

Chronus – An effort to make U-Pb LA-ICPMS data reduction fast and reproducible

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LA-ICPMS became a fast and cheap method of geochronological analysis in recent years, with special use for sedimentary provenance studies, which require a large number of spot ages per sample to investigate sediment sources. As important as the analytical method applied to acquire the data, the protocols used to reduce them can change dramatically the results. Physical constants (e.g. $^{235}\text{U}/^{238}\text{U}$ ratio, decay constants), the methods used to correct mass fractionation induced by the laser ablation and by the mass spectrometer, and the uncertainty propagation are some of the points that can cause differences between laboratories, making comparisons of results unreliable. These calculations are usually carried out in in-house spreadsheets (designed by small teams for specific laboratory routines) and in computer programs. One of the most important weaknesses of the in-house spreadsheets is that they are not usually well documented and described in peer-reviewed papers, making it almost impossible to check the exact processing steps. The programs available for U-Pb data reduction are not free, or they do not have any graphical user interface (GUIs), disadvantages that might compromise their use by other users than their own creators.

Chronus is a new computer program designed especially to reduce U-Pb data acquired by LA-ICPMS. This is motivated by the need of standardization of the data reduction methods, avoiding bias induced by different laboratories procedures, so that the comparison of the ages generated is possible. It has been developed based on the experience of researchers of the Geochronology Laboratory of the University of Brasília (UnB). The program development was carried out using Visual Basic for Application (VBA) programming language in an Excel environment. Chronus is freeware and its code will be available in an online repository, so every user will be able to download it and suggest new improvements. It may be updated on demand to serve other research groups from the scientific community who use different methods and equipment. The operation of the software is done using GUIs, making the data processing easy. It subtracts blank from the analysis, corrects mass bias induced by the laser and by the ICPMS, creating sheets for each step. Based on the filenames, the program also identifies the primary and secondary standards. The final report contains the most relevant information about the samples and the secondary standard analyses. The standard-bracketing method is applied to the analyses, requiring the time when the data was acquired. Using this information, the software sets automatically the most appropriate blank and primary standard analyses for each sample (although, the user can change this setting).