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Nonsulfide Zinc-Lead-Vanadium Ores in the Kihabe and Nxuu Prospects (Aha Hills, Botswana) - A Mineralogical Insight

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The Kihabe and Nxuu Zn-V (>Pb>Cu-Ag-Ge) prospects are located at the boundary between Namibia and Botswana (Aha Hills, Ngamiland District). The prospects, currently under exploration by Mount Burgess Mining N.L., contain total resources (2004 JORC compliant) of 25.3 million tonnes ore at 3.00% zinc equivalent, a silver amount of 3.3 million ounces, and notable V+Ge credits that are still not evaluated at a resource level. The orebodies, consisting of mixed sulfide-nonsulfide minerals, occur in a strongly deformed Proterozoic terrain representing the eastern extension in Botswana of the Damara belt of Namibia, and are hosted by quartzwackes at the contact with dolostones. Sulfides have been formed before or during the Panafrican orogeny, similarly to those occurring in the Namibian Otavi Mountainland.

Several drillcore samples from the Kihabe and Nxuu partly oxidized ores were analyzed for conventional optical and scanning electron microscopy, X-ray diffraction, and bulk-rock geochemistry. Sulfide minerals, mainly consisting of sphalerite, Ag-bearing galena, and minor pyrite, appear to be finely intergrown with quartz and mica within the host rock. This mineral assemblage is overprinted by secondary oxidized minerals, mostly consisting of willemite, various Zn-bearing phyllosilicates, smithsonite, and vanadates. Willemite has been detected in patches and/or as vein filling, and is As-rich. Zn-bearing phyllosilicates are finely dispersed in the quartzwacke, texturally growing on preexisting micas and locally replacing illite and K-feldspar; they can also occur as aggregates of newly formed crystals directly precipitated in cavities. Specific X-ray diffraction analysis on clay minerals allowed determining that they mostly consist of fraipontite (a Zn-bearing species of the kaolinite-serpentine group), in contrast with previous studies that prevailingly identified the most abundant phyllosilicate as baileychlore. The Zn-phyllosilicates at Nxuu are characterized by contents ranging from 36 to 46 wt % ZnO, MgO variable between 1 and 4 wt %, Al_2O_3 between 11 and 15 wt %, and SiO_2 between 25 and 30 wt %. Smithsonite occurs as concretions in cavities or it replaces willemite. Locally the Zn-carbonate is associated with cerussite, which directly replaces galena. The most abundant V-mineral is descloizite, which has been widely detected in the most surficial zones of the orebodies, in association with calcretes within the Kalahari sedimentary cover.

In analogy with the Zn deposits of the Otavi Mountainland, willemite and fraipontite at Kihabe and Nxuu could be genetically related to a hydrothermal mineralization stage, which shortly followed or was contemporaneous with the Panafrican orogeny. The other secondary minerals, i.e., the Zn-Pb carbonates and vanadates, likely represent more recent weathering-derived products.