Cosmogenic noble gas systematics in lithologies important for Antarctic exposure-dating research

GREG BALCO[1]

[1]Berkeley Geochronology Center, 2455 Ridge Road, Berkeley CA 94709 USA (balcs@bgc.org)

Here I review and summarize a variety of investigations of helium and neon systematics in quartz and pyroxene from two common lithologies in Antarctica: Beacon Group sandstones and Ferrar dolerite, respectively. This is important because these lithologies are ubiquitous in outcrop, and as a constituent of glacial deposits with ages up to 14 Ma, throughout the ~3000-km length of the Transantarctic Mountains. Thus, the majority of cosmogenic-nuclide exposure-dating studies aimed at reconstructing changes in the Antarctic ice sheets over million-year time scales involve cosmogenic ^{21}Ne and ^{3}He measurements on samples from these lithologies.

First, I summarize relatively large data sets of cosmogenic noble gas measurements that now exist for these lithologies, as well as associated standardization measurements using BGC analytical facilities, to better characterize measurement precision, replicability, and interlaboratory comparison for ^{3}He-in-pyroxene and ^{21}Ne-in-quartz measurements. Second, I describe analytical strategies, as well as information about diffusion kinetics in quartz and pyroxene from these lithologies, that are useful in optimizing measurement throughput, accuracy, and reproducibility. Third, I describe measurements of U/Th concentrations in target minerals, as well as measurements of He and Ne concentrations and isotope ratios in shielded samples, that together improve characterization of magmatic, nucleogenic, and otherwise noncosmogenic ^{21}Ne and ^{3}He inventories and in turn improve the signal-to-noise ratio for exposure-dating studies using these lithologies. Fourth, I summarize these and other data useful for improving production rate estimates for cosmogenic ^{21}Ne and ^{3}He.