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# Characterization of Iron-Manganese Concretions in Kentucky Alfisols with Perched Water Tables

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**Abstract:** Iron-manganese concretions are common in upper sola of Alfisols in the Inner Bluegrass Region of Kentucky. Their nature and quantities appear to be related to the fluctuation of seasonal perched water tables above clayey argillic horizons. This study was conducted to examine changes in the macro- and micromorphology, chemistry and mineralogy of concretions as a function of size, color and soil depth. Total Mn and Fe contents increased, while  $\text{SiO}_2$  decreased with concretion size. Black concretions contained higher Mn, while brown concretions were higher in Fe. Crystalline Mn- and Fe-oxides fractionated with a sequential extraction procedure increased, but amorphous Mn and Fe decreased with concretion size. Goethite was the only crystalline Fe oxide mineral identified by X-ray diffraction (XRD) analysis. Manganese oxide minerals were very difficult to detect due to the diffuse nature of their XRD peaks and poor crystallinity. Examination of soil thin sections showed concretions of soil horizons overlying restrictive clayey layers to exhibit differentiated fabrics, sharp external boundaries and generally spherical shapes. Concretions found within clayey restrictive layers or above lithic interfaces usually had less structural organization, softer matrices and diffuse external boundaries due to longer term saturated conditions. Scanning electron microscopy (SEM) examinations suggested that the concretionary matrix, in spite of its density, has numerous cavities and an extensive micropore system within which dissolved plasmic Fe and Mn can diffuse and precipitate.

**Key Words:** Elemental Composition • Fractionation • Micromorphology • Mineralogy

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