What can be learnt from the G-Chron U-Th-Pb Proficiency Testing Program

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Independent proficiency tests are an important tool for laboratories to show evidence of their performance and to ensure that their measurement results can be trusted. Since 2019 the International Association of Geoanalysts has operated the G-Chron proficiency testing scheme (http://www.gchron.info/) devoted to U-Th-Pb zircon geochronology. To date, two rounds of this PT scheme have been completed: Round#1 based on the Permian Rak-17 zircon from Norway and Round#2 based on the late Archaean Kara-18 zircon from Western Australia. The $^{206}Pb/^{238}U$ and $^{207}Pb/^{206}Pb$ target ages for these materials were established by ID-TIMS conducted in multiple, independent laboratories. The laboratories participating in the actual proficiency test were required to submit both their determined $^{206}Pb/^{238}U$ and their $^{207}Pb/^{206}Pb$ ages. The following table provides some key parameters from these first two rounds of G-Chron:

Sample Name	$^{206}Pb/^{238}U$ target age (Ma)	number of labs reporting data
Rak-17	295.6	63
Kara-18	2628.4	50

Several significant insights can be gained based on the data reported by the participating laboratories. (1) The $^{206}Pb/^{238}U$ system produced non-Gaussian data sets with no clear consensus ages, whereas the reported $^{207}Pb/^{206}Pb$ data sets yielded much better-defined age plateaus within their distribution plots. (2) LA-ICP-MS facilities dominated the data sets, where in general those labs using ICP-QMS systems reported smaller $^{206}Pb/^{238}U$ uncertainty estimates than did the sector-field instruments. In the case of $^{207}Pb/^{206}Pb$ geochronometer the two types of instruments reported similar uncertainty estimates for the of the Archean Kara-18 zircon. (3) Both G-Chron data sets show only modest correlations between the reported measurement uncertainties and the bias of the reported age results relative to the defined target ages. (4) For both G-Chron rounds over a quarter of the laboratories produced data deemed to be unfit-for-purpose. According to the design of the G-Chron programme, a result is fit-for-purpose when the age bias relative to the target age is less than ± 2 times the median of the reported measurement uncertainties for the given instrument class. Sample distribution for the next round of the G-Chron scheme is planned for late 2023.