are chlorite and biotite. Although calcic feldspars are known to contribute NP, the feldspars identified in these rocks are mainly sodic. Quartz is inert. Jambor et al's (2002) static NP

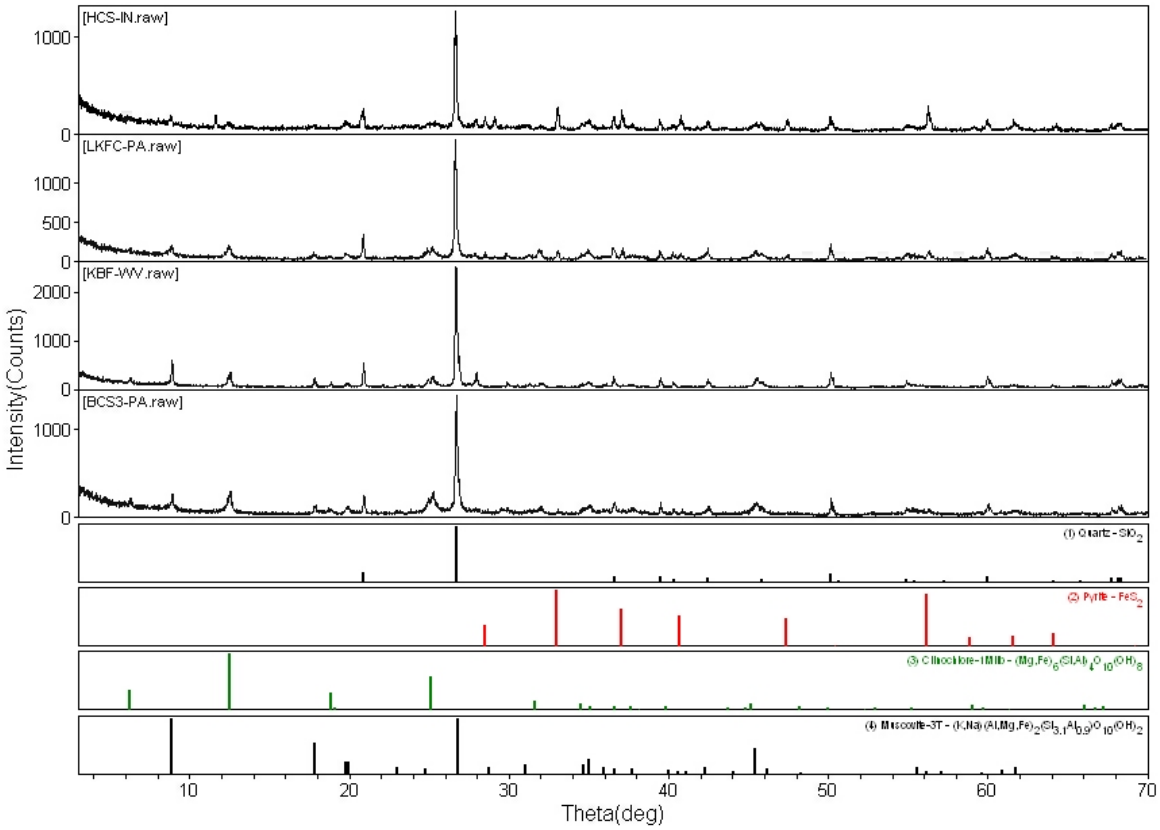

Figure 5.39. XRD patterns for shales and peak locations for standard reference patterns for quartz, pyrite, chlorite (clinochlore variety), and muscovite. Note that the strongest peak in each XRD pattern is the most intense quartz peak at 26.6 degrees.

determinations on individual minerals show that most rock-forming silicate and aluminosilicate minerals provide insufficient NP to produce a threshold NP of 20 kg $CaCO_3$ equivalent. Ideal formulas for minerals identified in the ADTI samples are listed in Table 5.3, along with comments on weathering behavior (based on Goldrich, 1938) and potential acid-neutralizing capacity of individual minerals based on relative reactivities of monomineralic samples at pH5 (Sverdrup, 1990) and NP determinations for monomineralic samples (Jambor et al., 2002). Relative dissolution rates for calcite in laboratory experiments at pH5 are several orders of magnitude faster than dissolution rates for any of the silicate minerals such as biotite or chlorite (Jambor, 2003; Kowalewski and Rimstidt, 2003). Textural relations, such as pyrite in contact with calcite as shown in Figure 5.13, demonstrate inherent neutralization for oxidative weathering of pyrite. Although none of the leach effluents in the USGS experiments were net acidic after the 16 weeks of the experiment, the relative rates of exhaustion of pyrite versus calcite determine long-term weathering behavior of the samples. Leachate experiments on Houchin Creek Shale from some of the other laboratories did go acidic during the final weeks of the experiments. See Chapter 8 for evaluation of weathering rates and predictions of the long-term weathering behavior of the samples based on the complete interlaboratory data set.