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Mineralogical characterisation and deportment studies of different mine waste material from a historic tailings pond in Plombières, East Belgium.

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Recent studies on historic mine waste (e.g. tailings, waste rock, metallurgical waste) indicate the recycling potential of the material for metal extraction. Historic mine wastes have been shown to be of more interest than modern mine wastes, due to the lower efficiency of ore processing in the past. Although the knowledge of processing has significantly improved, there are still some areas in the processing sector that could be improved. Most previous studies have focused on the bulk analysis of mine wastes, without a detailed analysis of important characteristics, such as mineral texture, associations, liberation and locking. Recent studies focus on detailed mineralogical analysis, in order to more accurately assess the availability of the metals within the potential material for metal extraction. The present study investigates the geochemical and mineralogical characteristics of different mine and metallurgical waste material from a tailings pond in Plombières (East Belgium). The tailings pond covers a minimum surface area of 8000 m^2, comprising 4 main types of material. Ore microscopy, X-ray fluorescence (XRF), quantitative X-ray powder diffraction (XRD), scanning electron microscope (SEM) based Mineral Liberation Analysis (MLA) and electron microprobe (EPMA) were used to identify and characterise Pb and Zn phases within the material. XRF analysis shows that the mine wastes dominantly consist of SiO_2, Al_2O_3 and Fe_2O_3, while the content of Zn and Pb varies from 51 ppm to 24 wt % and 10 ppm to 10.1 wt %, respectively. The mineralogy of the mine waste is characterised by quartz, amorphous phases and phyllosilicates, with minor amounts of Fe-oxide, Pb- and Zn-bearing minerals. Based on the processing of the ore, the amorphous phase is present as pyrometallurgical slag. Mineral- to element- conversion shows a lack of Pb and Zn content. MLA and EPMA analysis confirm that the missing Pb is distributed between Pb- droplets within the slags and in the amorphous structure of the slags. Additionally, the analyses reveal that zinc is also dominantly located within the slags.