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Determination of major elements and lithium in micas by LA-ICP-MS

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The determination of quantitative Li contents in micas has long been complicated by interferences and lack of matrix-matched reference materials. With the increase in accessibility of *in situ* Rb-Sr geochronology of micas, the need for mica characterization, especially for Li-micas, comes to the forefront of analytical necessity. Here we present a method for *in situ* quantitative measurement of major elements in micas by LA-ICP-MS, including Li-micas. Major element contents were determined using the 3D Trace Elements data reduction scheme in iolite4. Calibration curves were constructed using multiple glass reference materials, with an attempt to cover a wide spread of major element compositions for the elements most relevant to micas (K, Fe, Mg, Si, Al): BCR-2G, GSD-1G, KPho-2G, NIST SRM612, and a newly created synthetic phlogopite glass Phl-120-G. In order to determine Li contents, we used a characterized piece of the Li-mica polylithionite from Tajikistan for which the Li was determined by wet chemical analyses [1] as a calibration material for the Li calibration curve in addition to the reference glasses. We validated this method by comparing our results to independent EPMA analyses of reference materials LaPosta biotite, Harvard 98973 muscovite, Hogsbo muscovite, and lepidolite (sample 4576) from the Sinceni pegmatite field, Swaziland, for which Li_2O was determined by calculation from EPMA data of the other major elements [2]. Li determination for lepidolite 4576 is within 1 % of the calculated value from [2]. Determination of the other major elements in the white micas, including lepidolite, have more variation compared to microprobe values, which may be due to a lack of matrix matching. Major elements by LA-ICP-MS in biotite are generally within ~2 % of microprobe values. Extension of this method to combine it with *in situ* Rb-Sr geochronology is promising; Li determined in reaction gas mode for lepidolite 4576 falls within the range of values calculated from microprobe data and concurrently yields a Rb-Sr date consistent with the TIMS dates for the Sinceni pegmatite field.

[1] Grew, Belakovskiy, et al. (1993), *Eur J Mineral 5*, 971–84.

[2] Grew, Bosi, et al. (2018), *Eur J Mineral 30*, 205–218.