8. SUPPLEMENTARY MATERIAL:

Table S1: Ar data incorporating three possible scenarios for neutron capture corrections. See text for full explanation. Concentrations given in cm^3 STP g^{-1}.

	^{36}Ar (10^{-8})	$^{36}Ar_t$ (10^{-8})	$^{38}Ar_c$ (10^{-8})	$^{38}Ar/^{36}Ar$	$^{40}Ar/^{36}Ar$	$^{40}Ar/^{36}Ar_t$	$(^{36}Ar/^{132}Xe)_t$
Case (i) Thermal n, Cl/Br = 100							
1000 °C	0.33 ± 0.13	0.03 ± 0.13	0.46 ± 0.24	1.43 ± 0.51	6795 ± 2433	83731 ± 409890	28 ± 138
1800 °C	0.18 ± 0.22	-0.28 ± -0.68	0.71 ± 1.21	3.51 ± 4.22	2709 ± 3258	-1775 ± -4354	-158 ± -388
Sum	0.51 ± 0.25	-0.25 ± 0.70	1.17 ± 1.23	2.18 ± 1.57	5329 ± 1996	-10762 ± -74127	-93 ± -258
Total	0.37 ± 0.29	-0.42 ± 0.72	1.21 ± 1.24	3.02 ± 2.82	7390 ± 9211	-6462 ± 27259	-151 ± -257
Case (ii) Rao cross section, Cl/Br = 50							
1000 °C	0.70 ± 0.10	0.47 ± 0.07	0.35 ± 0.05	0.66 ± 0.02	3154 ± 80	4695 ± 173	502 ± 79
1800 °C	1.13 ± 0.17	0.85 ± 0.12	0.44 ± 0.07	0.57 ± 0.01	437 ± 11	585 ± 19	480 ± 74
Sum	1.83 ± 0.19	1.32 ± 0.14	0.79 ± 0.08	0.60 ± 0.01	1478 ± 88	2058 ± 142	496 ± 56
Total	1.82 ± 0.20	1.30 ± 0.14	0.80 ± 0.09	0.61 ± 0.01	1490 ± 97	2086 ± 177	476 ± 54
Case (iii) Thermal n, Cl/Br = 50							
1000 °C	0.54 ± 0.10	0.28 ± 0.06	0.40 ± 0.09	0.86 ± 0.09	4109 ± 449	7948 ± 1445	297 ± 70
1800 °C	0.72 ± 0.15	0.36 ± 0.11	0.56 ± 0.15	0.89 ± 0.14	686 ± 105	1381 ± 364	203 ± 62
Sum	1.26 ± 0.18	0.64 ± 0.13	0.96 ± 0.17	0.88 ± 0.09	2153 ± 241	4257 ± 749	236 ± 47
Total	1.19 ± 0.19	0.56 ± 0.15	0.98 ± 0.17	0.93 ± 0.12	2279 ± 432	4892 ± 2743	199 ± 55

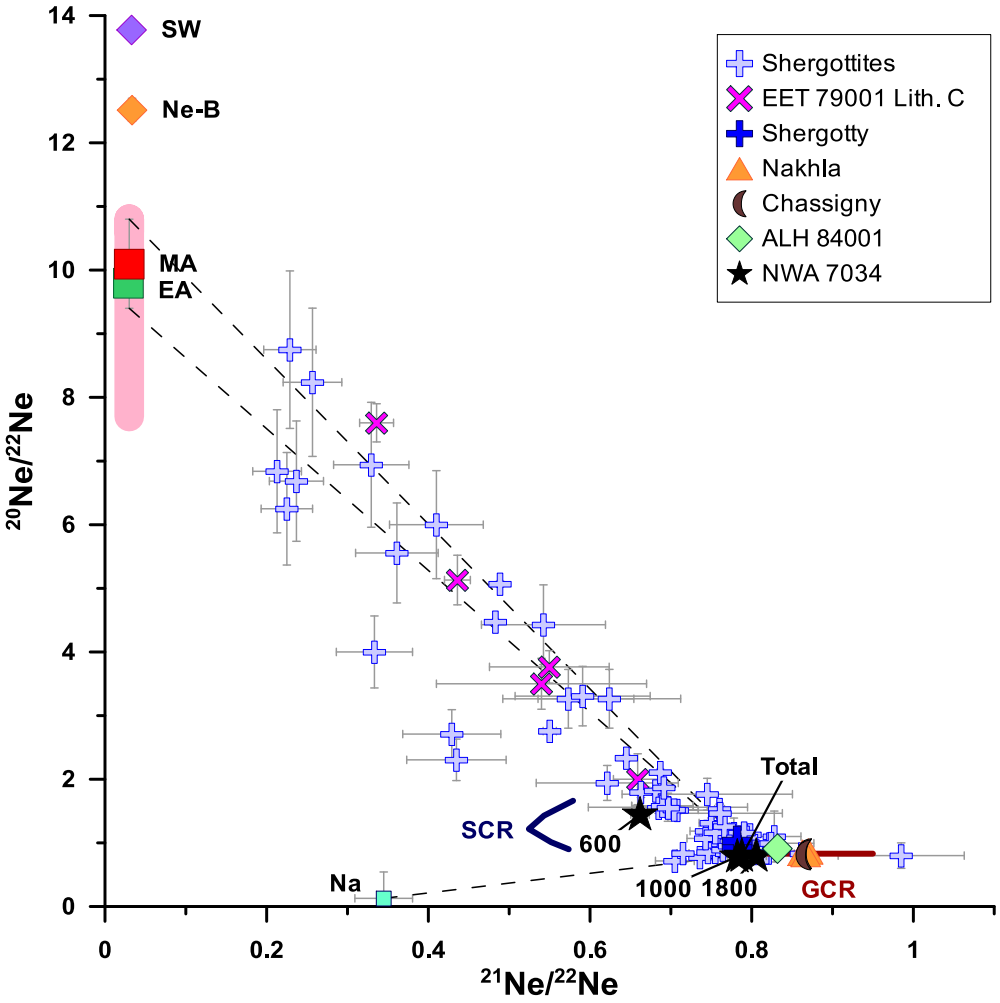

Figure S1: Three isotope plot of $^{21}Ne/^{22}Ne$ vs. $^{20}Ne/^{22}Ne$ showing the step-heated results for NWA 7034. Other components plotted include SW (Heber et al., 2009), MA (Swindle et al., 1986; Wiens et al., 1986), EA (Eberhardt et al., 1965), galactic cosmic rays (GCR) (Garrison et al., 1995), solar cosmic rays (SCR, 0.5-10 g/cm2, R0 = 70 MV; Reedy, 1992), contribution from Na (Smith and Huneke, 1975). Also shown for comparison are previous data for shergottites (Becker and Pepin, 1984; Becker and Pepin, 1986; Bogard et al., 1984; Eugster et al., 2002; Eugster et al., 1997; Garrison and Bogard, 1998; Garrison and Bogard, 2000; Llorca et al., 2013; Mathew et al., 2003; Mohapatra et al., 2009; Schwenzer et al., 2007; Swindle et al., 1986), EET 79001 Lithology C (Becker and Pepin, 1984; Swindle et al., 1986; Wiens, 1988; Wiens et al., 1986) and Shergotty, Nakhla and Chassigny totals (Ott, 1988). The thick pink line depicts the range of Ne ratios for MA reported in previous data (Ott and Löhr, 1992; Swindle et al., 1986; Wiens et al., 1986). The dashed lines represent mixing between GCR and upper/lower limits on MA, or GCR and Na. NWA 7034 plots within the range observed for previous analyses Martian meteorites, though does not show strong evidence for trapped Ne. Instead, NWA 7034 shows cosmogenic components, and possible production on Na or (less likely) by solar cosmic rays.

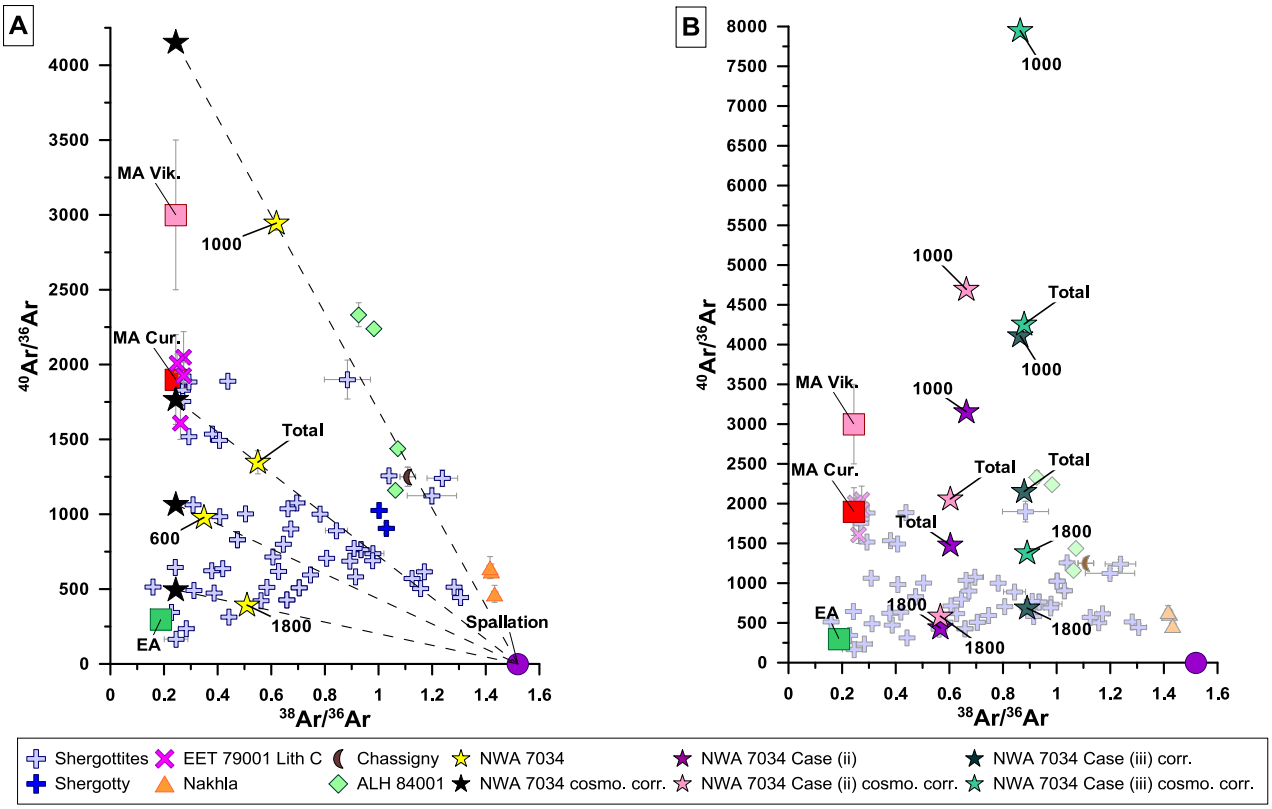

Figure S2: Three-isotope plot of ^{40}Ar/^{36}Ar vs. ^{38}Ar/^{36}Ar for step-releases of NWA 7034, with comparison to previous shergottite data, (Becker and Pepin, 1984; Becker and Pepin, 1986; Bogard et al., 1984; Eugster et al., 2002; Eugster et al., 1997; Garrison and Bogard, 1998; Llorca et al., 2013; Mathew et al., 2003; Mohapatra et al., 2009; Schwenzer et al., 2007; Swindle et al., 1986; Wiens et al., 1986), EET 79001 Lithology C (Becker and Pepin, 1984; Wiens, 1988; Wiens et al., 1986), Shergotty, Nakhla and Chassigny totals (Ott, 1988), and ALH 84001 (Eugster et al., 1997; Garrison and Bogard, 1998). Also plotted are components Martian atmosphere with ^{40}Ar/^{36}Ar measured by Curiosity (MA Cur.) (Atreya et al., 2013; Mahaffy et al., 2013) and Viking (MA Vik.) (Owen et al., 1977; Wiens et al., 1986), Earth's atmosphere (EA) (Lee et al., 2006) and spallation. In A) Dashed lines show spallation correction on NWA 7034 data without considering neutron capture on ^{36}Ar. In B) we have plotted two possible corrections on NWA 7034 relating to possible neutron capture contributions on ^{36}Ar and associated cosmogenic corrections: Case (ii) possible n-capture in the regolith using cross sections derived by Rao et al., (2002) (Cl/Br = 100); Case (iii) effect of thermal neutrons (Cl/Br = 50).

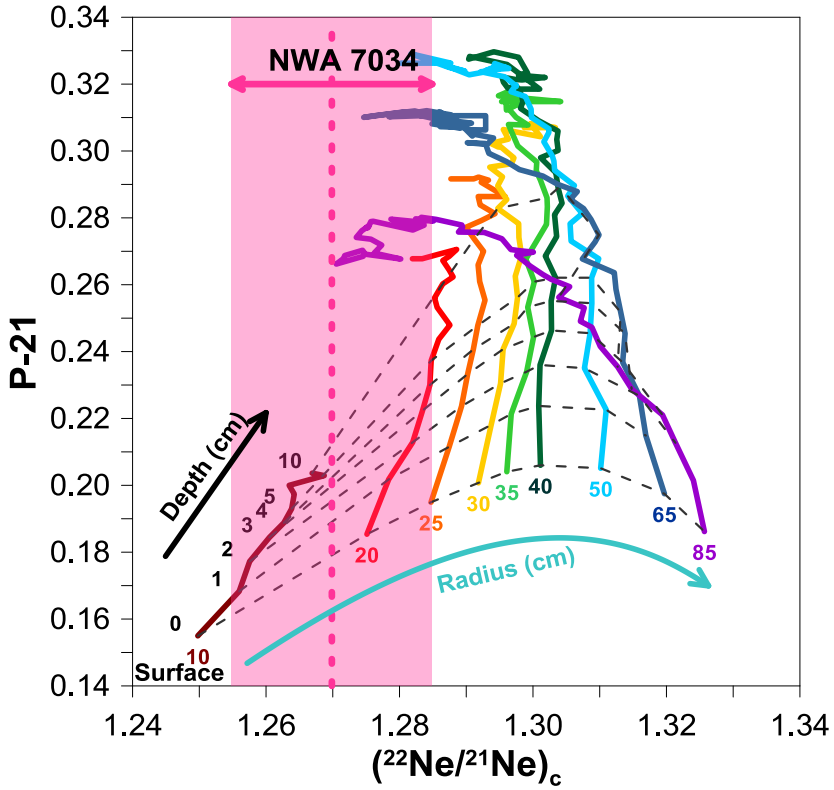

Figure S3: Plot of P-21 vs. $(^{22}Ne/^{21}Ne)_c$ the Monte-Carlo model (Leya and Masarik, 2009) and NWA 7034 element abundances (Agee et al., 2013). Coloured full lines = potential pre-atmospheric radii. Dashed black lines = depth within a sample of such radius. Pink band = total measured $(^{22}Ne/^{21}Ne)_c$ for NWA 7034.

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