much to do with, if they were not the principal cause of the disrupted and almost chaotic state of things in Placer county.

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