

## **In-situ Rb-Sr dating of mica without employing the MicaMG standard**

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In-situ Rb-Sr dating of mica by laser ablation ICP-MS/MS has recently emerged as a new tool to date a range of geological processes including magmatic intrusions, metamorphic and thermal events, crustal deformation and hydrothermal mineralisation. The majority of age results presented to date are based on Rb/Sr calibration using the widely available MicaMG pressed-powder pellet. However, several studies have reported low accuracy associated with mica Rb-Sr ages using this method or large variations in calculated Rb/Sr for the same mica attributed to the different ablation properties of MicaMG and natural mica. In this work we report the results of a detailed geochronological study of phlogopite from the Tonguma and Koidu micaceous kimberlites (Sierra Leone). The Rb-Sr ages of micas from three samples (two for Koidu and one for Tonguma) were robustly constrained by isotope dilution MC-ICPMS (~145 Ma and ~138 Ma, respectively). These ages and those previously obtained by isotope dilution for micas in South-African Cretaceous kimberlites (Bultfontein: ~88 Ma; Wimbledon: ~114 Ma) were then compared with those obtained by laser ablation ICP-MS/MS using two different procedures. The first one is identical to the widely applied strategy of calibrating  $^{87}\text{Sr}/^{86}\text{Sr}$  using the synthetic glass NIST610 SRM and  $^{87}\text{Rb}/^{86}\text{Sr}$  using MicaMG. This procedure generates inaccurate age results which deviate between 3% and 8% from those obtained by isotope dilution. We have therefore devised a new procedure where NIST610 is initially employed to estimate both  $^{87}\text{Sr}/^{86}\text{Sr}$  and  $^{87}\text{Rb}/^{86}\text{Sr}$ , thus producing highly reproducible single-spot data, and an in-house mica standard (from Wimbledon) is then utilised to re-calibrate  $^{87}\text{Rb}/^{86}\text{Sr}$  in the unknowns. This procedure generates age data which matches 'isotope-dilution' ages for the same micas. For Tonguma and Koidu, pooling of laser ablation analyses of micas in multiple samples returns ages of  $137.1 \pm 2.0$  Ma ( $n = 133$ ; 5 samples) and  $145.1 \pm 2.4$  Ma ( $n = 92$ ; 4 samples), which are indistinguishable from the solution-based age data. We conclude that employment of MicaMG as primary calibration standard for mica Rb/Sr is not recommended and developments of suitable mica reference materials showing large spread in Rb/Sr such as our Wimbledon mica is required.