INTERROGATION OF TEMPORAL PLANETARY ANALOGS FOR BIOSIGNATURE DETECTION. P. G. Conrad[1], R. D. Arevalo[1], K. A. Farley[2], M. S. Rice[3], S. Gupta[4], W. B. Brinckerhoff[1], S. A. Getty[1], and P. R. Mahaffy[1], [1]NASA Goddard Space Flight Center, Greenbelt MD 20771, Pamela.G.Conrad@nasa.gov, [2]California Institute of Technology, Pasadena, CA 91125, [3]Western Washington University, Bellingham, WA 98225, [4]Imperial College, London UK.

Introduction: The radiation environment at the surface of Mars poses a significant challenge to survival for many chemical compounds over time, including potential chemical biosignatures.

Therefore, it is important to determine whether materials have been exposed to the environment recently or for a long time in order to evaluate the probability of alteration for putative biosignatures or other chemical indicators of habitable environments in the rock record.

Farley et al. have advocated that the best environments for which to search for organic materials in the rock record on Mars could be on rapidly retreating scarp faces where we can exploit the exposure due to Aeolian abrasion [1]. We have developed an instrument and an approach for the evaluation of both the exposure age [1] and the radiometric age, the latter based upon a double-spiked technique demonstrated by Farley et al. [2]: Isotope Dilution K-Ar Dating (IDKArD).

Approach and Instrumentation: The instrumentation for measuring the radiometric age of the materials includes a quadrupole mass spectrometer (2-250 AMU) a thermal ionization source, and a pyrolysis oven, that is capable of achieving 1200°C. The instrument surveys the geochemistry of a sample unknown by standard pyrolysis evolved gas analysis (EGA). A second sample split is then characterized with respect to its radiometric and exposure ages.

The IDKArD approach to dating makes use of a lithium borate flux and a terrestrial calibrant, artificially spiked in both ^{39}Ar and ^{41}K. The thermal ionization source allows for collection and release of ^{39}K from the sample unknown as well as ^{41}K from a spiked glass calibrant, as per the IDKArD method. The advantages of using this dating approach include no requirement for either measurement of sample mass or for high temperature to achieve complete Ar release from the sample.

Exposure Age: On Mars, exposure age is determined by concordant isotope measurements of cosmogenic ^{36}Ar, ^{21}Ne and ^{3}He. On Earth, however, these isotopes are mostly atmospheric and nucleogenic. So for Earth analog studies, we are measuring ^{10}Be.

Field Site: We are assessing the viability of a field site in Alberta Canada, Dinosaur Provincial Park (near 456920 N, 5622350 E), as a potential analog environment for studying the age and exposure time of rock strata. The park features a badlands area (Fig. 1) that is accessible, well exposed and has been well studied. It has also been radiometrically dated [3, 4].

The sedimentary deposits are bounded by bentonite beds and there are also coal seams, providing both organic and inorganic lithofacies, the latter of which are of known age.

Figure 1. Dinosaur Provincial Park badlands exposure

References: [1] Farley, K. A., et al. (2014) *Science* 343.6169: 1247166. [2] Farley, K. A., et al. (2013) *Geochimica et Cosmochimica Acta* 110:1-12. [3] Thomas, R. G., et al. (1990) *Cretaceous Research* 11.2: 125-162. [4] Eberth, D. A., and A. L. Deino. (1992) *SEPN 1992 Theme N1 Meeting, Mesozoic of the-Western Interior* 24-25.

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