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# Origin of an Underclay as Revealed by Vertical Variations in Mineralogy and Chemistry

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**Abstract:** Regular vertical variations in mineralogy and chemistry indicate that underclay beneath the Herrin (No. 6) coal in southwestern Illinois has undergone *in situ* alteration. Alteration resulted from the downward movement of hydrogen ions, as indicated by the progressive leaching of acid-sensitive minerals adjacent to the coal. Mineralogical trends observed in the underclay with increasing depth below the coal include: (1) a decrease in the expandability of mixed-layer illite/smectite (I/S); (2) an increase in the amount of ordered I/S with respect to randomly interstratified I/S; (3) an increase in the amount of discrete illite with respect to expandable clays; and (4) an increase in chlorite and calcite. Ordered I/S is the dominant mixed-layer clay where calcite is present, but randomly interstratified I/S dominates where calcite is absent. The pH of the underclay also increases with depth. These trends are consistent with an origin by acid leaching of a preexisting mineral assemblage that included illite, chlorite, and calcite. Other acid-alteration trends may be expected for different precursor minerals and for different leaching intensities and durations.

**Key Words:** Acid leaching • Coal • Expandability • Illite/smectite • Mixed layer • Underclay

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