

Geochemistry of tailings, Gullbridge tailings pond

The Mineral Development Division of the Mines Branch, Natural Resources, has previously sampled the tailings contained in the Gullbridge tailings dam. This information can be used to evaluate the potential impact of the tailings that escaped during the December 17 breach. No data is available for the tailings pond water.

The data provided consists of samples taken at depth of 5-60 cm at two different locations. The results show only moderate variability, suggesting the tailings are homogenous, and that these samples are representative of the tailings as a whole.

Two different analytic methods were used, and the results from the full suite of elements are provided, including numerous elements that are present at low levels and which have no implications for human or aquatic habitat health. When discussing the data, only those elements generally reported in water quality work are considered. It should be noted that there was no analysis of the tailings for mercury or selenium.

Background levels in the area can be evaluated by comparing the results from tailings with those from till and lake sediment samples in the surrounding area. All data from these samples are available on-line at

<http://gis.geosurv.gov.nl.ca/>

In the discussion below, results from five till samples within 2 km of the tailings area are used as background.

In terms of major elements, iron content is high, ranging from 19-31% (background~4%); the Gullbridge ore body consisted of massive sulphides, and pyrite (iron sulphide) would be a major waste product from concentrating of copper minerals. Pyrite can be acid generating when exposed to water and oxygen, as the sulphur is released from the mineral. The majority of the tailings consist of silica minerals (40-52% silica oxides), typical of most rocks. Calcium levels are low (0.7-1.3%), and this likely is contained in insoluble calc-silicate minerals rather than limestone or dolomite, reducing the ability to buffer acid generating minerals. Magnesium levels range from 6-7% and are thus elevated as compared to background (0.6-0.7%).

The main element that shows significant elevation over background is copper. This shows values from 230 to 1926 ppm, whereas background levels range from 27 to 41 ppm. The Gullbridge mine extracted ore that contained between 1 and 2% copper, and the copper in the tailings likely is derived from copper in this ore that could not be extracted in processing. It is almost certainly mostly in a relatively insoluble form as copper sulphides.

Zinc is only slightly elevated – 68-221 ppm compared to 38-49 ppm in tills. Nickel similarly is higher in the tailings (28-150 ppm) than in tills (13-18). These metals were likely somewhat concentrated in the ore being mined. Chromium is also somewhat elevated (260-361 ppm vs 54-73 ppm in tills) as is manganese (1281-1560 ppm in tailings, 585-764 in tills)

Arsenic in the tailings (4-9 ppm) is essentially at background levels (6-8 ppm), as is barium (288-560 ppm tailings, 385-464 tills), uranium and lead (4-7 ppm tailings, 6-10 ppm tills). Cadmium is close to detection limit for the analytical method (0.1 ppm), and is very low.

| Element | Range (tailings); ppm unless stated otherwise) | Range (tills) |
|---------|--|---------------|
| As | 4-9 | 6-8 |
| Ba | 288-560 | 385-464 |
| Cd | 0.2-0.7 | - |
| Cr | 260-361 | 54-73 |
| Cu | 230-1926 | 27-41 |
| Fe | 19.74-30.94% | 4.0-4.3% |
| Pb | 4-7 | 6-10 |
| Mg | 6.49-7.12% | 0.6-0.7% |
| Mn | 1281-1504 | 586-764 |
| Ni | 28-170 | 13-18 |
| U | 0.6-1 | 0.9-1.7 |
| Zn | 68-221 | 38-49 |