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public; and the deposits are fully described in the various volumes published by the West Virginia Geological Survey.

The aggregate amount of coal of future commercial thickness underlying the area of the State before mining operations began is estimated by the West Virginia Geological Survey at 115,676,615,224 short tons. Allowing a mining waste of 30 per cent, and deducing the 1,629,401,469 short tons already mined out, there is left the enormous total of 79,344,000,000 short tons of commercial coal still available in the West Virginia hills. At the present rate of enormous output this will supply the markets for more than 800 years.

I. C. WHITE

Vanadinite Deposits of the Elephant Butte. When in 1902, the soft-lead ore-bodies were first opened up in the Sierra de los Caballos, in central New Mexico a hundred miles north of El Paso, near the point on the Rio Grande where the Elephant Butte reclamation dam now stands, there were certain features observed concerning the rare lead combinations which, for obvious business reasons, could not be made public at the time. Besides the principal ore, which is galena disseminated through a fluor gangue, with minor quantities of the sulphate and carbonate minerals, there appears also the molybdate of lead, wulfenite, and the vanadate of lead, vanadinite, in recoverable quantities.

These ore deposits of the Caballos, or Horse, Mountains are peculiar in that they occupy fault-planes which are transverse to the axis of the range. These faults are numerous, parallel to one another, and spaced about 300 feet apart. At first glance they appear to be merely normal type phenomena, with small throw; but upon close examination it is discovered that the fault movement is not vertical but horizontal. The fault-planes are disposed normally to the major thrust-plane, but the direction of movement is clearly with that of the thrusting. Their trend appears also to coincide with the direction of foliation in the pre-Cambrian schists forming the pediment of the mountains.

The molybdate mineral occurs in small cubes of ruby colored crystals disseminated thickly through the fluor gangue which serves to form the central streak in the ore-vein. In milling it would probably go with the galena, and it would not be separated

perfectly from that mineral. This mineral is widely distributed through all the veins of the district.

The vanadate lead comes chiefly from three veins, on locations situated on the east side of the range, near the head of the Palomas Canyon which cuts in two the lofty mountain ridge. Until after the purchase of the claims this mineral was always spoken of as lead carbonate. The principal vein is composed of a thick plate of galena, accompanied by a sheet of very pure vanadinite six inches in thickness. In the main, the coarsely crystalline, massive mineral forms the workable ore. When the mineral occurs in vugs the crystals are long, very slender, hexagonal prisims, terminating in unit pyramids, and clear, yellowish to reddish-brown in color. In the porous sections of the vein little rosettes of hair-like crystals line many of the cavities.

As they reach the concentrator the local ores of the Caballos veins run about 8 to 10 per cent of galena, one to two per cent. of vanadinite, and one to three per cent copper. The mine-run of vanadinite is expected to exceed 1 per cent. Low-grade ore exists in large amounts but the treatment of these remains until the process of leaching is more fully perfected.

In the extraction of the vanadium from the concentrates it is likely that the German method of smelting with an acid flux and then leaching the metal from the slag with water, will be found the simplest, cheapest and most efficient. The Vanadium Mines Company, which did the most work on these vanadium ores of the Palomas Gap, before its guiding spirit died, erected a small leaching-plant on the railroad, 12 miles distant from the mines and concentrator, using sulphuric acid, the lead being left in residue as lead sulphate, and the liquor containing the vanadium being evaporated to dryness and then calcined to vanadium oxide. The latter is then converted into ferro-vanadium in which form it is used by the steel companies. One grave difficulty met at first in the adoption of this process was the incompleteness of the vanadium recovery. Although the ore was ground to 20-mesh the acid had a tendency to only form a coating of lead sulphate around the crystal grains, which effectually protected them from further action. The degree of fineness to which the ore must be ground in order to overcome this drawback was not determined.

KEYES