

SHORT COMMUNICATIONS

A new analysis of villamaninite.

VILLAMANINITE was described and analysed by W. R. Schoeller and A. R. Powell (1919, 1920) from Cármenes, Villamanín, León, Spain, which is still its only known locality; the formula suggested was $(\text{Cu}, \text{Ni})\text{S}_2$, with some sulphur deficiency, a little iron and cobalt, about 1 % of selenium, and some variation in Cu:Ni ratio.

E. Thomson (1921) examined specimens under the ore-microscope and found them to be a mixture of two minerals, one white and resembling polydymite, the other dark grey and resembling blende, and on this evidence the species was commonly discredited (see, e.g., J. E. Hibsich, 1928; E. S. Simpson, 1932) though no mixture of known minerals could account for the low metal:sulphur ratio in so copper-rich a substance. P. Ramdohr (1937) showed that much of the material has undergone alteration to a mixture of chalcopyrite and linnaeite, but 'homogenes, erzmikroskopisch geprüftes Material zeigt ein den Pyrit völlig analoges Pulverdiagramm, das zonenweise etwas verschieden auf $a_0 = 5.65$ bzw. 5.59 \AA [i.e. kX] führte'; the material with $a 5.59 \text{ kX}$ (5.60 \AA) is a relatively minor component. Ramdohr apparently regards both the 5.65 and 5.59 kX zones as villamaninite; he concludes that Thomson's material was altered.

C. Palache, H. Berman, and C. Frondel (1944) appear to have overlooked Ramdohr's work, and include villamaninite as a synonym of bravoite, without explanation and despite its high copper and low iron content. In view of this, and since the original analyses were made on material that may have been partly altered, while Ramdohr's X-ray study was made on unanalysed material, we have re-examined the type material (B.M. 1919, 309). A new analysis on 9 mg gave: Cu 24.0, Ni 11.8, Fe 5.3, Co 4.0, S 54.0, Se 0.06, total 99.2%, in good agreement with Schoeller and Powell's original analyses except that we did not find any deficiency of sulphur, but rather a small excess. X-ray examination of the actual powder used for analysis revealed the presence of two phases, both with pyrite structure; the major component had $a 5.693 \text{ \AA}$ and the minor $a 5.62 \text{ \AA}$, and the relative intensities indicate that the minor component is less than 25 % and perhaps as little as 10 % of the material. Taking a weighted mean cell-dimension of 5.68 \AA and a specific gravity of 4.523 (Schoeller and Powell, on crystalline material) the empirical unit-cell contents are: Cu 1.90, Ni 1.01, Co 0.34, Fe 0.48, S 8.48, Se 0.005, Σ metals 3.73, Σ (S, Se) 8.48.

The cell dimension of the major component is slightly greater, and that of the minor component slightly less, than that of vaesite (a 5.652, on a specimen, B.M. 1957, 579, from Katanga, Congo); it is evident that the octahedral covalent radius of Cu is nearly the same as that of Ni, and appreciably greater than those of Fe and Co. The major component, to which the name villamaninite must properly be attached, clearly has the composition $(\text{Cu,Ni})\text{S}_2$, as assigned by Schoeller and Powell; the minor component is probably to be interpreted as a ferrian (and perhaps cobaltian) vaesite, and if this is true the Cu:Ni ratio in the villamaninite must be still higher than the 1.9 found by analysis of the mixture. It is hoped to make an examination of the two phases separately with the Castaing micro-probe when facilities are available.

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An X-ray study of manganese oxide minerals from Sandur, Mysore.

MANY manganese oxide minerals in the Sandur area, Bellary District, Mysore, India, were reported by Fermor (1909), but without detailed mineralogical study. Mukherjee (1959) made an X-ray study of the ore samples collected by Fermor and confirmed the presence of pyrolusite and cryptomelane with amorphous admixture, also ramsdellite.

The present author has undertaken a mineralogical study of the manganese ores of Sandur, and as a part of this investigation X-ray photographs were obtained in a powder camera of diameter 114.592 mm, using Fe radiation with a manganese filter. The X-ray diffraction data agree well with the values of Ramdohr (1956), and confirm the presence of pyrolusite, cryptomelane, and ramsdellite, already reported from Sandur; but they also reveal the presence of manganite, hydrohausmannite, jacobsonite, braunite, psilomelane, and lithiophorite, all of which are new