A new apporach to laser ablation ICP-MS using the flexible map interrogation tool 'Monocle'

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We present a flexible new interrogation tool for 2-dimensional chemical and isotope maps obtained by LA-ICP-MS. The tool, called Monocle, works with Iolite, a popular LA-ICP-MS data processing software package (www.iolite-software.com; [1]), to enhance and simplify one's ability to define and extract data from regions of interest (ROI) on a map. Initially, a customizable loupe is panned over the map while 'inspectors' (*e.g.*, histogram, kernel density estimate, rare earth element, or U-Pb concordia diagrams) update continuously to provide a sense of the variation within the map that is not always apparent when looking at elements or isotopes individually. From this initial assessment, ROI can be defined using four different strategies: 1) from the loupe itself; 2) by drawing polygons, ellipses, rectangles, etc.; 3) by 'growing a seed'; or 4) from a list of criteria. Drawing a ROI can be useful to pool data for irregular zones of apparently similar chemistry thereby improving the accuracy and precision. Growing a ROI from a seed works by adding adjacent 'pixels' to the ROI if they satisfy some statistical boundary set by the user (*e.g.*, 1 SD of the original seed). Lastly, for cases in which too few adjacent pixels exist to grow a ROI from a seed, multiple criteria can be set (*e.g.*, element A > 1 ppm and $^{206}Pb/^{238}U$ age < 1500 Ma) to determine which pixels to include in the ROI.

The tool and its various features are illustrated with four examples, including a Mn crust from behind the Mariana Arc, a garnet from a serpentinised lherzolite, zoned augite from Mt. Etna, and a zircon with complex core-rim structures. These examples show that the extraction of data from 2-dimensional maps that are < 1 um deep avoids many of the limitations/complications of conventional LA-ICP-MS analyses that rely on typically larger and deeper pits. In combination with fast aerosol transfer systems that permit high repetition rate mapping (up to ~ 80 Hz), the extraction of quantitative data with Monocle heralds a new era of *in situ* chemical and isotopic analysis.

[1] Paton *et al.* (2011) *JAAS*, **26**, 2508-2518.