

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  $\alpha$ -ray studies by M. E. Thompson and qualitative chemical analysis by F. S. Grimaldi of the Geological Survey.

In the spring of 1954, Carl Roach collected samples of high-grade vanadium-uranium ore from the Peanut mine, Bull Canyon, Montrose County, Colo. The Peanut mine is in the Salt Wash sandstone member of the Morrison formation of Late Jurassic age. The ore samples contained two new quadrivalent vanadium minerals and abundant crystals of native selenium.

A sample collected in June 1954 by M. E. Thompson from the Parco No. 23 mine, Thompsons district, Grand County, Utah, contained crystals of native selenium associated with zippeite, metatyuyamunite, metarossite, montroseite, and corvusite. The Parco No. 23 mine is also in the Salt Wash sandstone member of the Morrison formation.

The physical properties of the selenium from the three localities are similar. It occurs as purple-gray metallic acicular crystals, usually as felty aggregates of very small crystals. The largest of the crystals is not more than 2 mm. in length. By transmitted light the crystals are nearly opaque, but they transmit red light and show parallel extinction. By reflected light they are anisotropic and dichroic (creamy white and darker).

Native selenium was reported from several carnotite deposits of the Colorado Plateau by Hillebrand, Merwin, and Wright (1914) on the basis of sublimation tests. The selenium crystals described above give a red sublimate in the closed tube. Although selenium is not easily recognized in the hand specimen, further occurrences of native selenium will undoubtedly be found in sandstones containing uranium and vanadium minerals.

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#### AGE DETERMINATION OF ZIRCON CRYSTALS FROM CEYLON\*

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#### INTRODUCTION

Zircon crystals from Ceylon have long been known to gemmologists for their abundance and high quality as semiprecious stones. Because of extraordinary variations in physical properties, such as the indices of refraction and density, they have captured the attention of mineralogists for almost the last 100 years. However, very little is known regarding

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