in depth be perceived. Some of the fissures are completely filled, and give forth neither mineral water, steam, nor gas.

In the group, about 656ft. wide and one-sixth of a mile long, which lies nearest to the railway-track, these phenomena are most strikingly exhibited. Besides the principal substances mentioned below in the table, Becker found in this mineral water also small amounts of metallic compounds, as, for instance, HgS, a trace of Na_2S, 1 gramme per ton of Na_2SbS_3, and 8·7 grammes per ton of Na_2AsS_3.

About one mile to the west is a group of similar fissures, yielding some steam and CO_2, but no mineral water. In the mineral crusts of these, however, several metallic sulphides occur. In 1863 Laur declared that he had seen in them distinct traces of gold. In 1878, one of these fissures was opened by an adit, about 49ft. under the surface, and produced a vein-matter carrying cinnabar, which was mined for a while as quicksilver-ore. The temperature of this mine was not so high as to cause serious trouble to the workmen.

G. F. Becker carefully analysed the filling of several fissures, and found, besides hydrated ferric oxide, considerable quantities of Sb, As, Pb, Cu, Hg, sulphides, and gold and silver, as well as traces of Zn, Mn, Co, and Ni. Since from 2·2lb. to 7·7lb. of the vein-stuff were employed for each analysis, the results are specially trustworthy. The records are quoted of three analyses here, expressing them in grammes per ton (1 ton = 1,000,000 grammes):—

	I.	II.	III.
Sulphides of antimony and arsenic	...	23,000·0	150·0
Ferric oxide	...	2,500·0	...
Sulphide of mercury	1·4	2·5	1·0
Lead	88·0	21·0	...
Copper	0·3	12·0	...
Gold	0·9	1·0	...
Silver	0·3	0·3	...

(Considering the gold and silver to be alloyed in the above proportions, we should have bullion 0·750 and 0·769 fine, which is the general grade of the so-called "free gold" of Transylvania.)

The careful study of the phenomena, particularly by G. F. Becker, leaves no doubt that in this case ascending mineral waters have deposited, besides the various forms of silica (from opal to crystalline quartz), different metallic sulphides, and that the fissure-fillings exhibit a very clear instance of crustification. It is, indeed, not proved that the process is now going on. But that is not the main point. We may be content to have the proof that it has taken place.

Mineral Springs at the Surface.—When we isolate a spring characterized by high temperature, a large quantity of gas, or of matter in solution, we notice at once that its level is higher than that of the ground-water. The more thorough the isolation or walling-in, the more striking is this phenomenon, so clearly unlike that of the vadose or shallow circulation.

Isolation is usually performed by digging as deep as possible, so as to get at the spring below the loose surface-material in an impermeable rock, and then by building a well-pit to give it freer ascent. But, since the circulation of the ground-water in the loose surface is very lively, the necessary depression of the water-level in such an excavation involves the lifting of large quantities of water. Moreover, the escape of gas from the mineral spring often hinders the operation; so that there is, as a rule, little opportunity for thorongh investigations. Cases in which accurate observations have been properly recorded for preservation are very rare.

The first good fissure encountered in the bed-rock is deemed to be the channel of the mineral spring, and the well is built over it. Complete isolation from the ground-water is probably seldom practicable. Nevertheless, the mineral spring, being under higher pressure than the ground-water, will tend to exclude it from the well. The imperfection of the isolation is shown, however, when we try for any reason to pump out the well. To lower the water-level—say, 3·28ft.—we have to raise many times the amount of water which the spring itself would normally furnish (even taking into account the decreased pressure, which affects the flow in the proportion of the square root of the head). The excess, generally surprisingly great, comes from the ground-water which finds its way into the wells.

If we allow the mineral water to ascend again quietly in the well, the level rises at first rapidly, then slowly, and finally remains (in the absence of change in the height of the ground-water and in the barometric pressure) stationary at a certain height above the ground-level. This difference of height represents the ascensional force of the mineral spring.

If the spring makes a deposit at its mouth (mostly of lime carbonate, hydrated ferric oxide, and silica) it may thus build a conduit, extending above the ground-water level and the surface to the height represented by the ascensional force. Thus, we find conical mounds from the top of which mineral springs flow. This phenomenon is shown in the highest degree by geysers—*i.e.*, thermal springs in which paroxysmal developments of steam and gas occur, often forcing the water to notable heights. Some of the magnificent geysers of the Yellowstone National Park have built chimney-like conduits of considerable size. Their structure has much similarity to that of stalactites: indeed, we may recognise generally, in the various deposits of ascending mineral springs (in other words, in the products of the deep circulation), many analogies with the vadose circulation. This circumstance indicates a relation between the phenomena of the two regions which is often entirely ignored or even denied.

While, for instance, the geysers have a temperature above boiling-point, some mineral springs rise but little above the mean local temperature of the surface or of the ground-water. This may be especially observed in the acid springs; yet these are also ascending springs, and must have been formed in the deep region.

Within the vadose region we have, sometimes, ascending waters, which are, however, mostly to be explained by hydrostatic pressure. But within the deep region hydrostatic pressure can play no part; and here it is the higher temperature and the presence of gas which cause the ascension of mineral springs. The extreme instances of this kind, such as geysers, steaming springs, mud-