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What is a good thermal history model?

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Quantifying a thermal history from thermochronology data can be achieved with either a forward or inverse modelling approach. In either case, we are interested in finding thermal histories that can reproduce the observed data adequately, but also in understanding what features of the thermal history are well resolved or not. In most cases we will tend to improve the fit to the data as we introduce more complexity in the thermal history. Generally, we will reach a point where adding even more complexity makes little or no difference to the data fit. Therefore, we might characterise a good model as one that achieves a balance between fitting the data and not being too complex.

In trying to find such models, we need to specify the mathematical form of the thermal history model. This is generally done in terms of a discrete number of time-temperature points (or nodes), and some form of interpolation (usually linear) between these nodes. In some cases, we have prior geological information (such as stratigraphic age for a sample, or a more or less complete burial history for a well) that can be incorporated into the thermal history. In other situations, we may just have a surface sample from a basement terrain with effectively no prior information on the thermal history.

In terms of the complexity of the thermal history, this will be partly reflected in the number of time temperature points are appropriate, as well as how much variability is justified in the thermal history

Another issue is how best to quantify the uncertainty in an inferred thermal history, or in predictions made from a thermal history. Previous approaches have typically relied on some form of local perturbation to a best-fit thermal history