"To understand the property in question it is necessary to be familiar with the surrounding Gunnison region, and particularly with that portion of the so called gold belt of which the well known Vulcan Camp is the center. I had an opportunity to become acquainted with the peculiar conditions of this area when acting as mining geologist some years ago in an expedition over the whole of the gold belts in behalf of the Miners Appropriation of Gunnison.

Mr. Thomas Tonge, secretary of the Chamber of Commerce in Denver, was in charge of the expedition.

The area locally known as the Gunnison gold belt, covering many square miles in the southwestern part of the county, is unlike that of any mining region I am acquainted with in Colorado. The geology consists largely, especially in the vicinity of Vulcan and Spencer, of upturned crystalline schists of Paleozoic age, together with beds of dark or white quartzites, all underlaid by eruptive igneous granite. The whole series is traversed by dikes lavas of recent date. The region is one of great past volcanic activity and disturbance. On that account it is favorable to the occurrence of ore by providing fissures for the decent of mineral solutions as well as igneous heat for their dissolution from the rocks and concentration in vein forming impregnations of surrounding rocks. To the mining geologist the region would appear as being a very likely one. The ores occur at times in quartz veins occupying fissures more or less parallel with the bedding planes of the schists by sometimes cutting diagonally across them at the other times the ore impregnates for a width of several feet zones of upturned schist containing thin seams of quartz. The prevailing ores are iron pyrites and some copper pyrites both carrying gold, but commonly low grade.

Free gold also locally occurs. The highest values, however, have been obtained from certain gold bearing elements invisible to the eye enclosed in a matrix of chalcedony or opaline quartz. As fine specimens of native tellurium have been found in the mines it is supposed that the invisible enriching element is of a telluride character, as at Cripple Creek. Fine specimens of native gold are also at times visible in the banded chalcedonies & jaspers of the mines. Some of the white quartz veins are heavily stained with green and blue carbonates of copper.

A third and important, though rarer form of fissure vein, is that like the Vulcan, Mammoth Chimney and Good Hope opened up parallel with and along the strike of the schists, which is filled by chalcedonic and opaline quartz, similar in many respects to that which is now being deposited by gysers and ascending hot springs in the National Yellowstone Park, also at Steamboat Springs and Sulphur Bank, Nevada. At these points the silica or quartz is being dissolved out of the deposited in fissures in a gelatinous state mixed with and accompanied by elements of precious metals. In the Vulcan, Good Hope and Mammoth Chimney and at the Headlight this gelatinous silica has hardened and congealed into chalcedony and opaline quartz, which is the carrier of the principle and highest gold values. Adjacent to the opaline fissure, which may be five or ten feet wide, the schists are much altered, decomposed and quartzified and impregnated with pyrites, and also at times contains certain amount of free gold.

Large bodies of native sulphur also occurs towards the middle part of the mines at Vulcan, doubtless derived from the same sources, deposited by the same agencies as formed the pyrite.
Upwards of $500,000 worth of gold and silver have been extracted from mines at Vulcan in this fissure within a depth of 500 feet" (Besides a large body of low grade ore lying on the dumps and in the stopes).

NOTES ON VULCAN MINES:

As the conditions at Vulcan may be more or less repeated in the future development of the headlight, particularly of its chalcedony chimney and vein, the following notes which I made at the time of my examination of the Vulcan & Mammoth Chimney and Good Hope may be of interest and may be of use for future reference by those engaged in the Headlight explorations.

The most peculiar and interesting mines of the Gunnison gold belt district are the Vulcan & the Mammoth Chimney and the Good Hope illustrating in a remarkable way the solfetoric, or Hot spring, or possibly even griper-like formation or action connected with the origin of some mineral veins.

These mines, located on the same fissure zone, are in a region of sericite or silverly mica schists standing nearly vertical with sharp slab like outcrops."

On the bank of Camp Creek the snow white dumps of the Vulcan Mammoth Chimney & Good Hope appear about 100 feet vertically above the bed of the creek. On the road up to the mines we cross the well defined outcrop which led to the discovery. This consists of a coarse breccia of quartz fragments, white, yellow, nasty or honeycombed, mingled with patches of red and yellow jasper, all cemented together by a matrix of iron oxide and sand.

The width of this vein or outcrop was from five to ten feet. Its width at the time of our visit had not been determined, but it was easily traceable for a hundred feet or more outside of the Mining work on it. The strike corresponds with that of the sericite enclosing it. viz. East Northeast by West, Southwest.

The dumps at a distance appear snow white but closer they are streaked with sulphur yellow, red, tawny brown and black from the color of different materials encountered at different depths.

The bulk of the material from the early workings was a fine white granular quartz sand, like powdered sugar or salt, mingled with masses of exceedingly light honeycombed porous rusty quartz, often showing concentric nugs of iron oxidation. This oxidized matter came from near the surface. Next came large porcelain-like masses of a chocolate colored or brown tint, locally called "brown obsidian" but in reality a branded opaline quartz with shelly or conoidal fracture. With these were duller brown pieces of jasper veined and ribboned with chalcedony and white opal, also fragments of black flint like opal and masses of greenish and cream colored opal mottled with dark purple or chocolate spots and blotches. All these products apayed in gold, especially the cream colored opal which has shown, as much as 16 ounces in gold and from $1,100 to $1,700 gold per ton. Apayers thought the values were in the purple spots and were probably due to the telluride influences.

"The later deposits thrown out from below 100 feet were granular yellow sulphur and below it quantities of disintegrated with iron pyrites and below that masses of solid iron pyrites."

Descending the shaft and workings, down the center of the roof through the length of the drift a dark belt extends composed of somewhat loose breccia, or fragmentary masses of dark opal with blackish sand on either side of it. This zone may locally pass into bodies of brown branded opal, or cream colored mottled opal, or into a brown or
veined jasper, and in one place into a saccharoidal quartz much like maple sugar. This brecciated and variegated loose material constitutes the richest part of the ore bearing zone.

No metal of any kind is visible in this upper portion. On either side of this zone, which may be from five to six feet wide, and forming the walls of the drift, is fine granular white quartz sand showing indistinct lines of former bedding revealing its origin from the original sericite schists in place, mingled with this is a silvery white lubricating powder also a relic of the white mica of the sericite schists. These walls of sand are stained with iron oxide. In the cresscuts the sand passes into more compact bodies of laminated white opaque opaline quartz, resembling novaculite or whetstone rock, but not so hard. Thence the zone grades into a beautiful asbestos like silver white schist and thence into a characteristic greenish sericite schist of the region.

The section of the zone as shown in the cresscut generalized is.

A central zone of fracture and principal mineralization composed of breciated opal, jasper and black sand.

On either side of this white sand passing into compact laminated quartz and that into white sericite schist with some rusty clay next to the schist country rock.

In the Vulcan shaft at 100 feet the walls on either side the main opaline zone were of granular sulphur said to be 15 feet thick. This sulphur passed down into quicksand of loose iron pyrite which kept on pouring down on the men who were digging and cutting the shaft. (The total depth of the Vulcan shaft was 386 feet)" The sulphur was said to spay in gold. The loose pyrite was nearly barren of gold, while the massive, solid pyrite was said to carry from $4.00 to $14.00 per ton in gold in addition to the copper values.

This mineralized and altered zone appears to have been the seat of soffaterio action. Hot waters accompanied by steam and gases ascended through a line of fissure or weakness in the schists. This fissure may have passed down through the zone of schists into the underlying semi-molten granite which may have helped to supply the heat to the mineral solutions and yielded also some of the silica of the opal.

The heated waters dissolved out silica from the rocks through which they passed and deposited it in a gelatinous condition on either side the line of fissure forming the breciated opaline zone. This opal is due to watery solutions, not like obsidian for which some of it had been mistaken, to igneous heat alone.

From this central zone steam and gases penetrating the adjacent schists decomposed them, leached their iron and set the mica and quartz free as mica dust and sand, or in a less disintegrated state formed compact schistose quartz.

These waters were laden with the elements of iron pyrites carrying some gold and originally may have reached the upper and now oxidised zone as a body of pyrite which near the surface has been oxidized into the porous light honey-combed quartz we have mentioned, lower down the pyrite may have been desulphurised leaving in place of pyrite a bed of sulphur, below the bed of disintegrated pyrite, and finally the oxidized pyrite vein which may continue to depths unknown.

Respectfully,

(signed) Arthur Lakes,

-3- Mining Geologist.

M.S.2-U