Optimization of the U-Pb age dating method by LA-Q-ICP-MS

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LA-ICP-MS is considered the most efficient equipment to obtain instantaneously U-Pb data, with higher rates of material transference and a large number of analyses per day. Our study uses a modified LA-Q-ICP-MS method (with a low volume tear-drop shaped sample cell, a gas homogenizer and new analytical conditions) that improved sensitivity and signal stability with higher counts per second (on masses 204, 206, 207, 208, 232 and 238), in addition reduced the laser ablation time. Oxide formations, within run drift and down-hole fractionation (drastically minimized with the use of a gas homogenizer) were corrected with zircon standard GJ-1. System precision and accuracy were demonstrated with analytical tests on GJ-1, Plesovice, M257, M127 and 91500 zircon standards, resulting on satisfactory concordia ages of 607 ± 4 Ma to 610.1 ± 3.8 Ma (uncertainty (2 σ) of 2 - 4%), 337 ± 1.6 Ma to 340 ± 1.3 Ma (2 σ of 1.5 - 2.5%), 558 ± 2.4 Ma to 566 ± 4.2 Ma (2 σ of 2.4 - 4.7%), 520 ± 3.5 Ma to 528 ± 3.4 Ma (2 σ of 1.4 - 4.3%) and 1062 ± 5.1 Ma to 1070 ± 6.7 Ma (2 σ of 4.4 - 8.2%), respectively. By testing different equipment configurations (e.g. 30 µm and 40 µm diameter spots, gas conditions and laser frequency) we could observe, for example, higher counts of the ^{206}Pb and ^{207}Pb masses for 40 µm analysis (46000 cps; 2800 cps) than for 30 µm analysis (30000 cps; 1600 cps). The errors for the $^{207}Pb/^{206}Pb$, $^{206}Pb/^{238}U$ were lower for 40 µm spot analysis. With these results it was possible to optimize the equipment in order to obtain more precise and accurate concordia ages, with larger counts and lower errors, acquiring then a more reliable data.

Keywords: U-Pb; LA-Q-ICP-MS; Dating; Accuracy.