ASSESSING LUNAR REGOLITH NOBLE GAS BUDGETS

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The lunar regolith has been witness to over 4 billion years of Solar System history. Samples from the regolith contains a wealth of knowledge regarding volatiles that have been endogenically and exogenically added to the lunar surface [1-2]. These volatiles include noble gases which have been added to the regolith by the trapping of solar wind particles, production of cosmogenic nuclides (from solar and galactic cosmic rays) and the *in situ* decay of radioactive elements. A key aspect in understanding these volatiles is to determine the source/s (i.e., end-members) and when in time these volatiles were delivered or produced.

Method: To understand the Moon's noble gas inventory we have developed a database of existing literature data for regolith samples (soils, breccias, sub-surface drill cores and lunar meteorites). The database so far includes data for >240 different samples from ~40 refereed published papers. Data recorded includes: sample name and type, analysed masses, noble gas isotope concentrations (He, Ne, Ar, Kr, Xe), analytical uncertainties, and temperature of the gas release. We have also recorded the sample trapped components, exposure age and antiquity indicator $(^{40}Ar/^{36}Ar)_{tr}$ [3-4]. We also welcome additional data contributions from authors.

Results: Within the dataset there are huge variations (e.g., ^{36}Ar, <0.05-1300 × $10^{-6}cm^3$.STP/g) in noble gas concentrations. The majority of the Apollo regolith samples are dominated by a "solar" component. In comparison, lunar meteorites show more of a range in trapped and cosmogenic components, likely from the varying depths they are excavated from.

Applications: This database will provide a framework of the noble gas budget in sampled regions of the lunar regolith for use in planning for future missions to the Moon. For example, a key outcome is to provide an insight into the minimum temperature requirements for analysis of noble gases on Luna-27, a south polar lander mission to the Moon, which aims to investigate potential resources and volatiles budgets at the lunar surface using the PROSPECT experiment package [5].

References: [1] McKay D. et al. (1991) Lunar Sourcebook, 285-355 [2] Wieler R. (1998) Space Sci. Rev., 85, 303-314. [3] Joy K. H. et al. (2011) GCA, 75, 7208-7225. [4] Eugster O. et al. (2001) MAPS, 36, 1097-1115. [5] Carpenter J. et al. (2015) LEAG, #2027.