Allopalladium from British Guiana.

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At the November (1923) meeting of the Society I gave an account of a new find of euclase of peculiar habit and of native platinum from the gold and diamond washings in British Guiana. The occurrence of platinum being a new record for that country, the announcement was naturally received there with some interest—but also with some scepticism. Mr. J. C. Menzies, by whom the platinum was found, has been accused of 'salting' the locality, or, alternatively, doubt has been cast on the correctness of my determination. The euclase aggregates, thought by Mr. Menzies to be fossils, could certainly not have been used by him for 'salting'; and as the platinum (together with some small, silvery scales of mica) came with these, I have no reason to doubt his bona fides. I am also quite satisfied with the correctness of my determination of the material as platinum, as set out in detail on p. 191 of this volume.

Since then, Mr. Menzies has sent three more metallic grains for identification. These were obtained from another trial pit in the conglomerates in the neighbourhood of the Kaieteur gorge on the Potaro river, and situated about half a mile from that which had previously yielded the grain of platinum. These grains are very heavy and present quite the appearance of native platinum; and without applying a special test they might very well be passed as such. But the material was found to be brittle; and when dissolved in aqua regia, the solution yielded with ammonium chloride a crop of minute, optically-isotropic octahedra, but of a striking scarlet (cinnabar-red) colour instead of the pale lemon-yellow characteristic of platinum. The identity of the metal was at first puzzling. Eventually, it was found to answer to such chemical tests for palladium as could be applied with minute fragments on a microscope slide.

The largest of the grains weighs 76 milligrams (specific gravity approximately 12), and the total weight of the three grains (after some minute fragments had already been used) amounted to 0·124 gram. The colour is light steel-grey with bright metallic lustre. The grains are irregular in shape with a cavernous and granular surface. When an attempt was made to cut or saw off a fragment with a knife, the material broke. The detached fragment when hammered on an anvil was reduced to powder. A fragment when pressed on a microscope slide with the flat of a knife blade also breaks up to powder. The fractured surfaces present a crystalline, granular aspect, and when examined by reflected light under a metallographic microscope they show bright cleavage surfaces with silver-white colour. The material thus seems to consist of a granular aggregate of small crystals, and its brittleness is perhaps due to the cleavage.

In a small drop of hydrochloric acid on a microscope slide, the material is not appreciably affected; but in a drop of warm nitric acid it is readily and completely dissolved to a brown solution. With potassium iodide this solution yields a black precipitate which is soluble in excess of potassium iodide to a wine-red liquid. With potassium cyanide a yellowish-white precipitate was obtained. The cinnabar-red octahedra mentioned above are evidently ammonium palladichloride, $(NH_4)_2PdCl_6$. The material is therefore palladium; and with the small amount that could be used for the tests no evidence was detected of the presence of any other metal. Palladium is, however, always described as being malleable, whilst the material now dealt with is quite brittle. The latter must therefore be the hexagonal modification known as allo-palladium.

Palladium is always present in crude native platinum, the amount being usually less than one per cent., but in one analysis[1] it reaches 5·95 %. It is also found in nature alloyed with gold—palladic gold or porpezite containing up to 12 % of palladium. But as a native metal it is of extremely rare occurrence, and there are only few rather indefinite records in the literature.[2] It is not represented in the British Museum collection, and it figures in the desiderata lists of most museums. The present commercial supply of the metal is chiefly as a by-product from

[1] L. Duparc and M. N. Tikonowitch, Le platine et les gîtes platinifères de l'Oural et du monde. Genève, 1920, p. 239. [Min. Abstr., vol. 1, p. 179.]

[2] See references in C. Hintze's Handbuch d. Mineralogie, 1898, vol. 1 (part 1), pp. 131–133; also later, E. Hussak, Über das Vorkommen von Palladium und Platin in Brasilien. Sitzungsber. Akad. Wiss. Wien, Math.-naturwiss. Kl.,

the nickel-copper ores of Sudbury in Ontario; but in what form it there exists is not known.

The name allopalladium was introduced by J. D. Dana in 1868 for the hexagonal modification of native palladium. This is known only from Tilkerode and Zorge in the Harz Mountains, where it occurs as microscopical hexagonal scales with native gold and selenides of lead and mercury. The crystals have a perfect basal cleavage and are brittle.

The metals of the platinum group fall crystallographically into two series—cubic and hexagonal; and it was pointed out by G. Rose[1] in 1842 that palladium and iridium crystallize in both forms, being dimorphous. Unfortunately very few reliable crystallographic data are available. From the data collected together by P. Groth,[2] artificial crystallizations of palladium, platinum, ruthenium, rhodium, iridium, osmium, and mixtures of iridium and osmium are cubic, whilst the natural minerals allopalladium and iridosmine are hexagonal (or trigonal) with basal cleavage. Groth suggests that perhaps all the metals of this group are dimorphous. In the hexagonal series V. I. Vernadsky[3] further distinguishes as minerals ruthenium-nevyanskite (Ir, Os, Ru), rhodium-nevyanskite, and platinum-nevyanskite. Recent determinations of crystal-structure by X-ray methods[4] place platinum, iridium, rhodium, and palladium in the face-centred cubic group, and osmium and ruthenium in the close-packed hexagonal group, but without any suggestion of dimorphism.

1904, vol. 113, Abt. I, pp. 379–466; Zeits. prakt. Geol., 1906, vol. 14, pp. 284–293. J. L. Howe and H. C. Holtz, Bibliography of the metals of the platinum group. Bull. U.S. Geol. Survey, 1919, no. 694. [Min. Abstr., vol. 1, p. 83.]

[1] G. Rose, Ueber die Dimorphie des Palladiums. Ann. Phys. Chem. (Poggendorff), 1842, vol. 55, pp. 329–331.

[2] P. Groth, Chemische Krystallographie, 1906, vol. 1, p. 38.

[3] V. I. Vernadsky, Opuit opisatelnoi mineralogii, St. Peterburg, 1914, vol. 1, pp. 157, 249–251.

[4] A. W. Hall, 1920 and 1921 (Min. Abstr., vol. 1, p. 185); L. W. McKeehan, 1922.