West Virginia where selenium has been identified as mostly closely associated with coal and carbon rich shales in parts of the Kanawha formation in West Virginia (Vesper et al, 2008). This sample leached negligible quantities of selenium.

Figure 8-4 shows weeks 1 and 14 concentration data for the mine water metals iron, aluminum and manganese. Most leachate analyses were at or near detection levels for iron and aluminum, so few trends are evident. The low concentrations are consistent with the test protocol, and geochemical behavior of these elements. The column is a strongly oxidizing environment, with oxygenated air continually passing through the apparatus. Under strongly oxidizing conditions, conversion of Fe(II) to Fe(III) is favored, and occurs as:

$$Fe^{2+} + 0.25\ O_2 + H^+ \rightarrow Fe^{+3} + 0.5\ H_2O$$

At circumneutral pH, the conversion can progress rapidly, followed by formation of solid phase Fe(III) oxyhydroxide minerals (Langmuir, 1997). Aluminum solubility is strongly pH dependent, with a minimum concentration at circumneutral pH leachates such as those produced in four of the rocks. Only the acidic HCS-IN leachates contained appreciable soluble aluminum and iron. Manganese, which is soluble over a wide range of pH and redox conditions, is present in small to moderate amounts in all samples.

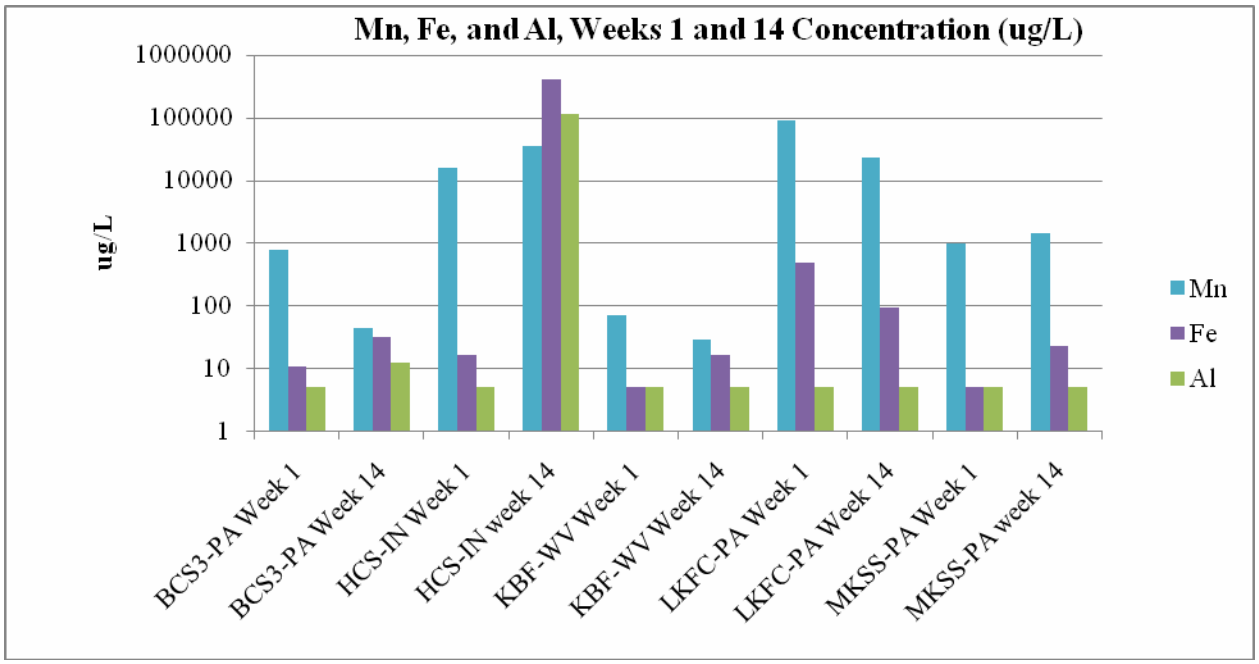

Figure 8-4. Iron, Manganese and Aluminum Concentration, Weeks 1 and 14 For 5 Rocks. Values are medians of all labs. Concentration is ug/L, log scale.

The lack of significant concentrations of iron and aluminum in most leachates should not be interpreted as lack of weathering of iron and aluminum bearing minerals. Significant weathering did take place within the columns, as described in the Chapter 5 comparisons of pre and post leaching mineralogical observations and as shown in the cumulative weathering graphs in Chapter 7. Iron and aluminum were largely removed from solution by the formation of new minerals in four samples, rather than being leached from the columns.