



Semi-Quantitative Evaluation of Secondary Carbonates via Portable X-ray Fluorescence Spectrometry

Somsubhra Chakraborty (1), David Weindorf (2), Camille Weindorf (3), Bogdan Duda (2), Sarah Pennington (2), and Rebekah Ortiz (2)

(1) Indian Institute of Technology Kharagpur, India, (2) Texas Tech University, Department of Plant and Soil Science, Lubbock, TX, United States (david.weindorf@ttu.edu), (3) Irons Middle School, Lubbock, TX, United States

Secondary calcium carbonate commonly occurs in subsoils of semi-arid soils worldwide. In US Soil Taxonomy, such horizons are frequently described as Bk, Bkk, Bkm, Bkkm, or Ck horizons at variable stages of development. Specifically, the Soil Survey Staff uses a qualitative scale of one through six to indicate differential developmental stages. However, considerable disagreement exists even among experienced soil scientists. Evaluating 75 soil samples from across four US states, a portable X-ray fluorescence (PXRF) spectrometer was used to quantify the total soil Ca content and compare it to average developmental stage scores as determined by a panel of Soil Survey Staff personnel. Samples were evaluated both as intact aggregates as well as ground (<2 mm), homogenized powders. PXRF readings of total soil Ca concentration steadily increased under both conditions as developmental stage progressed. However, minimal difference was observed between stage five and six carbonate accumulation. Stage three showed the widest variability in total soil Ca. Given that PXRF cannot distinguish between primary and secondary CaCO₃ in soils, interpretation by the analyst remains essential. Nonetheless, PXRF provides an important tool for assessing carbonate laden subsoils providing elemental differentiation beyond that perceived by the human eye.