GRAND JUNCTION GEOLOGICAL SOCIETY

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JANUARY MEETING

WEDNESDAY 18, 2017

Joint meeting with the CMU Geology Students
7:30 PM
Saccomanno Lecture Hall
(In the Wubben Science Building)

Cassandra R. Fenton, Instructor, CMU Geosciences
Will Speak On
"The SPICE Project: Preliminary Cosmogenic Nuclide Production Rates In Quartz Calibrated At The ~ 70 KA SP Lava Flow, AZ, USA"

Abstract on Reverse

Guests Are Always Welcome

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GJGS, P O Box 4045, Grand Junction, CO 81502

ABSTRACT

By

Fenton, Cassandra R., CMU and

Niederman, Samuel, Potsdam, Germany; Dunai, Tibor and Binnie, Steven, University of Cologne, Germany; Marrero, Shasta, University of Edinburgh, Scotland

The SP Flow is a quartz-, olivine- and pyroxene-bearing basalt with an $^{40}Ar/^{39}Ar$ age of 72±4 ka (2σ). The flow is preserved in the arid desert climate of northern Arizona, USA. Its unweathered appearance and the lack of soil development indicate it has undergone negligible erosion. Our earlier cosmogenic ^{3}He and ^{21}Ne production rates in pyroxene at the SP flow are consistent with the eruption age, and they agree with other rates reported in recent literature. The uncertainties (7%; 2σ) associated with these SP Flow production rates are low due to the high-precision $^{40}Ar/^{39}Ar$ age. The SPICE Project (**S**P Flow **P**roduction-Rate **I**nter-calibration Site for **C**osmogenic-Nuclide **E**valuations Project) grew out of our CRONUS-EU study at the SP flow.

During this project, we will measure cross-calibrated production rates of each of the most commonly used cosmogenic nuclides – ^{3}He, ^{10}Be, ^{14}C, ^{21}Ne, ^{26}Al, and ^{36}Cl. Never before have all these commonly used terrestrial cosmogenic nuclides been inter-calibrated in co-existing quartz, pyroxene, and olivine at one calibration site, much less integrated over the past 70 ka. Currently, all existing ^{10}Be primary production rates are calibrated on surfaces that have been exposed to cosmic rays for less than 20 ka. Between 20 and 50 ka, the geomagnetic field was weaker than it is today. Theoretically, production rates of cosmogenic nuclides increase during periods of weaker geomagnetic field strength. The SPICE calibration site allows us to determine whether production rates for the past 70 ka are measurably higher than rates integrated over the past 20 ka. SPICE data will also provide another local production-rate calibration site, especially for surfaces and landforms older than 20 ka. Here we present preliminary results of cosmogenic ^{10}Be and ^{21}Ne production rates in quartz from the SP lava flow.

Though impressive progress has been made over the past 20 years in determining cosmogenic nuclide production rates, there still exist significant systematic uncertainties that stem from production rates and scaling schemes. Research is still needed to minimize these uncertainties to <5%. Cosmogenic nuclide exposure ages can only be as accurate as the production rates themselves. The SPICE Project thus aims to help increase the accuracy of studies involving cosmogenic ^{3}He, ^{10}Be, ^{14}C, ^{21}Ne, ^{26}Al, and ^{36}Cl.