

## ALUM DEPOSIT NEAR SILVER PEAK, ESMERALDA COUNTY, NEV.

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*Locality.*—About 10 miles north of Silver Peak, Nevada, there lies, by the roadside, a deposit of alum and sulphur. This has been many times located and prospected as a sulphur mine, but not until recently has the relatively important amount of alum in it been recognized. No important work has yet been done on the deposit.

*Mode of occurrence.*—At the locality mentioned there is an elongated dike-like or neck-like mass of rhyolite, having all the appearance of being intrusive into gently folded white and red sedimentary rhyolitic tuffs of Tertiary age. In parts the rhyolite is easily recognizable as such; in other portions it is decomposed to a white powdery variety. This is especially true of two portions examined, about 600 feet apart; one some 200 feet in diameter, the other about 30 feet. The former, at the south end of the area, contains the chief alum and sulphur deposits. The latter contains sulphur, but no alum.

In the larger area the decomposed rhyolite shows sulphur throughout, coating all cracks and crevices, but generally not over a fraction of an inch thick. With the sulphur is closely associated pure alum, which has a different habit, forming veins, some of them several inches thick, that split and ramify irregularly throughout the broken masses of altered rhyolite. Analysis in the chemical laboratory of the United States Geological Survey shows it to be an ordinary potassium alum (kalinite). There are also occasional gypsum seams, of the same habit as the alum, but much less abundant. Bright-red stains are associated with the sulphur and alum, which were thought in the field possibly to be cinnabar. The small quantity represented by these spots is not suitable for chemical examination. During the past summer, however, Dr. George I. Adams has investigated the Rabbit Hole sulphur mine, in northern Nevada, near Humboldt House station, on the Southern Pacific Railway, where the geology appears to be not greatly different from that of the place being described, and has found there similar bright-red stains. Analysis of these shows them to be really cinnabar (sulphide of mercury), and there can be little question that the stains of the deposit near Silver Peak are of the same material.

The smaller area above noted, north of the principal deposit, shows sulphur in crevices, in moderately large, perfect crystals, nearly or quite isolated.

When exposed to the air the alum rapidly dehydrates and crumbles to a white powder, so that it is not conspicuous in the outcrop, and the real amount of it present is visible only when it has been freshly taken out.

*Manner of formation.*—These areas are evidently pipes or chimneys through which sulphurous volcanic gases have ascended. Since the rhyolite bodies are probably intrusive, the gases seem to have directly followed the intrusion. This action is familiar around recently active volcanoes, and is called solfataric action, from the fact that sulphur (Italian *solfo*) is deposited by it. For this reason the volcanoes of Italy, Mexico, and other places yield a large amount of the world's sulphur. The formation of alum by the escaping steam and gases of these solfataras is also known to occur in many localities. While the sulphur is a direct sublimate from the sulphurous gases, as its occurrence just described in the Silver Peak deposits indicates, the alum, which is a hydrous sulphate of aluminum and potassium, is formed by a combination of the steam and the sulphuric acid emitted from the solfataras with the potash and aluminum contained in the rhyolite. This combination is rendered possible by a preliminary decomposition of the rhyolite by the escaping gases. The presence of cinnabar is also interesting, since this mineral is one of those which has been found as a sublimate on the walls of crevices in volcanoes, as, for example, at Vesuvius, where it has been deposited by jets of escaping gases. The deposit of cinnabar at Steamboat Springs, some distance north of here and just north of Carson, is also significant.

*Commercial aspects.*—Though the alum in these prospects is present in far larger quantity than the sulphur, it is somewhat more localized. It forms an irregular network of veinlets, and yet from the manner of formation the chimney undoubtedly continues downward. The decomposed rhyolite is so friable that the material could easily be worked on a large scale. The rhyolite itself, in the alum locality, has been found by analysis to contain a large percentage of alum. The whole deposit, therefore, would have to be worked together, and the sulphur could also be collected as a by-product.