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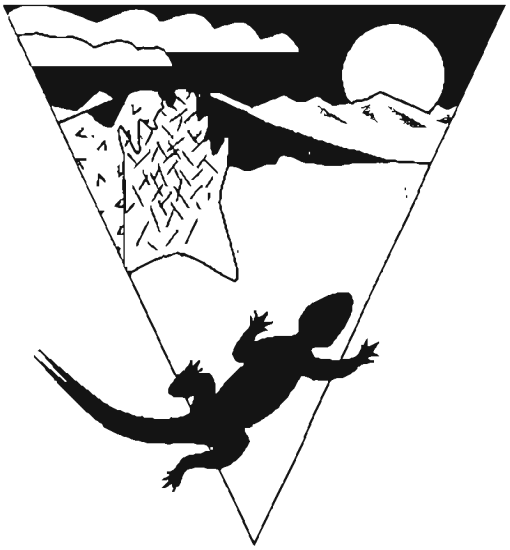

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HEAVY-METAL CONTENTS OF SEDIMENT FROM THE KUSKOKWIM RIVER, BETHEL, ALASKA— A BASELINE STUDY*

Harvey E. Belkin and Harold M. Sparck

The Kuskokwim River, at Bethel, Alaska, drains a major mercury-antimony metallogenic province in its upper reaches and tributaries. Gray and others (1991) and Nelson and others (1977) have reported anomalously high heavy-metal values (up to ≈1,800 ppm) for stream sediments in the river above Bethel that are invariably associated with

*Not presented at Forum.

Table 1 (Bawiec and Ambrosiak). Estimates of undiscovered mineral deposits at specified probability levels, for Puerto Rico.

[MARK3 Input]

Model	Known mineral deposits	Known occurrences	Probability .90	.50	.10	.05	.01	Level of prospecting
Porphyry Cu	2	8	--	--	--	--	--	--
Copper skarn	2	10	1	4	8	--	--	Low.
Fe skarn	1	16	0	0	1	2	3	Mod/High.
Porphyry Cu-Au	5	2	2	3	5	8	10	High?
Polymetallic veins	2	59	1	4	15	--	--	Moderate.
Volcanogenic manganese	3	11	1	3	8	--	--	Moderate.
Epithermal qtz-alu Au (low grade)	2	3	1	2	4	--	--	Low.
Kuroko massive sulfide	0	0	0	0	1	--	--	Very low.
Placer Au-PGE	Ancient placer sites	3	0	0	--	--	1	Very high.

mercury-mineralized lode deposits. However, downstream from these lode deposits, approximately 10–25 km, they described a decrease of the heavy-metal content in the sediments to essentially background levels. This decrease is mainly due to dilution with relatively clean bed, bank, and hillslope material.

Bethel (population 4,000) is situated on the Kuskokwim River floodplain and draws its water supply from wells located in river-deposited sediment. These sediments may be secondary sources of contaiants to ground-water quality. These potential contaminants are not necessarily fixed as inorganic particulates but may be mobilized via biological and chemical processes within the sediment column and ground water, although biological processes may be minimal in this high-latitude environment. The Bethel area, typical of arctic tundra environments, is underlain by permafrost, and the ground is frozen for extended periods of time. Nevertheless, examining samples of the Kuskokwim River sediment is important in order to establish a baseline datum for heavy-metal concentration.

A boring on the riverbank down to and into permafrost (≈8 m) provided 11 samples that we analyzed for mercury, arsenic, antimony, and selenium. These elements are present in anomalously high concentrations in the upstream deposits (Nelson and others, 1977; Gray and others, 1991). All the sediment passed through a 150-µm sieve and was therefore mostly very fine sand and silt; we noted little visible organic matter. Splits of the dried sediment were analyzed as follows: total mercury by cold vapor atomic absorption spectrometry, arsenic and selenium by hydride generation atomic absorption spectrometry, and antimony by graphite furnace atomic absorption spectrometry. Aluminum was analyzed by inductively coupled plasma atomic emission spectrometry and was used as a normalizing factor.

The values of all the elements did not vary systematically with depth and ranged from (all ppm dry weight) [mean, 1 sigma]; Hg=0.08–0.29 [0.16, 0.06], As=2.7–4.2 [3.5, 0.4], Sb=0.53–1.5 [0.87, 0.27], and Se=0.2–0.3 [0.2, 0.0]. Aluminum (ppm×10^4) ranged from 5.91 to 6.27 [6.07, 0.12].

The values determined at Bethel represent the normal products of weathering and show no indication of contamination from mercury-antimony mineralized areas. This study helps to establish a useful baseline datum at Bethel for these elements and will be valuable if mining activities increase upstream.

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