Geophysical Research Abstracts
Vol. 21, EGU2019-5234, 2019
EGU General Assembly 2019

Improving the precision of single grain mica $^{40}Ar/^{39}Ar$-dating on smaller and younger muscovite grains: application to provenance studies.

Lorenzo Gemignani (1,2), Klaudia Kuiper (2), and Jan Wijbrans (2)

(1) Freie Universität Berlin, Department of Earth Sciences, Berlin (DE)., (2) Vrije Universiteit Amsterdam, Department of Earth Sciences, Amsterdam (NL).

Current generation multi-collector mass spectrometers allow for increasingly precise measurement of small ion beams. The improvement of instrument sensitivity and resolution compared with older generation mass spectrometers has important implications for $^{40}Ar/^{39}Ar$ dating and allows to expand its range of applicability.
Thermochronological analysis of detrital modern river sands is used for unraveling provenance and exhumation histories of eroding hinterlands. Better instrument sensitivity allows refining the precision of dates for young (< 2 Ma) and small grains ($\sim$250 μm), which in turn allows an interpretation of the detrital signals from a wider range of micas, in particular, in tectonically active mountain ranges. Previous studies used the $^{40}Ar/^{39}Ar$ method to assess how the detrital mineral age signals can evolve downstream in the river trunk. So far, however, there has not been a robust assessment of how grain-size variability can introduce biases in the analysis of age distributions. For example, the white mica signal from the Namche Barwa syntaxis in the eastern Himalaya is diluted downstream from its source due to the admixture of micas from downstream sources to the total population. Can this dilution effect in part be explained by grain size reduction? Can the analysis of both the medium grain size fraction and smaller grain sizes better constrain the evolution of the downstream age signal?
Here we use the latest developments in multi-collector noble gas mass spectrometry to (1) test if the precision in the analysis of young and small muscovite samples can be improved by use of new faraday collector amplifier technology and (2) to apply this approach to test the variability of the age distribution as a function of the grain size from five modern rivers samples draining the Eastern Himalaya.
We show that for larger catchment areas multi grain-size analyses lead to a more complete assessment of the full spectrum of ages obtained from different sources. The analyses of smaller grain sizes ($\sim$ < 250 μm) show that previous arguments about the process of dilution of the Namche Barwa syntaxis age signal for muscovite could have been biased due to the measurement of exclusively the larger grain-sizes of the analyzed samples. This outcome potentially has important implications for future provenance studies.