Geochronology from the producer to the consumer

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Tectonic modelling requires large amounts of age data. Automated hardware appears capable to deliver numbers at an unprecedented rate. From the consumer's point of view, this may look like paradise.

The problem is, automation has not been the only advance. Improvements in sensitivity and precision have initiated a wave of innovative experiments on age patterns within and between mineral grains. Today we know more than was thought possible two decades ago. More knowledge means that the interpretive paradigm is no longer the simple "closure temperature" scheme fashionable in the early 1960s, yet consumers sometimes struggle to keep up-to-date in an exponentially rising amount of literature. As a consequence, a comment very frequently made by consumers is "I am not interested in your discussions, I want data quickly".

The producers of age data have reached a consensus on the paired geochronology+petrology advances. Pseudosections in P-T-A-X space, developed by petrologists, have taken the place of the "thermal isograds" of yore. Most minerals record internally discordant ages, diffusion being usually overrun by recrystallization. Petrographic relics coincide with isotopic inheritance. Zircon is the most obvious example, but similar observations are being increasingly documented for every single mineral chronometer (Villa & Williams 2013). This requires to no longer view minerals as "thermochronometers", but as *hygrochronometers* instead, and demands that each analysis be provided its complete context at the intercrystalline (retrogression, petrologic disequilibria, etc) and intracrystalline (microchemical gradients, age patches, etc) level. The modelling of exhumation rates by dating context-free detrital minerals, which forgoes the necessary petrologic equilibrium information, is not founded on solid bases. As context-finding is a typically human task, no automated protocol is predicted to reliably provide correct interpretations. One must never forget that accuracy must be laboriously sought and is not a guaranteed by-product of better precision. Today we know more: there are many more factors to be taken into account nowadays than our forefathers thought of half a century ago, and the complexity of the petrology-geochronology dependence is not going to make data production faster. The good news is that taking into account this complexity makes accurate geological reconstructions possible.

References

Villa, I.M. and Williams, M.L., 2013, Geochronology of metasomatic events, In: Harlov, D.E. and Austrheim, H. (eds.), Metasomatism and the Chemical Transformation of Rock, 171-202, Springer, Heidelberg, ISBN 978-3-642-28393-2.

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