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IsoplotR: a free and open toolbox for geochronology

Pieter Vermeesch

University College London, University College London, Department of Earth Sciences, Gower Street, London, United Kingdom (p.vermeesch@ucl.ac.uk)

Geochronologists have long relied on a powerful Excel add-in called `Isoplot` for data processing and presentation. Unfortunately `Isoplot` is no longer maintained and does not work properly in recent versions of Excel. This is causing real problems for geochronologists, to the point where some laboratories keep an old Windows XP computer with Excel 2003 around just for the purpose of running `Isoplot`. `IsoplotR` is a free, flexible and future-proof substitute for `Isoplot`. `IsoplotR` is free because it is written in non-proprietary languages (`R`, `Javascript` and `html`) and is released under the GPL license. The program is flexible because its graphical user interface (GUI) is separated from the command line functionality, and because its code is completely open for inspection and modification. The software is future-proof because it is built on free and platform-independent foundations that adhere to international standards, have existed for several decades, and continue to grow in popularity. `IsoplotR` implement functions for U-Pb, Pb-Pb, $^{40}Ar/^{39}Ar$, Rb-Sr, Sm-Nd, Lu-Hf, Re-Os, U-Th-He, fission track and U-series disequilibrium dating. It implements isochron regression in two and three dimensions, visualises multi-aliquot datasets as cumulative age distributions, kernel density estimates and radial plots, and calculates weighted mean ages using a modified Chauvenet outlier detection criterion that accounts for the analytical uncertainties in heteroscedastic datasets. Overdispersion of geochronological data with respect to these analytical uncertainties can be attributed to either a proportional underestimation of the analytical uncertainties, or to an additive geological scatter term. `IsoplotR` keeps track of error correlations of the isotopic ratio measurements within aliquots of the same samples. It uses a statistical framework that will allow it to handle error correlations between aliquots in the future. Other ongoing developments include the implementation of alternative user interfaces and the integration of `IsoplotR` with other data reduction software. The new computing platform can be accessed from `http://isoplotr.london-geochron.com`