
Illite Polytype Quantification using WILDFIRE© Calculated X-Ray Diffraction Patterns

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Abstract: Illite polytype quantification allows the differentiation of diagenetic and detrital illite components. In Paleozoic shales from the Illinois Basin, we observe 3 polytypes: $1M_d$, $1M$ and $2M_1$. $1M_d$ and $1M$ are of diagenetic origin and $2M_1$ is of detrital origin. In this paper, we compare experimental X-ray diffraction (XRD) traces with traces calculated using WILDFIRE© and quantify mixtures of all 3 polytypes, adjusting the effects of preferred orientation and overlapping peaks. The broad intensity ("illite hump") around the illite 003, which is very common in illite from shales, is caused by the presence of $1M_d$ illite and mixing of illite polytypes and is not an artifact of sample preparation or other impurities in the sample. Illite polytype quantification provides a tool to extrapolate the K/Ar age and chemistry of the detrital and diagenetic end-members by analysis of different size fractions containing different proportions of diagenetic and detrital illite polytypes.

Key Words: Cis-vacant • Illite • Polytypes • Quantification • Trans-vacant • X-ray Diffraction

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