MARTIAN NOBLE GASES IN RECENTLY FOUND SHERGOTTITES, NAKHLITES AND BRECCIA NORTHWEST AFRICA 8114.

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Introduction: More than 80 individual Martian meteorites have been found so far. An important part of a complete Martian meteorite characterization is the study of its cosmogenic, radiogenic and trapped noble gas components [e.g., 1-2]. Studying the noble gases helps to classify the meteorites, detect possible source crater paring, examine the closure ages for He or Ar loss, and to detect Martian atmospheric and interior components. Here we discuss the results for several recent Martian meteorite finds.

Samples and experimental: We analyzed the noble gases in Larkman Nunatak (LAR) 06319 and 12011 (paired), 12095 and 12240 (paired), Northwest Africa (NWA) 7397 (two aliquots), 7944, 8114 and 10153 (two aliquots). The LAR meteorites are enriched and depleted permafic olivine-phyric shergottites, respectively. NWA 7397 is an enriched permafic poikilitic and NWA 7944 an enriched mafic diabasic shergottite. NWA 8114 is a breccia and paired with NWA 7034, 7533, 7475 and others. NWA 10153 is a recently described nakhlite [3]. All isotopes of He to Xe have been analyzed by extraction in a crucible in a single step at ~1700 °C, cleaned and analyzed according to standard procedures in our custom-built mass spectrometer.

Results: All noble gases are in the typical range observed for shergottites and nakhlites, respectively, including the scarcity of trapped Ne, the low $(^{21}Ne/^{22}Ne)_{cos}$ observed in many shergottites due to additional contributions from solar cosmic rays [2], the high $^{40}Ar/^{36}Ar$ ratios due to ^{40}K decay, and the characteristically elevated $^{129}Xe/^{132}Xe$ and $^{84}Kr/^{132}Xe$ ratios [e.g., 1,4]. NWA 10153 plots in the typical range defined by Nakhla, distinct from the shergottites [e.g., 1,2]. Production rates and, hence, cosmic-ray exposure (CRE) ages presented here are based on a chemistry-depending physical model [5]. We determined a mean (^{21}Ne, ^{38}Ar) CRE age of 8.2 Ma for NWA 8114. In contrast, [1] favored ~5 Ma for the paired NWA 7034. The discrepancy is most likely due to the distinct choice of production rate calculations: [1] used empirical formulae for HED achondrites [6]. If we use the data from [1] and apply the model by [5], we obtain a CRE age of 10.0 Ma, in better agreement with our new age for NWA 8114.

NWA 10153 has a CRE age of 11.9 Ma, in agreement with most other nakhlites, whereas the distinct [e.g., 7] NWA 5790 may have s a shorter CRE age of 7.3 Ma [2,8]. The exposure age of NWA 7034 of ~5 Ma favored by [5] has been linked to the formation of the Gratteri crater [e.g., 9]. However, an origin of the Martian breccias from this crater might be less likely if the age for NWA 8114, as determined here (~8.2 Ma), is adopted.

References: [1] Cartwright J. A. et al. 2014. *Earth Planet. Sci. Lett.* 400:77-87. [2] Wieler R. et al. 2015. *Meteorit. Planet. Sci.* 50:in prep. [3] Irving A.J. et al. 2015. *this meeting*. [4] Busemann H. and Eugster O. 2002. *LPSC* 33:1823. [5] Leya I. and Masarik J. 2009. *Meteorit. Planet. Sci.* 44:1061-1086. [6] Eugster O. and Michel T. 1995. *Geochim. Cosmochim. Acta* 59:177-199. [7] Mikouchi T. et al. 2012. *LPSC* 43:2363. [8] Huber L. et al. 2012. *LPSC* 43:1408. [9] Wittmann A. et al. 2015. *Meteorit. Planet. Sci.* 50:326-352.