to brown ash, others a green or blue ash. The latter produced a green or blue water solution which turned pink on the addition of hydrochloric, nitric or sulfuric acid. The hydrochloric acid solution soon faded, but the nitric and sulfuric acid solutions retained their color for twenty-four hours.

The tendency to form the green or blue ash depends on both the soil and the vegetable. Of the plants grown on the Alabama Experiment Station at Auburn, New Zealand spinach and chard gave an intense green ash; tendergreen and Chinese cabbage gave a medium green ash; while the ash from turnips varied from green in some cases to brown in other cases. Cabbage grown in the greenhouse on Norfolk, Cecil and Hartselle soils gave a green ash of varying intensities; that grown on Eutaw soil gave a white ash. Turnips similarly grown on Oktibbeha soil gave a pale green ash.

Since the Allison apparatus[1] gives one or more light minima characteristic of each compound present and since it will detect approximately four parts in 10^{12}, it seemed a desirable means to determine the cause of the green color referred to above. Several samples of vegetables were ashed, dissolved with hydrochloric acid and examined for the chlorides of iron, chromium, manganese, cobalt, nickel and copper. Cobalt was always absent in the white or brown ash but always present in the green or blue ash, nickel was always absent and the other elements listed above were always present. Hence, it is concluded that the green or blue ash is due to the presence of cobalt. No relation was observed between plant growth and the presence or absence of cobalt in the ash.

We wish to express our appreciation to Dr. Allison for the use of his apparatus and his interest in the work.

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THE RELATIONSHIP OF THE GRANITES TO THE RHYOLITES IN SOUTHEASTERN MISSOURI

HAWORTH,[1] in his account of the igneous rocks of Missouri, states that the granites, with few exceptions, grade into the porphyry (rhyolite). He cites many localities where such gradation can be seen and draws the following conclusion. "It is therefore useless to attempt to decide which is the older, the granite or the porphyry." He emphasizes the fact that the granite occurs in the lower ground between the higher hills of porphyry and concludes that the porphyry represents the more rapidly cooled portion at the surface, and the granites and granite porphyries the slower cooled portion deeper down, and that all the rocks belong to the same eruption of igneous material and hence grade one into the other.

This relationship, as interpreted by Haworth, has been accepted by the present Missouri Bureau of Geology and Mines, as is shown by the following quotation from its report on the "Quarrying Industry of Missouri" (p. 61). "The gradation of rhyolite into granite and *vice versa* can often be traced horizontally and vertically."

For many years, I have doubted that a granite in which the grains average nearly one half inch in diameter (which is true of some of those occurring in southeastern Missouri) could change to a dense rhyolite showing flow structure within a few feet, as, under the Haworth gradational theory, would be required by the relationship of many occurrences of these two rocks. It was not until 1919, however, that I found the first positive proof that the granite was instrusive into the rhyolite. This locality was near the top of Knoblick Mountain in St. Francis County, which is in the northeastern part of the area of igneous rocks. The contact found was so sharp and clear-cut that there was absolutely no doubt that the granite was later than the rhyolite and that it was intrusive.

During subsequent years, I have searched for further evidence on the problem, and have been rewarded from time to time by finding other localities where similar relationships exist, although the widespread mantle rock has handicapped the search for actual contacts.

During the last three years, an intensive search throughout the area of igneous rocks of southeastern Missouri has resulted in finding evidence that the granites are not only younger than the rhyolites, but that they were injected into them. Sharp contacts of medium to coarse-grained granites with the dense rhyolites that were undoubtedly surface flows have been found in every locality where the relationship of the two rocks has been determined. This intensive study has shown that probably more than one granite injection occurred, or else that there was marked differentiation within a large intrusive; more probably the former. A detailed account of the relationship of these two rocks was given at the meeting of the Geological Society of America in December, 1931.

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[1] Allison and Murphy, *J. Am. Chem. Soc.*, 52, 3796, 1930.

[1] E. Haworth, "The Crystalline Rocks of Missouri," Mo. Geol. Surv., Vol. 8, 84–220, 1895.