

---

**Distribution of arsenic and mercury in marine  
sediments impacted by gold mine tailings,  
Wine Harbour, Nova Scotia**

---

MEGAN E. LITTLE<sup>1</sup>, MICHAEL B. PARSONS<sup>2</sup>,  
AND ANNE-MARIE O'BEIRNE-RYAN<sup>1</sup>

*1. Department of Earth Sciences, Dalhousie University, Halifax,  
NS, B3H 4J1 <melittle@dal.ca> ¶ 2. Geological Survey of Canada  
(Atlantic), P.O. Box 1006, Dartmouth, NS, B2Y 4A2*

This study focuses on the environmental impacts of historical gold mining and milling practices in the Wine Harbour gold district, Guysborough County, Nova Scotia. Gold mining was intermittent at Wine Harbour between 1862 and 1939, producing a total of 42,726 oz. of Au from 72,413 tonnes of crushed rock. The gold occurs in a series of quartz veins, typically associated with arsenopyrite, that are hosted by the Goldenville Formation of the Meguma Group. Stamp milling and mercury amalgamation were the primary gold extraction methods. Wilfley tables and a cyanide plant were also employed to recover additional gold from arsenopyrite concentrates and stamp mill tailings. The tailings were slurried directly into surrounding streams and low-lying areas around the shores of Wine Harbour. The main objectives of this study are: (1) to evaluate the spatial extent of gold mine tailings in both the terrestrial and marine environments; (2) to determine the concentrations and speciation of As, Hg, and other elements in mine wastes, sediments, and waters; and (3) to provide geoscience data that can be used to assess potential risks to ecosystem and human health.

In July 2005, mine tailings, waters and marine sediment samples were collected throughout the Wine Harbour gold district. Marine sediments were collected using both a grab sampler ( $n = 21$ ) and a gravity corer ( $n = 6$ ). Chemical analyses of 10 tailings samples collected on-land show very high concentrations of both As (200 to >10 000 ppm; mean 5800 ppm) and Hg (4900 to >100 000 ppb; mean 19 000 ppb). Electron microprobe analyses indicate that arsenopyrite is the main host for As in the tailings, and also confirm the presence of elemental Hg in one sample collected from a stamp mill. The distribution of As and Hg in marine sediments confirms that most areas of Wine Harbour have been impacted by historical gold milling activities. Chemical analyses of 233 marine sediment subsamples show a wide range in both As (4 to 1500 ppm; mean 75 ppm) and Hg (5 to 9500 ppb; mean 850 ppb) concentrations. In general, the highest As and Hg values are located

close to known stamp mill structures along the shores of Wine Harbour. However, high levels of both As and Hg also occur in the bottom sediments of a small inlet on the western end of the harbour, within the bounds of an active mussel aquaculture operation. Contamination of this latter site is likely related to a mill site(s) that is not shown on the historical maps for this gold district.

This investigation is part of an ongoing project involving both Federal and Provincial government departments, which is assessing the marine environmental impacts of historical gold mining activities throughout Nova Scotia. Results from this study will aid in determining the precautionary measures necessary for minimizing risks associated with elevated levels of As and Hg in the Wine Harbour area.