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Armoring effect of limestone in acid mine drainage: Static immersion experiments

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Study on armoring effect is helpful to understand the mechanism of acid mine drainage (AMD) releasing from limestone-rich metal sulfide tailings (limestone tailings). By performing static experiments of AMD immersing limestone particle materials, this paper studied the formation of secondary armor under acid water saturation condition, similar to the circumstances in acidified tailings. The results show that Fe content in AMD may be one of the main factors affecting the armoring effect of limestone. In high Fe concentration AMD (Fe≥74.8 mg/L), the order of secondary precipitants is: Al-rich phase→gypsum→lepidocrocite (adsorbing Zn, Cu and As) on the surface of limestone particles, and the precipitants made the limestone armored/passivated, resulting in the solution to maintain acidity. By contrast, in low Fe concentration AMD (Fe<74.8 mg/L), the secondary armor may not form, therefore limestone can be dissolved and release a large amount of CO_3^{2-}, which fully neutralized H^+ in solution, so that the solution can reach neutral circumstances. Based on this study, the limestone tailings with high Fe sulfide content (e.g. Fe 10.62 wt%, S 5.70 wt%) could have a higher risk of releasing AMD (and heavy metals), because the tailings by oxidation could produce the acid water with high Fe content and the armoring effect of limestone could happen easily.

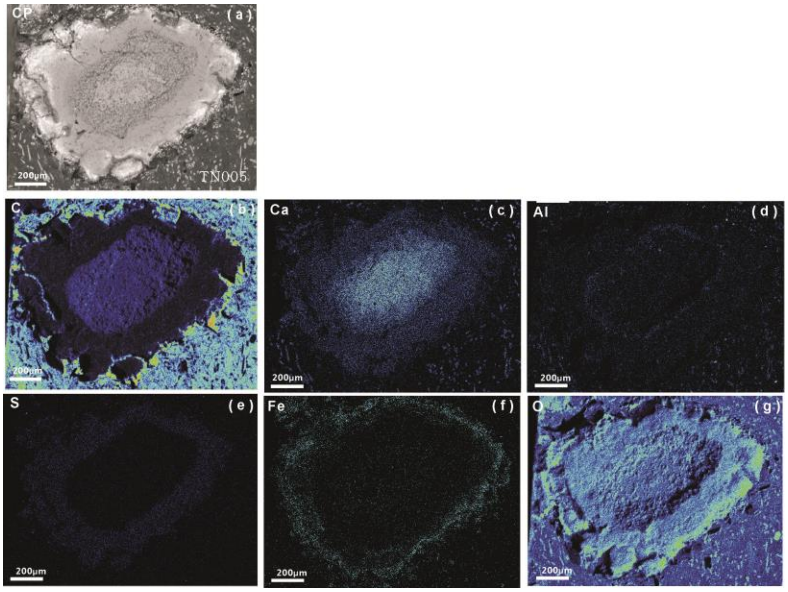

Figure 1 Amor structure of limestone particle. (a) Electron Microscope; (b)-(g). electron image of Electron Back Scattered Diffraction.