

SEM data show that fossils are calcite with minor iron and manganese. Groundmass carbonates are zoned with calcic cores and more iron-rich rims. The zoning is apparent in backscattered SEM images because the iron-rims appear brighter due to average atomic number contrasts with more calcic cores (Figure 5.19).

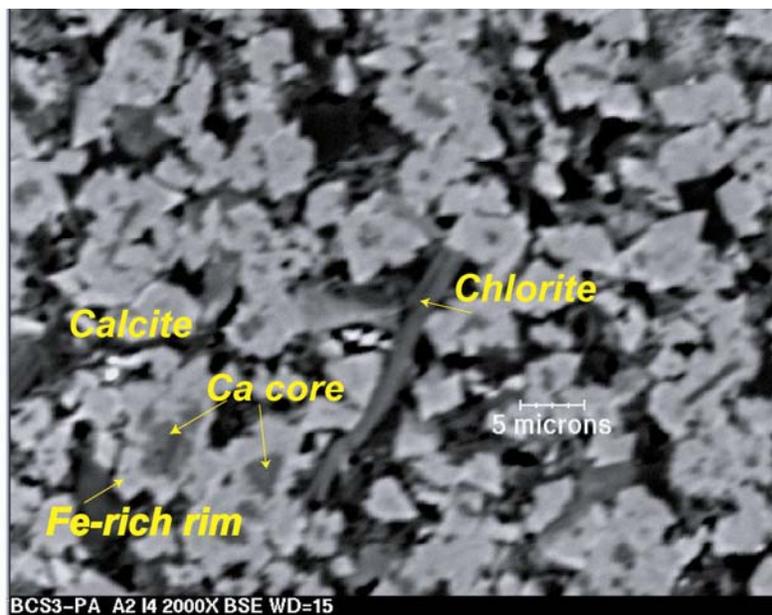


Figure 5.19. Brush Creek Shale (Sample BCS3-PA). SEM image (2,000X) of a groundmass carbonates. Much of the calcite is zoned, with calcium-rich cores (dark gray) surrounded by iron-rich rims (whiter areas).

Middle Kittanning Sandstone (Sample MKSS). The Middle Kittanning Sandstone sample was collected from Hawbaker quarry in Clearfield County, PA. The sandstone has low NP and low total sulfur (0.09 weight percent). MKSS was included as a relatively inert sample and was expected to behave as a minimal contributor of target analytes in the leaching study. Sample MKSS had a low temperature ash measurement of 91 weight percent and a loss-on-ignition of 5 weight percent. MKSS is a homogeneous, quartzose sandstone having an equigranular texture (Figure 5.20). Angular to subrounded 0.3 millimeter quartz grains are cemented by a fine-grained groundmass of mica, chlorite, clay and carbonate (Figure 5.21). XRD analysis estimated the mineralogical composition (in weight percent) as: 65 % quartz, 18% micas and clay minerals, 4% chlorite, 2% feldspar, <1% pyrite, and 8% carbonate minerals (Table 5.4). The accessory minerals zircon, rutile, monazite, and apatite were all confirmed by SEM. MKSS contains zoned carbonate (Figure 5.21) as well as discrete, adjacent grains of calcite and siderite (Figure 5.22) near pyrite framboids. SEM analyses confirm the XRD analysis of kaolin.