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Recovery appraisal of Ag, Bi, In, Sb, Se, and Te in processing samples from the Ruwai Pb-Zn skarn deposit, Central Kalimantan, Indonesia

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Processing samples from the Ruwai skarn deposit, the largest polymetallic skarn deposit in Indonesia, were analyzed to assess mass balances, recovery rates, and deportments of selected critical elements in order to understand their distribution and behaviour within the deposit. These samples included feed ore, Pb scavenger and final Pb concentrates, Zn scavenger and final Zn concentrates, and final tailings. They underwent bulk geochemical, mineralogical, and mineral chemical analyses.

The analyses revealed that Ag and Bi are the predominant critical elements in the samples, with highest recoveries occurring in the Pb concentrate at 75-90% and 78-90%, respectively. This observation is consistent with the results of the Ag and Bi deportments, as these elements are mainly hosted in solid solution within galena (PbS), whereas particulate Ag- and Bi-bearing minerals, such as acanthite (Ag_2S), freibergite ($(Ag,Cu,Fe)_{12}(Sb,As)_4S_{13}$), pyrargyrite ($Ag_3SbS_3$), bismuthinite ($Bi_2S_3$), native bismuth (Bi), and cosalite ($Pb_2Bi_2S_5$) are commonly associated with galena.

The majority of In reported to the Zn concentrate (61-84%), suggesting an association with sphalerite. However, a notable portion, approximately 13-33%, was lost to the final tailings. A significant proportion of Sb (44-62%) was lost to the final tailings, while only 33-52% reported to the Pb concentrate. Recovery rates of Se in the Pb and Zn concentrate reach 30-61% and 32-63%, respectively. Meanwhile, 56-77% of Te was recovered in the Pb concentrate, and 16-34% was lost to the final tailings. Sphalerite is expected to be the primary carrier of In, whereas freibergite and pyrargyrite have been identified as carriers of Sb, and pilsenite/tsumoite (Bi_4Te_3/BiTe), hessite (Ag_2Te) and BiTeAg host Te. Additionally, it is possible that some gangue minerals are responsible for carrying some of these elements to the final tailings