## Evidence from HP/UHP metasediments for recycling of isotopically heterogeneous potassium into the mantle

ZE-ZHOU WANG<sup>1,2</sup>, FANG-ZHEN TENG<sup>1,\*,†</sup>, VINCENT BUSIGNY<sup>3,4</sup>, AND SHENG-AO LIU<sup>2</sup>

<sup>1</sup>Isotope Laboratory, Department of Earth and Space Sciences, University of Washington, Seattle, Washington 98195, U.S.A.
<sup>2</sup>State Key Laboratory of Geological Processes and Mineral Resources, China University of Geosciences, Beijing 100083, China
<sup>3</sup>Institut de Physique du Globe de Paris, CNRS, Université de Paris, F-75005, Paris, France
<sup>4</sup>Institut Universitaire de France, Paris, 75005, France

## ABSTRACT

Potassium isotopes may provide a novel approach for fingerprinting recycled sediments in the mantle due to the significant differences in K abundance and isotopic ratio between subducting sediment and the mantle. However, the behavior of K isotopes in sediments during subduction zone metamorphism is still unknown. Here we investigate K isotopic composition of a set of well-characterized high- to ultrahigh-pressure metasediments from the Schistes Lustrés nappe (western Alps), which represents marine sediments subducted down to ~90 km depth in a cold subduction zone, and their protoliths from the Lavagna nappe (Apennines, Italy). The metasediments display  $\delta^{41}K_{SRM 3141a}$  values from -0.76%to -0.48%, which are on average lower than the mantle value (-0.43%) but similar to those of nonmetamorphic equivalents (-0.79‰ to -0.49‰). No systemic variation of  $\delta^{41}$ K with metamorphic grade is observed, suggesting negligible K isotope fractionation in these sediments during prograde metamorphism. This is in accord with the limited loss of K during the entire metamorphic history as evidenced by the constancy of K/Rb and K/Cs ratios between metamorphic and non-metamorphic sediments and the absence of correlations of  $\delta^{41}$ K with K/Rb and K/Cs. The heterogeneous  $\delta^{41}$ K values of metasediments are most likely inherited from their protoliths, which experienced different degrees of chemical weathering depending on their provenances. Our results demonstrate that the variable and light K isotopic signatures in subducting sediments could be preserved to depths of at least 90 km along a cold geotherm gradient, indicating that the introduction of sediments into the mantle could produce K isotope heterogeneity in the source regions of mantle-derived lavas.

**Keywords:** Potassium isotopes, metasediment, metamorphism, subduction zone; Isotopes, Minerals, and Petrology: Honoring John Valley