men collected by Smith is somewhat altered and is coated with impurities. The amount of material present in the specimen found by the writer was insufficient for a quantitative chemical analysis. However, a semi-quantitative spectrographic analysis of the Oklahoma novacekite indicated As_2O_5 in the greater-than-10 per cent bracket, but P_2O_5 was not observed in any bracket down to a sensitivity limit to 0.1 per cent.

The novacekite is straw yellow in color. Euhedral crystals are rectangular in shape. The basal cleavage is perfect and luster is waxy. The specific gravity is 3.66.

X-ray studies showed this novackeite to be tetragonal. The unit cell dimensions are: $a_0 = 7.18$ Å, $c_0 = 20.16$ Å. Thus, the *x*-ray powder pattern of novacekite differs from the patterns of saléeite and arsenatian saléeite only by its slightly larger unit cell dimensions. (The unit cell dimensions of arsenatian saléeite are: $a_0 = 7.05$ Å, $c_0 = 19.87$ Å.)

Optically this mineral is anomalously biaxial with $(-)2V_D = 5°–18°$. Indices of refraction for *D* light at 25° C. are: $\alpha = 1.624$, $\beta = \gamma = 1.640$. Pleochroism is weak: X = nearly colorless, Y = Z = yellow to pale yellow. The mineral fluoresces bright straw yellow to lemon yellow in both short and long wave-length ultraviolet radiation, though the intensity of the fluorescence is somewhat less in short wave-length than in long wave-length radiation.

The writer wishes to express this appreciation to Mr. Earl Smith, graduate student of the University of Oklahoma, for the specimen that he contributed to this investigation, and to Professor Earl T. Apfel, Director of Geo-Research at Syracuse University Research Institute, who kindly read the manuscript.

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AN UNUSUAL PALAGONITE TUFF

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About a decade ago a fine-grained, black rock specimen was submitted to the laboratories of the Bureau of Reclamation, U. S. Department of the Interior, Denver, Colorado. The hand specimen had a satin-like luster and conchoidal fracture, giving it the appearance of cannel coal. It came from a complex series of flows and beds of volcanic origin, $6\frac{1}{2}$ miles east of Vantage, Washington. According to Dr. Wiliam H. Irwin, who later

visited the locality and collected further samples, the rocks of the vicinity show great diversity in color, texture, and structure, and show evidences of significant alteration. He further commented that it is not necessarily possible from examination of a hand specimen to ascertain which rocks are lavas and which are altered tuffs.

Microscopically, the rock is observed to consist of many small bodies of a dark greenish-brown substance contained within a colorless matrix (Fig. 1). This dark-colored substance shows weak anisotropism and a moderate range in refractive index. In general the refractive index is slightly below 1.495, but measurements as high as 1.510 were obtained.

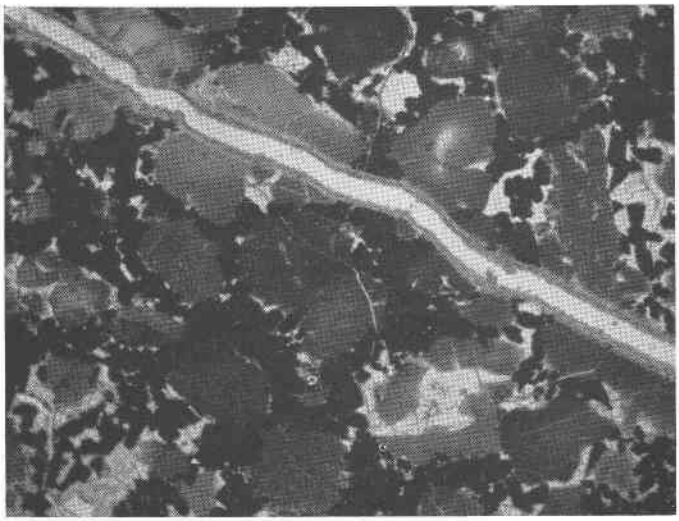

FIG. 1. Representative area of palagonitic bodies, magnetite crystals and opaline matrix of specimen which is virtually devoid of carbonation. The chalcedonic veinlet has opaline margins. Magnification 117×; without analyzer.

The term, palagonite, has been applied to such dark-colored, altered, glassy materials. Its use is retained with the reservation that it does not denote a mineral species. About half of the volume of the rock is composed of these bodies of palagonite; they average 0.15 mm. and are fairly uniform in color and shape.

The colorless matrix is opal with a refractive index ranging from 1.455 to 1.435. The opal also shows weak anisotropism and appears to be microcrystalline in certain portions. Although these phenomena suggest the presence of tridymite or cristobalite, material with appropriate refractive indices for these minerals was not isolated. Chalcedonic varieties of silica occur as irregular bodies and veins (Fig. 1).

The third essential constituent of the rock is fine, granular magnetite. Carbonates occur in variable amounts within and substituting for the opaline matrix, sometimes almost to the exclusion of the latter (Fig. 2). A few small, detrital grains of quartz, feldspar, and mica were observed. Although zeolites were not detected in the thin sections examined, their complete absence would be unlikely in a rock of this type.

Occasional particles of a diabasic rock were observed in the thin sections, one of which was as large as 6 mm. (Fig. 2). This rock fragment has been highly altered so that the relict feldspar laths now are composed essentially of carbonates.

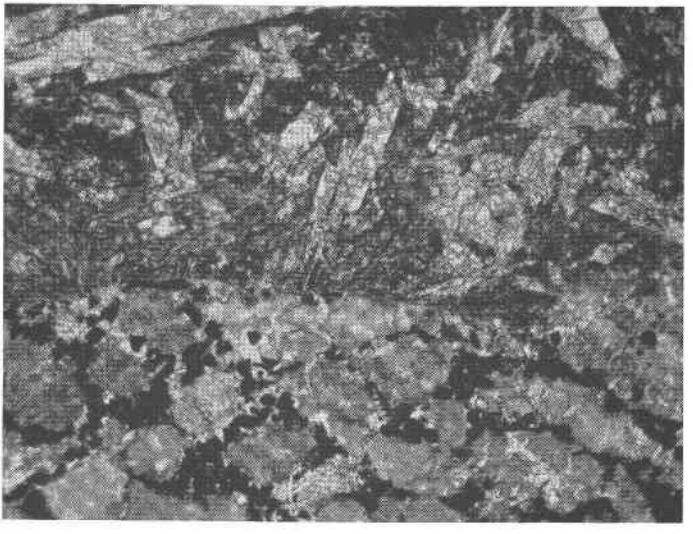

FIG. 2. Specimen showing intensive carbonation. The upper half is a fragment of diabase showing relict feldspar laths. Magnification 85×; without analyzer.

The water content of this rock is considerably below the range, 14.2 to 24.4 per cent, reported by Tyrrell and Peacock (1926) as is indicated by an ignition loss of only 9.1 per cent. However, alteration of the state of oxidation of the iron compounds could contribute to an error in the direction of a low result. More important is the fact that a significant volume of the rock is magnetite which has a high specific gravity but contributes no water. The ignition loss was determined on a sample containing little, if any, calcite.

In attempting to reconstruct the geologic history of the rock several factors must be considered. The palimsest textures of the rock particles imply a basaltic composition, but the types of alteration observed do not necessarily imply that these lithic fragments were subjected in situ to the

same alteration processes as the main material of the rock. The uniform textural characteristics of the bulk of the rock show no relationship to any primary igneous texture. In view of the predominance of palagonitic bodies, it is presumed that the rock was originally deposited as a vitric tuff of basaltic composition, which subsequently has been highly altered through silicification and carbonation. The highest temperature phase of the metasomatic processes presumably produced recrystallization of or introduction of iron-bearing substances to yield magnetite. In view of their very small size and their usual occurrence interstitially among the palagonitic bodies, it is unlikely that the magnetite crystals existed in their present form in the unaltered tuff.

Although palagonite tuffs probably are not items of great rarity, and may be fairly common in certain localities, the rock described here presents several interesting features. The most unusual characteristic is the uniformity and peculiarity of its texture.

The writer is indebted to his former colleagues with the Bureau of Reclamation. William H. Irwin supplied information on the field occurrence and William Y. Holland made the photomicrographs. L. N. McClellan, Assistant Commissioner and Chief Engineer, granted permission to publish this information.

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NEW OCCURRENCES OF NATIVE SELENIUM

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Native selenium has been identified in three localities during the course of study of the mineralogy of uranium in sandstone-type deposits, conducted by the U. S. Geological Survey on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

In June 1953 William Braddock collected several pieces of friable sandstone from the Road Hog No. 1A mine in the southern part of the Black Hills, Fall River County, S. Dak. Uranium and vanadium ores are being mined there in the Lakota sandstone of Early Cretaceous age. The sandstone contained small purple-gray metallic acicular crystals as felty aggregates on fracture surfaces and disseminated throughout the sandstone. The crystals were later identified as native selenium on the basis of x-ray studies by M. E. Thompson and qualitative chemical analysis by F. S. Grimaldi of the Geological Survey.