STORAGE OF MINING-RELATED ZINC IN FLOODPLAIN SEDIMENTS, BLUE RIVER, WISCONSIN

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Abstract: This study investigates spatial patterns of sediment-associated zinc (Zn) storage in floodplain deposits and the potential reintroduction of these metal-contaminated sediments to the active channel by bank erosion. We estimate patterns of Zn mass storage by combining longitudinal trends in Zn concentrations with measurements of sediment mass storage in overbank and point-bar deposits. Overbank deposits are the largest contaminant sink, storing five times more Zn than the point-bar deposits. While Zn concentrations decrease downstream because of dilution effects, the total mass of Zn stored in floodplains is greatest in both the upstream reaches and in the wider lower valleys where low channel gradients promote rapid sedimentation. Zn storage is low in middle reaches where steep, narrow valleys with high stream power favor sediment transport over deposition. Overall, more than half of the Zn released by mining remains stored in floodplain deposits within the watershed. The remobilization of Zn from storage is more likely in the upstream and mid-basin reaches where high stream power increases rates of lateral channel migration. Channels in the lower valley lack the stream power to migrate laterally and remobilize the large Zn mass stored in overbank sediments. [Key words: floodplains, Zn contamination, mining, stream power, Wisconsin.]

INTRODUCTION

Floodplain environments can function as semipermanent sinks for metal contaminants in watersheds with a long history of base-metal mining activities (Bradley, 1989; Moore and Luoma, 1990). The sediment loads imposed by the input of large quantities of metalliferous particles to river channels in association with tailings disposal, mill effluent discharges, and mine dewatering can significantly increase rates of alluvial storage of sediment-borne metals (Davies, 1983; Marron, 1992). Furthermore, hydrologic disturbances during the mining period (e.g., agriculture and deforestation) can increase upland soil erosion rates and flood magnitudes, and thus, indirectly increase the flux of sediment-borne contaminants to floodplains by increasing the capacity of channels to transport sediment (Knox, 1987). These alluvial sinks are reworked by channel erosion at time scales from 10 to more than 100 years (Meade, 1982; Trimble, 1983; Walling, 1983). Therefore, present-day con-

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