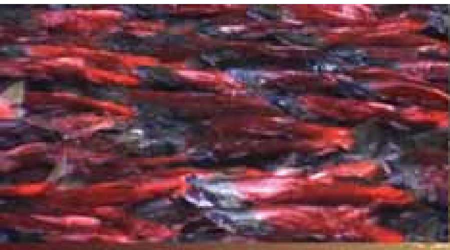

Copper, Salmon and the Proposed Pebble Mine

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Background

Copper occurs naturally in the environment at low levels. High levels are recorded for regions where hard rock and coal mining, smelting and refining occur and in areas near industrial and municipal waste sites[1]. The Pebble prospect, in Bristol Bay, Alaska, is a low grade copper/gold/molybdenum prospect estimated at 10.78 billion tons, of which more than 99.6% would be waste.[2]

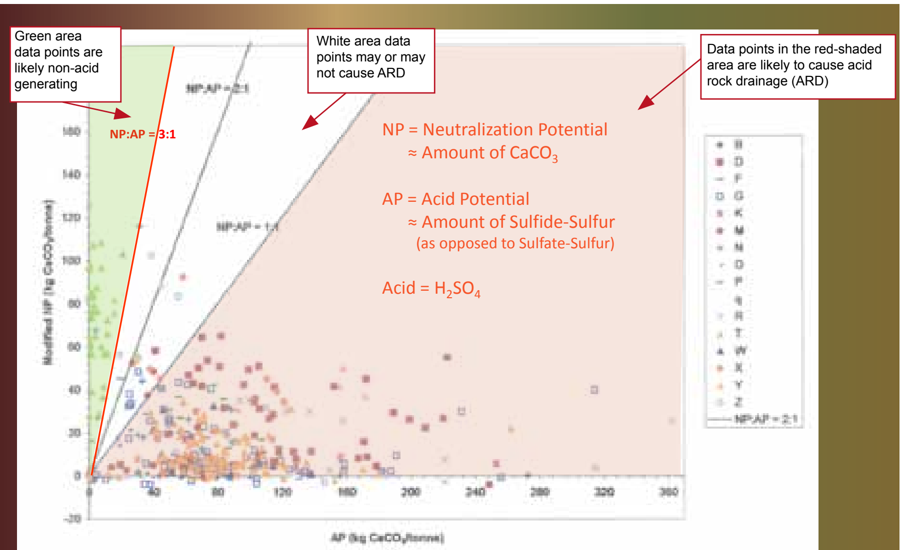

Figure 2. Acid generating potential (AP) of 399 samples from the Pebble West deposit, 1988-2003[4]. Explanations by D. Chambers.

The Pebble prospect contains about 36.3 million tonnes of copper, which occurs with sulfides. Excavating, crushing and exposing sulfide rock to air and precipitation can form sulfuric acid[3] (acid drainage) which dissolves metals carrying them into the watershed. Studies show rock at Pebble is potentially acid generating (Figure 2). Because ~10.6 billion tons of mined material at Pebble would be stored on-site as waste in perpetuity, there is concern that copper and other heavy metals will escape containment via acid drainage, wind (Figure 3), floods, leaks, or accidents, increasing concentrations in waters supporting valuable Bristol Bay fisheries. Legal discharges of copper into the environment can actually harm salmon.

Figure 1. The Bingham Canyon Mine is the largest copper-sulfide mine in the world measuring 2.75 miles across the top and 0.75 miles deep. Acid waters, from the leaching of mine wastes, escaped the collection system and contaminated about 80 mi^2 of groundwater. See: http://www.epa.gov/region8/superfund/ut/kennecottsouth/ for more information.

Copper and Salmon

Dissolved copper is very toxic to freshwater life[5]. Legal increases in dissolved copper concentrations can harm salmon and their food chains. Current Aquatic Water Quality Standards[6] allow increases in dissolved copper concentrations that can:

- ► Impair fish olfaction, which enables mating, food location, kin identification, predator avoidance and homing back to spawning sites[7]. Reduced olfactory ability can reduce fish survival[8].
- ► Harm or kill zooplankton[9] a preferred food of juvenile sockeye salmon.
- ► Reduce growth & survival of freshwater mussels[10], a food of Bristol Bay subsistence fish species.

Scientists agree there is a lack of research to accurately predict impacts of increased copper concentrations on salmon and ecosystems they rely on for survival. Predicting copper toxicity in freshwaters is difficult because many factors such as levels of calcium, pH, dissolved organic matter, and zinc in receiving waters affect copper bioavailability and toxicity. This means the exact same increase in copper to two different streams can be toxic to salmon in one stream, but not the other. Zinc, which occurs at Pebble, can interact with copper increasing the toxicity to aquatic species[11]. How increased copper exposure from mine development can affect salmon growth, reproduction, recruitment, and survivorship is unclear[12].

When a predator such as a pike attacks a salmon, fish downstream of the attack smell an alarm scent released from the wounded fish, and instinctively stop feeding and drop motionless to the bottom to avoid the same fate. Photo © Jim Lavrakas.

Dust can carry heavy metals from mine sites into local watersheds. Here potentially reactive dust blows from the Troy Mine tailings pond, Montana.

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