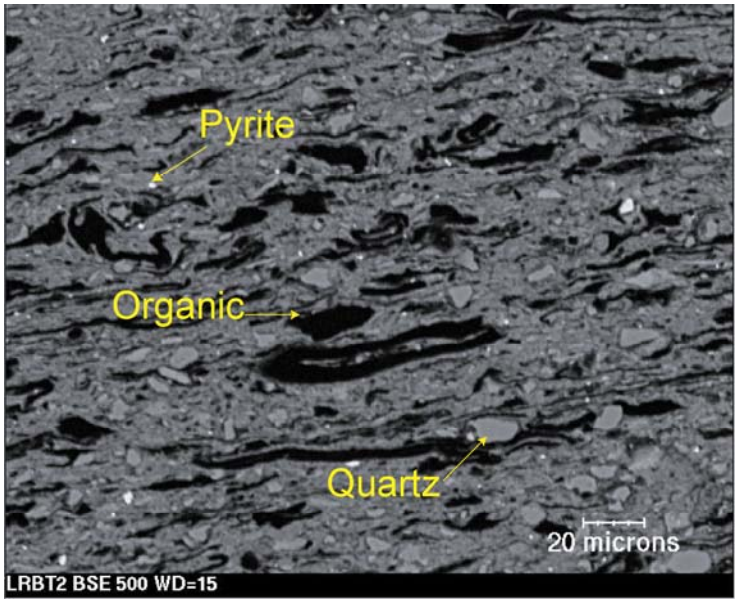

Figure 5.28. Leechburg Coal Refuse (Sample LRBT#2). SEM image showing fine-grained texture. The black material is organic; the bright white pinpoints are pyrite.

Mineral chemistry

Electron microprobe analytical data for pyrite and carbonate minerals are tabulated in Appendix 5.1, along with detection limits and statistics for each sample. Both mineral groups posed analytical challenges due to the fine grain size of the minerals. Ideally, mineral compositions total 100 (98 to 102) weight percent and computed atomic ratios match the expected mineral formulas. For pyrite, FeS_2, this means 2 atoms of sulfur for every atom of iron. Because the electron beam activates a volume of material at the mineral surface, uneven surfaces, holes, and the tiny grain size of individual pyrite grains in framboids produce low element totals. The atomic ratios, however, are appropriate for pyrite.

Pyrite. Pyrite was analyzed for iron, sulfur, selenium, nickel, arsenic, manganese, zinc, cadmium, cobalt, and copper. Trace element concentrations in pyrite varied within each sample; however, a few trends in the data are apparent (Figure 5.29). HCS-IN and Wadesville #29 were the only samples that contained selenium above detection limits; some pyrite in these samples contain over 1 weight percent manganese. Some pyrite grains in each sample contained arsenic above detection limits. Concentrations of other metals that typically occur in pyrite were at or below detection limits. Mercury was analyzed for in some samples, but none was detected. The trace elements are not evenly distributed throughout individual crystals in framboids, as shown by element maps (Figure 5.30). On these maps, the hotter colors indicate higher concentrations of an element. Note that the pyrite is outlined by high concentrations of iron, sulfur, arsenic, manganese, and selenium. The distribution of the trace elements is uneven across the pyrite crystals suggesting some zoning, even though spot analyses for selenium in pyrites in LKFC-WV are all below detection limits (Appendix 5.1) and the selenium concentrations in the bulk rock was <3 parts per million (Table 5.2). Sample HCS-IN has the highest whole-rock selenium content (81 parts per million; selenium was detected in 13 of the 17 pyrites analyzed from HCS-IN (Appendix 5.1).