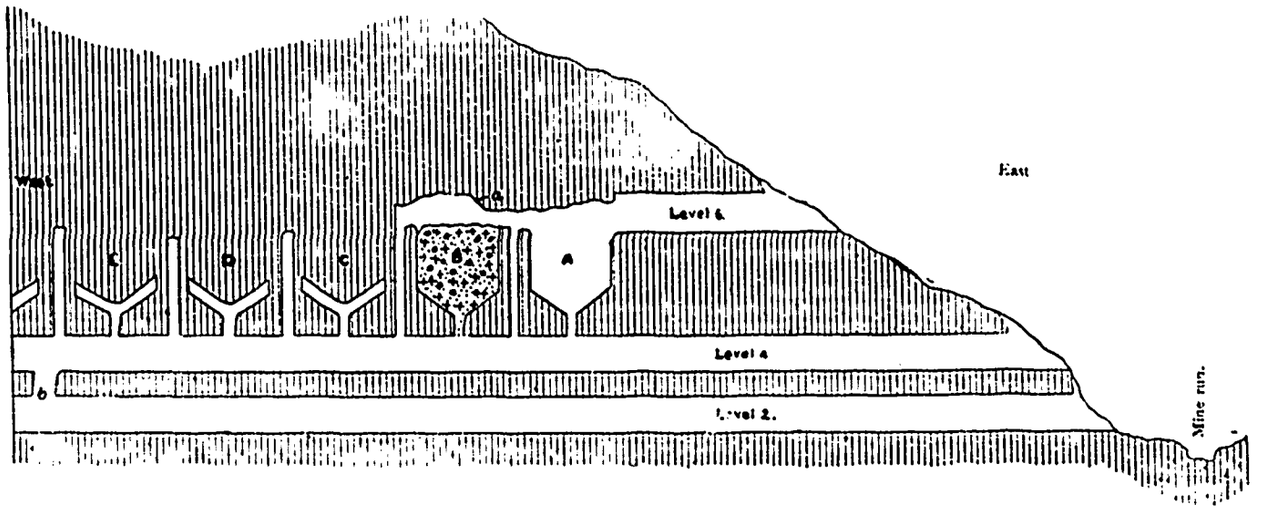


Vertical Section of the Ritchie Mine (West) as it existed February 9th, 1871.

Vertical Scale, $\frac{1}{8}$ *: Horizontal Scale,* $\frac{1}{16}$

thing. To use again the illustration of the cannon: Imagine it (level 4) to have been loaded with melted mineral with which its discharge coated all opposing objects; then imagine the mineral to have charred after sticking fast."* It might be well to mention that grahamite is plastic while hot; upon cooling it again solidifies.

In comparison with what was to be observed about the pit-head, relatively small quantities of the half-coked grahamite were found adhering to objects within the mine. The coarse-grained, whitish sandstone forming the two walls of the mine was quite free of it, except at two points, namely, about the top part of the air-way next west of room B, and about the portal of level 4, where the walls were much blackened. The occurrence of this material within the mine was noticeable chiefly because of its exceeding peculiarity, and not because of its abundance.

We supposed that little vein-matter had been burned within the mine, because of lack of air there, and that the abundance of dust in level 4 had been swept along it to the portal, and there heated to the plastic state and thence projected by the explosion. As the material had been thrown forward along the projected axis of level 4, and not laterally as well, we were led to suppose that the explosion had occurred just without the portal, where the restraining side-walls were without a roof-covering.

The evidences were that the disturbance initiated in room B by the blast was propagated downward along the air-way next west of it, as shown by the coked vein-matter adhering along the air-way, chiefly about its upper part, as already stated. Having reached level 4 it extended itself westward along the level at least 30 feet, as proved by the severe burns received, as above narrated, by the two men there. But it did not extend 140 feet in that direction, because the flame was not evident to the miner working above and in plain view of the level there. He saw only the reflection of a light in the level, and heard the sound of an explosion. The principal extension of ignition was eastward, outward to the portal of level 4 where that explosion occurred.

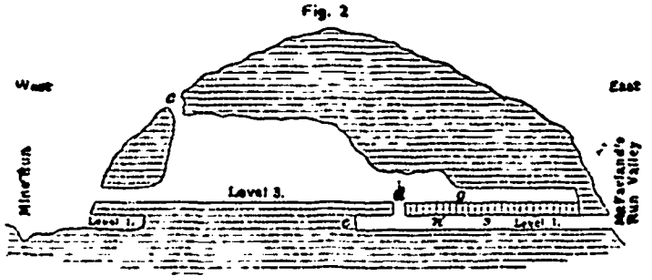
We were not able to find evidences of any ignition or of violent force in level 2, which might have occurred because of the air-way *b*, Fig. 1, between it and the level next above. The two men working at its end were conscious of nothing beyond the sound of a violent explosion and of an air-wave which nearly extinguished the flames of their open lights.

Nor could we learn of a commotion in any part of level 6; it exhibited no evidences of heat. Room A exhibited blackened walls at top, at least; but otherwise there was detected in it nothing unusual.

The impression entertained first and finally was, that gunpowder had been responsible for the accident. It was for this reason that its agency was promptly examined into. The magazine, a primitive structure, had been erected 1400 feet from the pit-head, and it stood intact after the explosion. The guardian of it was able to state that all the powder in or near the mine at that time had been contained in a tin tomato can which he described. We recovered this, and by his aid we determined that 18½ cubic inches of powder had disappeared out of it. The quantity was ridiculous as compared to the results we had witnessed. The report already cited contains this passage: "I have said to the men that the burning of the powder generated an explosive gas, which was driven out, mixed with air, and ignited." A supplementary report further stated in explanation: "Explosion of the powder pulverized a certain quantity of mineral, and in that state it was easiest decomposed. The mineral lying in the room B was slack, and every adjacent wall contained dust to be acted upon. The indications are that gas burned along all the air-passages and exploded at the portal."

The Ritchie mine above water-level was dry beyond all mines of which the writer has any knowledge. The only water which entered the part now under consideration

Fig. 2



Distorted Vertical Section of Ritchie Mine (East) as it existed February 25, 1873.

came after heavy rains through the roof of room A and through the adjoining part of the roof of room B. It was, in fact, surface-water, which found its way through the partly decomposed grahamite forming the backs of those workings.

It is also important to recall that the vein-matter was soft and friable, much reduced to dust in mining; and that it was pulverized in the levels by the traffic through them. Within the mine, all surfaces were abundantly coated with its dust, and the floors of the levels contained more than an inch in depth of it; and, of course, room B contained it in quantity, because it was nearly filled with the already mined vein-matter.

It may be said at once that so far we had not observed any indications of fire-damp (chiefly CH^4) within the mines. To quote once more from the report: "No fire-damp or choke-damp (CO^2) ever was detected in these mines, even when there was no ventilation; and the explosion began where ventilation was excellent. We have a level (No. 2) 600 feet long and no ventillation for it." An inspection of Fig. 1 will disclose that the air-currents flowed in through levels 2 and 4, then up the air-way next west of room B, then across both rooms and onward to and out of level 6. As February 9, 1871, was comparatively a cold day, ventilation then was all that could be desired. Moreover, we could not suppose that so light a gas as fire-damp could lie in room B, when at times water dripped from the natural surface into the east end of it, as well as into room A. Fissures which can convey water must readily permit the passage of a gas. We supposed that if fire-damp were present at all, necessarily it must have found lodgement in the small workings above the roof of level 4. These were ideal receptacles for it, and yet we had not found it there; we had not observed even so much as the lengthening of the naked lamp-flame of the miner who constructed them, or of that of the writer who visited them frequently. The tight end of level 2 was another good receptacle for the collection of fire-damp. If such had been present, we supposed it must have exhibited its presence any morning, after the quietude of a night in which to collect. But it had not done so.

Anticipating a little, it may here be said that fire-damp was first encountered in an inclined traffic-road (mine-slope) sunk subsequently, from the narrow ravine of Mine Run and under level 2. At about six fathoms vertically under water level a blower was disclosed in the south wall of the slope. The gas was promptly ignited; but it soon ceased to burn. While the lower levels disclosed other gas-blowers, none of them were serious, and the gas was readily disposed of. It never became necessary to use safety-lamps.

It was rather a curious fact that gas was never observed to issue out of the vein-matter. Apparently, that was so compacted into the fissure that, practically, gas could not circulate through it.

In these damp lower levels, shots were frequently put into the side-walls because of the necessity of widening the roads. And even though fire-damp at times must have been present in some degree, yet no disaster ever followed.

Among the many surprises which grahamite offered, none were so striking as the peculiarity of combustion of the mineral and of its dust. When warmed over the flame of an open light, the mineral grew viscous, and then might be drawn out into a thread. Warmed yet more, it kindled into a dull and smoky flame, which burned until the mass became a smutty coke of slight tenacity. Dust which fell from one's hand about the flame of the lamp, created a halo of scintillations around the light. Yet more widely diffused and brilliant effects at times followed the falling of dust from one's clothing upon a flame.

*Report already cited.