Inter- and Intragranular age variations: Diffusion or mineral growth? – And what is wrong with the error?

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We present various examples of age variations in Potassium-bearing minerals of tectonites obtained by ⁴⁰Ar/³⁹Ar in situ dating. Age variations in pre-kinematic clasts and syn-kinematic blasts both span large age ranges of significantly different ages values at the cores compared to the rims, calling for petrologic interpretation. Some of the synkinematic grains are overgrown by late- to post-kinematic blast that show consequently the youngest ages values within the samples. The concurrence of textural relation and age value in the case of late- to post-kinematic growth seem to be a robust tool to date the termination of deformation.

Additional examples where break down reactions lead to dissolution of the prekinematic texture and crystallization of new minerals as coronas, within fractures of strain shadows also yield partly reset age values with larger scatter. The interpretation of those age values is more challenging and might be obscured by the 3D textural geometry of the analysed volume as well as disequilibrium between reactants and products.

Commonly based on the percentage errors age values are interpreted as being geological significantly different, when errors do not overlap, or as natural geologic scatter, in the case errors overlap. This interpretation is biased by the absolute age value itself and might lead to over- and underestimations of geological events in geologic history. There is a strong need of error calculation that enables geological interpretation of tectonic event independent from their absolute age.