

## A new method of unspiked K-Ar dating

FEI WANG<sup>1</sup>, WENBEI SHI<sup>1</sup>, HERVÉ GUILLOU<sup>2</sup>, WEIBIN ZHANG<sup>3</sup>, LIEKUN YANG<sup>1</sup>, LIN WU<sup>1</sup>, YINZHI WANG<sup>1</sup>

<sup>1</sup> State Key Laboratory of Lithospheric Evolution, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, China

<sup>2</sup> Laboratoire des Sciences du Climat et de l'Environnement/IPSL, CEA-CNRS-UVSQ, Université Paris-Saclay, Avenue de la Terrasse, Bat.12, 91198 Gif sur Yvette Cedex, France

<sup>3</sup> Institute of Geology and Seismology, Seismological Bureau of China, Beijing 100029, China

Issues induced by neutron irradiation makes  $^{40}\text{Ar}/^{39}\text{Ar}$  dating inapplicable in some cases, and inherent shortcomings of traditional and unspiked K-Ar dating make it difficult to assess the validity of age results and hard to perform on apparatus in a modern Ar geochronological laboratory. By using laser fusion on single-grains ( $n \times 0.01$  to  $n \times 0.1$  mg), a new approach of unspiked K-Ar dating is proposed which can be readily performed using the facilities in a modern Ar geochronological laboratory. Well-calibrated and widely-used  $^{40}\text{Ar}/^{39}\text{Ar}$  standard minerals (e.g., GA1550 biotite in this study) are employed to directly quantify the contents of  $^{40}\text{Ar}$ ,  $^{38}\text{Ar}$  and  $^{36}\text{Ar}$ , from which a K-Ar age is calculated. Repeated dating using laser fusion suppresses inaccuracies arising from the possible inhomogeneity of K and increases the precision of K-Ar ages. Isochrons are readily obtained using this technique to cover the shortcomings of K-Ar dating. A new isochron - an "inverse isochron" - is designed for K-Ar dating, which has the same merits as that of  $^{40}\text{Ar}/^{39}\text{Ar}$  method over normal isochron. Analyzing international standard minerals of FCs, B4M and MMhb-1 as unknowns shows that this approach is able to yield accurate and precise age results and to assess the trapped Ar compositions. Due to its use of inverse isochron, this approach can partly replace  $^{40}\text{Ar}/^{39}\text{Ar}$  technique for dating alteration-free rocks or minerals with a closed Ar system throughout a broad geological time interval. The approach may improve unspiked K-Ar method and will provide an alternate method for low-cost, quick and accurate dating.