COSMIC RAY EXPOSURE AGE OF RAGHUNATHPURA (IIAB) IRON METEORITE, S.V.S. Murty*, S. Ghosh and Dwijesh Ray, PLANEX, Physical Research Laboratory, Ahmedabad 380009, India (*Email: murty@prl.res.in)

Introduction: Raghunathpura iron meteorite fell as a single piece of mass 10.2 kg (16.8x15.5x8.5 cm), in Rajasthan, India in 1986, and has been classified as II AB [1,2]. It has troilite nodules with bulk contents of P (0.34 wt %) and S (0.48 wt %) [3]. Ni diffusion and micro hardness studies indicate a cooling rate of ~4^{o}C/Ma and a pre atmospheric shock of ~ 100 kb respectively [3]. Here we report the noble gas data and estimate the cosmic ray exposure age.

Sample and experimental procedure: A clean piece of ~140 mg with no inclusions on visible surfaces has been analysed for all the noble gases in an all metal extraction system in two temperature steps of 800^{o}C and 1700^{o}C on a multi collector noble gas mass spectrometer by standard procedures. More than 95% of He, Ne and Ar are released in the 1700^{o}C step.

Results and Discussion: He, Ne and Ar are mostly cosmogenic, while some trapped air can be seen for Kr and Xe over a cosmogenic component. We calculated cosmogenic amounts, by assuming air as the trapped component, wherever present. The cosmogenic amounts/ratios are given in Table 1. Cosmogenic ^{21}Ne is profusely produced from P and S, which are heterogeneously distributed in the sample, while no such composition specific production occurs for ^{3}He and ^{38}Ar in Raghunathpura. Using the $(^{22}Ne/^{21}Ne)_c$ of the sample, it is possible to estimate the contribution of S+P in the sample to the total $^{21}Ne_c$ and calculate the exposure age using the amount and production rates from Fe+Ni only [4,5].

*Table 1: Cosmogenic amounts (in 10^{-8} ccSTP/g units) and exposure ages. *Corrected for contributions from S,P. **Uncertainities in exposure ages are ±15%.*

	^{3}He	^{21}Ne*	^{38}Ar	^{38}Ar/^{83}Kr	^{38}Ar/^{131}Xe
Cosmogenic	118	1.75	14.2	9.1x10^{4}	31x10^{4}
$T_{exp.}$(Ma)**	165	200	276	-	-

The depth of the analysed sample in the pre-atmospheric size of the body is needed for using the correct production rate to obtain the cosmic ray exposure age. Isotopic ratio $(^{3}He/^{4}He)_c$ as well as the elemental ratios $(^{3}He/^{21}Ne)_c$ and $(^{38}Ar/^{21}Ne)_c$ are good size and depth indicators. However, due to possible partial loss of ^{3}He and ^{21}Ne by thermal/shock effects, resulting in the change of elemental ratios, we choose to use $(^{3}He/^{4}He)_c = 0.2409\pm0.0109$, as depth indicator. Sample at a depth of 12-14 cm, in a 25 cm radius iron meteorite matches this He isotopic ratio and using corresponding production rates [5] we obtain the exposure ages (in Ma) of 165, 200 and 276 based on $^{3}He_c$, $^{21}Ne_c$ (from Fe+Ni only) and $^{38}Ar_c$. We take 276±41 Ma as the exposure age, attributing lower ages due to ^{3}He and ^{21}Ne due to partial gas loss, possibly during the shock event of magnitude ~ 100 kb derived from micro hardness measurements [3]. The production ratios $(^{38}Ar/^{83}Kr)_c$ and $(^{38}Ar/^{131}Xe)_c$ are similar to the values reported for Costilla Peak (IIIA) [6].

References: [1] Bapna V.S. et al. (1991) Meteoritics **26**, 65-67; [2] Dube A. et al. (1995) Indian Minerals, **49**, 143-152; [3] Ghosh S. et al. (2014) In preparation; [4] Ammon K. et al. (2008) MAPS **43**, 685-699; [5] Ammon K. et al. (2009) MAPS **44**, 485-503; [6] Munk M.N. (1967) EPSL **2**, 301-309.