Temporal and Spatial Changes in Riverine Sediment Geochemistry at the Ok Tedi Mine

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# ABSTRACT

The Ok Tedi Au-Cu-Ag mine is a porphyry and skarn deposit located in the Western province of Papua New Guinea (PNG), at the headwaters of the Ok Tedi. The mine has produced 5.25 Mt of copper, 16.2 Moz of gold and 37.2 Moz of silver since production commenced in 1984 to the end of 2023. Th operations comprise a single large-scale open-cut mine, ore concentrator and tailings pyrite plant (TPP). Tailings are discharged to the Ok Tedi, and waste rock is placed in erodible dumps which erode to the river. Prior to discharge, sulfides are removed from tailings at the TPP, and pyrite concentrate is deposited sub-aqueously in storage pits at Bige. Dredging operations occur along a section of the Ok Tedi at Bige approximately 110 km downstream of the mine to remove sediments and deposit them in engineered stockpiles.

This paper provides a review of long-term riverine sediment assay results, including total sulfur, acid neutralizing capacity (ANC) and metals content, between 2001 and 2023 along the extent of the river system from the mine site to the mouth of the Fly River, a distance of approximately 600 kilometres. The data show outcomes of ARD mitigation strategies implemented over the past 25 years including a reduction of net acid production potential (NAPP) and copper content in riverine sediments. Significant improvement to ARD parameters in near-mine river sediment samples are observed over time, with the most significant reductions in sulfur content occurring between 2005 and 2010; increased ANC and decreased NAPP is evident between 2005 and 2019. Sulfur, ANC and copper concentrations in river sediments generally decrease with distance downriver from the mine; most significant decreases occur downstream of dredging operations at Bige. Copper concentrations have decreased in river sediments over the study period.