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# Iron-Oxide Mineralogy of a Mollisol from Argentina: A Study by Selective-Dissolution Techniques, X-Ray Diffraction, and Mössbauer Spectroscopy

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**Abstract:** Selective-dissolution techniques by ammonium oxalate (OX), dithionite-citrate-bicarbonate (DCB), and dithionite-ethylenediaminetetraacetic acid (D-EDTA), and X-ray diffraction and Mössbauer spectroscopy were used to identify and characterize iron oxides and oxyhydroxides in the <2-mm, <50- $\mu\text{m}$ , and <2- $\mu\text{m}$  size fractions of a Mollisol from Bahía Blanca, Argentina. Iron compounds are present at low concentrations in mixtures with quartz, Na-rich feldspar, illite, interstratified illite-montmorillonite, and traces of kaolinite. Total Fe and Al content increases as soil particle size decreases, from 4.3 and 13.3 wt. % in the <2-mm size fraction to 8.5 and 22.8 wt. % in the clay fraction (<2  $\mu\text{m}$ ), respectively. No more than 25–30% of the total Fe is associated with the crystalline and the amorphous Fe oxides. Weakly ferromagnetic hematite and goethite were identified in the different fractions. These phases have small particle sizes and/or low crystallinity. They may also have Al for Fe substitutions. Crystalline magnetite or maghemite is rare. These Fe-rich phases are probably coating coarser particles.

The efficiency of Fe removal is highest for the D-EDTA treatment and least efficient for the OX method, for all fractions. The opposite is true for Al removal. Poorly crystalline hematite and goethite, which are soluble in oxalate, are only present in the coarser fractions. Poorly crystalline and crystalline hematite and goethite, which are soluble in DCB and EDTA, are present in coarser fractions, but do not occur in the clay fraction. DCB treatment probably dissolves Al in the 2:1 type phyllosilicates occurring in this soil, whereas D-EDTA dissolves Fe in the hydroxy interlayers of the smectite minerals or in the silicate phases.

**Key Words:** Ammonium-Oxalate Dissolution Treatment • Chemical Analysis • Dithionite-Citrate-Bicarbonate Dissolution Treatment • Dithionite-Ethylenediaminetetraacetic Acid Dissolution Treatment • Mollisols • Mössbauer Spectroscopy • X-ray Diffraction

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