
Quantitative X-Ray Diffraction Analysis of Clay-Bearing Rocks from Random Preparations

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Abstract: An internal standard X-ray diffraction (XRD) analysis technique permits reproducible and accurate calculation of the mineral contents of rocks, including the major clay mineral families: Fe-rich chlorites + berthierine, Mg-rich chlorites, Fe-rich dioctahedral 2:1 clays and micas, Al-rich dioctahedral 2:1 clays and micas, and kaolinites. A single XRD pattern from an air-dried random specimen is used. Clays are quantified from their 060 reflections which are well resolved and insensitive to structural defects. Zincite is used as the internal standard instead of corundum, because its reflections are more conveniently located and stronger, allowing for a smaller amount of spike (10%). The grinding technique used produces powders free of grains coarser than 20 µm and suitable for obtaining random and rigid specimens.

Errors in accuracy are low, <2 wt. % deviation from actual values for individual minerals, as tested on artificial shale mixtures. No normalization is applied and thus, for natural rocks, the analysis is tested by the departure of the sum of the measured components from 100%. Our approach compares favorably with other quantitative analysis techniques, including a Rietveld-based technique.

Key Words: Clay Minerals • Marls • Quantitative Analysis • Shales • X-ray Diffraction

Clays and Clay Minerals; December 2001 v. 49; no. 6; p. 514-528; DOI: [10.1346/CCMN.2001.0490604](https://doi.org/10.1346/CCMN.2001.0490604)

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