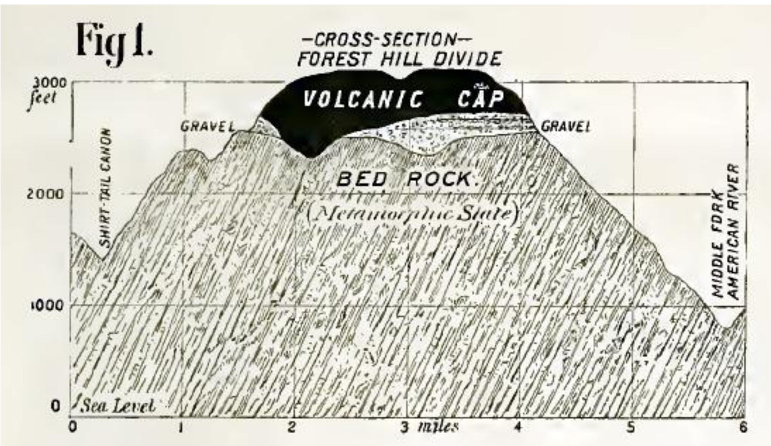
Ancient River Beds of the Forest Hill Divide.

The Forest Hill Divide, one of the numerous spur-like ridges of the western flank of the Sierra Nevada, is in Placer county, between the north and middle forks of the American river. The ridge line is uniformly graded and unbroken for 25 miles or more, extending from an altitude of 5,800 to 2,300 feet above sea-level. Midway between these points the ridge branches, the northerly branch being the Iowa Hill Divide, and the southerly, or main branch, the Forest Hill Divide proper. An examination of the district shows that the bases and main bodies of these ridges are composed of metamorphic rocks of great age, and that there are commonly exposed on the summits large accumulations of volcanic material and extensive river deposits of a comparatively recent geological epoch, ln a popular sense, however, these deposits are decidedly ancient, and they have been appropriately credited to an ancient river system, A characteristic cross-section of the Forest Hill Divide is given in Fig. 1 of the accompanying engravings, which we take from an article by Ross E. Browne, M. E., in the last published report of the State Mineralogist, condensing also the descriptive matter.

Fig 1.



The River Deposit consists of well-washed bowlders, pebbles, and sand, composed of the harder materials eroded from the bedrock—mostly quartz and siliceous rocks. Clay strata are of frequent occurrence, particularly in the upper portion of the deposit. Trunks of trees, commonly cedars and oaks, are found imbedded in the upper layers, either petrified or somewhat lignitized. Certain layers of the gravels thus formed have become strongly cemented, owing, probably, to the percolation of siliceous and calcareous waters. The color is gray, blue, green, reddish brown, or white, according to the material, as well as the degree of oxidation of the iron in the cementing substance.

Gold occurs throughout this deposit in the form of rounded nuggets, scales, and dust. This occurrence is the result of the breaking and grinding of fragments and bowlders of the gold-bearing portions of the bedrock. By a natural process of concentration the bottom layer of each deposit of gravel has become, as a rule, the richest.

That these auriferous gravels are river deposits, was but one of a number of theories advanced during the first decade of active mining operations. The theory was well established, however, by Professor Whitney, in his earlier work as State Geologist, and the accumulating evidences have long since become conclusive.

The Volcanic Cap consists of massive layers of beds of light gray, reddish brown, and dark-colored cements and conglomerates. It contains large bowlders and fragments of volcanic rocks, and in its bottom layers occasional trunks and branches of trees somewhat lignitized. It carries no appreciable quantities of gold, and is, in fact, the barren material of the district.

Between these massive beds are layers of gravel, marking distinct periods in the flow.

The Forest Hill Divide has been for thirty-nine years an active field for mining enterprise. There have been exposed by hydraulicking many sections of the river deposit and extensive areas of the river beds; and by drift mining a number of the channels have been explored and worked continuously for a mile or more of their lengths.

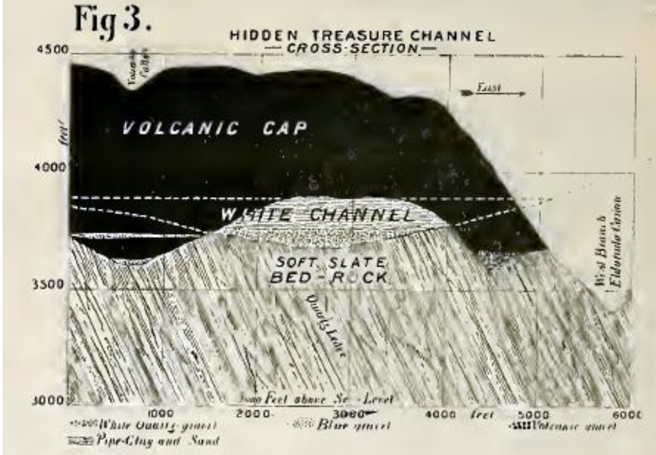
Of the mining terms used it appears necessary to define a few only: "Channel" refers to the deeper portion of the continuous trough-like bed of the river; "rim" to the sides of the trough, from the line above where the bedrock begins to pitch down, to the shore line of the bottom layer of gravel filling the channel; "upper lead" to an upper layer of pay gravel; "bench gravel" to a patch of an earlier deposit of gravel remaining in place after the greater portion has been washed away.

The network of channels under the volcanic cap is rather confusing. There are evidences of a number of channel systems, each representing a partial or complete displacement of the stream, a distinct cut, and a special deposit of gravel.

The series of volcanic eruptions in the high Sierras had a marked effect upon the watercourses and has enabled a ready grouping of the channel systems according to three important periods, covering the time before, during, and after the series of eruptions.

Prior to the first important flow of volcanic cement, this period is represented by a system of continuous valley like depressions in the bedrock, from a thousand to several hundred feet in depth and several miles in width, and containing broad river beds filled with gravel to very considerable depths. The rivers, in eroding the bedrock and forming these depressions, left a succession of broad, flat benches with shallow accumulations of gravel. The channels naturally followed, to a great extent, the belts of soft slate. This slate is easily eroded, slacks readily, and is washed away in the form of a fine silt. Quartz is the only important material contained in the belts which is hard and permanent enough to resist the destructive action of the current. Owing to these facts we find in the filling of the channel, for long stretches, quartz gravel and quartz sand almost to the exclusion of other materials. The white channel of the Mountain Gate and Hidden Treasure mines is a striking example (see Fig. 3).

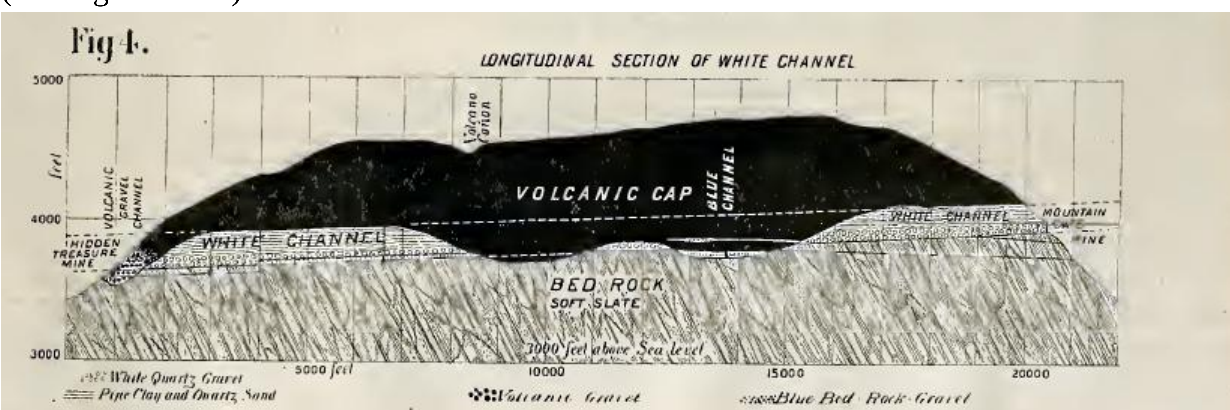
Fig 3.



The channel is filled to a depth of 50 feet, and a width of one-third of a mile, almost exclusively with smoothly washed bowlders, pebbles, and sand of pure white quartz. On top of this, to a depth of 150 feet or more, and an original width probably exceeding a mile, the filling is quartz sand and sandy pipe-clay. The course of these bells of soft slate being south, or somewhat east of south and not entirely continuous, and the general slope of the surface being to the southwest, the channels occasionally break across the harder belts of bedrock. The quartz gravel decreases in quantity, and there are substituted pebbles and bowlders of equally hard siliceous metamorphic rocks. There appears no conclusive evidence of the occurrence, during this period, of any disturbances to cause a wide diversion of the watercourse, and Mr. Browne is unable to say whether the period is represented by one large channel system only, with its tributaries, upper leads, and benches on the valley slopes, or by several such systems.

The first important volcanic eruption in the high Sierras changed the conditions. A mud composed of fine volcanic material was delivered to the river bed and washed down its course, spreading over the gravel to a considerable depth, solidifying and sealing the river deposit. The streams were diverted by the cement cap thus formed, and the first period came to a close.

Second Period, or period of the series of volcanic cement flows.—The capping of the older channel deposit occurred in a succession of flows. The watercourse was several times diverted by the heaping masses of volcanic materials. During the intervals between the periods of volcanic eruption both shallow and deep narrow channels were cut, sometimes following and partly obliterating the older deposit, sometimes crossing and leaving the deeper portion of the older bed altogether. Some of these later cuts are higher than the earlier; several of them, however, passed entirely through the older deposit and 60 to 100 feet deeper into the bedrock. (See Figs. 3 and 4)



The "blue channel " and the "volcanic gravel channel," shown in the section, represent two such cuts. The "blue channel" contains, in its lowest depression, five to fifteen feet of bedrock gravel of a grayish-blue color, and on top of this eighty feet of cement, then a layer of four five feet of bedrock gravel; and on top of this again, cement. The "volcanic gravel channel" contains a large body of coarse gravel, composed mostly of volcanic rocks, and to a small extent only of bedrock. These two channels represent distinct systems. The volcanic gravel channel is doubtless the later of the two; possibly the latest of the deep channels of the period. The final bed of the period was filled with coarser cements and conglomerates to a great depth. Volcanic eruptions in the high Sierras ceased altogether, and thus the cause of frequent diversions of the watercourse disappeared.

Third Period, immediately following the last important flow of volcanic cement and extending to the present time.—There still remains of the volcanic cap from three hundred to one thousand feet in depth. The ancient valley was filled to depths even greater than these, and there resulted a wider and more permanent diversion of the watercourses than heretofore. The streams started new channels, probably along the marginal lines of the cap, cutting across the cap at the juncture of tributaries of early periods, and ultimately obliterating the greater part of the deposits of the first period and a large part of the deposits of the second period. These streams, undisturbed by volcanic activity, have continued to cut, forming eventually as the forks of the American river the deep canyons of the present day.

Mining and Scientific Press, V. 67, 7/8/1893, p. 19

Drift Mines In Placer County.

Continuing Mr. Ross E. Browne's description of the ancient river beds of the Forest Hill divide, commenced in the last number of the Press, he says that from the frequent displacement of the streams during the second period described, there have arisen various complications in the channel systems. Although the mining developments are extensive in portions of the district, it still remains a difficult matter to separate the channel systems of the second period, and it is not always easy to distinguish between those of the first and second periods. In a general way it may be said that the channels of the second period differ from those of the first as follows : their beds are narrower, rims steeper, and accumulations of bedrock gravel incomparably smaller.

The following may be said concerning the gravels in the deeper channel bottoms, and their immediate volcanic cappings: The characteristic channel deposit of the first period consists of a large body of gravel of exclusively bedrock material, and a light cement capping the characteristic channel deposits of the second period, either of a small body of bedrock gravel and a heavier cement capping, or of a large body of volcanic gravel and a heavy volcanic conglomerate and cement capping.

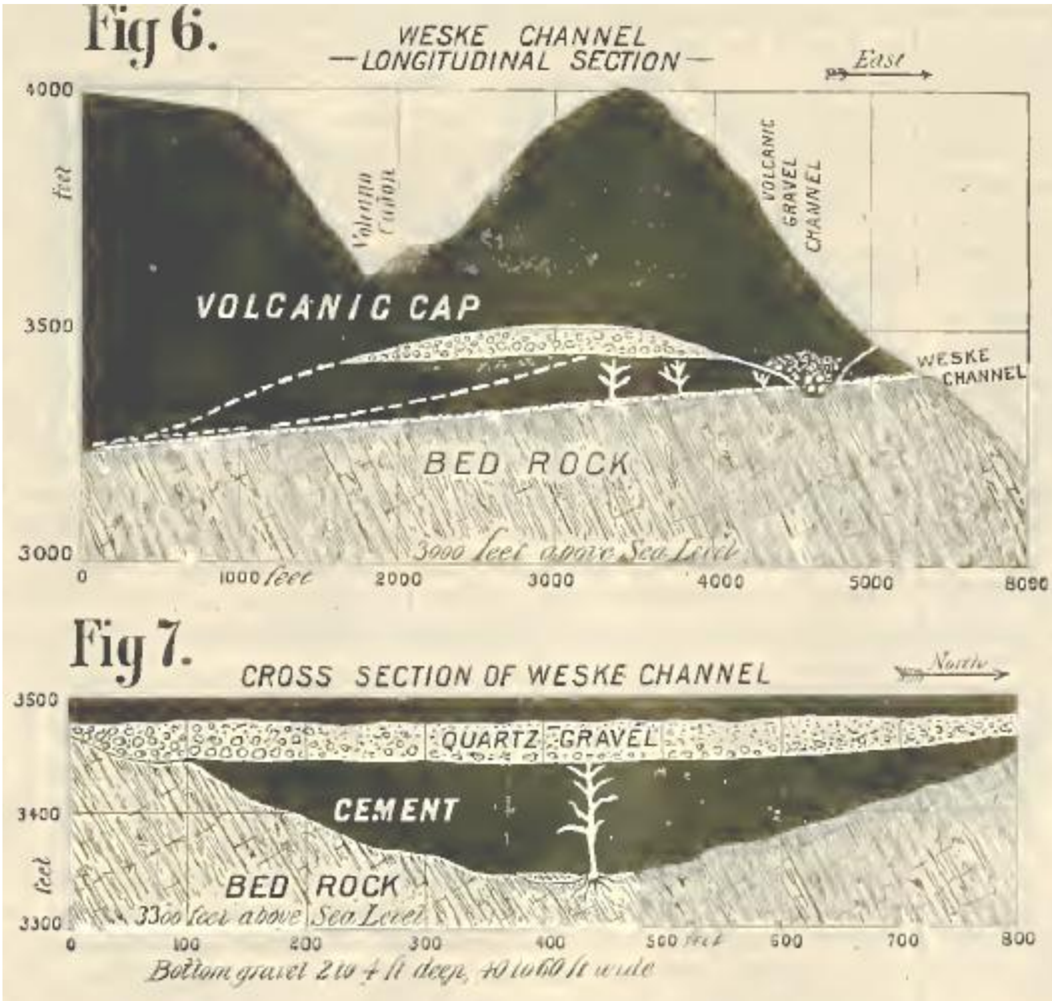
A continuous cap of so-called pipe-clay generally indicates the first period.

Where one deep channel cuts across the deposit of another, the channel which does the cutting belongs, as a rule, to the second period. The channel which has been cut may belong to either period. A careful study of the immediate volcanic caps of the gravel deposits by a competent specialist in petrography may lead to important criterions in classifying the channels. It will be evident that Mr. Browne's opportunities have been mainly for a study of the topographical features.

There occurs occasionally very large accumulations of bedrock gravel between the deposits of volcanic cement, which are evidently the result of the cutting and dislodgement of sections of the old deposit. (See figure 6 figure, 5 is omitted.)

The upper body of quartz gravel shown in the figure is such an occurrence. It has not been explored to any great extent, and the limiting lines in this section are conjectural.

The section in figure 6 shows an interesting occurrence. The cement filling the bed to a depth of 100 feet is a more uniformly fine-grained sediment than is commonly encountered. It encloses a number of oak and cedar trees standing on the banks of the channel, with the roots intact in the gravelly soil and bedrock. One of these is a cedar nearly 100 feet in height and four feet in diameter at the base, and stands perfectly upright, and, considering its age, is in a surprising state of preservation.



BURIED TREES IN FOREST HILL DIVIDE DRIFT MINES.

Similar standing trees are found in the Bowen mine, in the same channel. These trees are immediately on the shore line of the shallow deposit of gravel, and show that for a few centuries at least before the depositing of the volcanic material the stream was a small one, figure 7)

These standing trees show also that the first flow of the cement was not torrential, though moving with a certain velocity. The existence of a current and its direction are plainly indicated by the structure ot the deposit immediately surrounding the trunks of the trees.

The Weske channel is apparently one of the earlier channels of the second period. It is cut by a slightly deeper channel, which is filled to a considerable depth with a coarse, Volcanic gravel, containing large, waterworn bowlders of lava, mixed with a certain amount of coarse bedrock gravel. The whole is capped with hard cement and conglomerate. By following the course of the Weske channel it will be seen that it, in turn, cuts and recuts the Paragon and May Flower channels.

Mining and Scientific Press, V. 67, 7/15/1893, p. 32