COSMOGENIC RECORDS IN THE RECENTLY FALLEN DEVGAON (H4) CHONDRITE. S.V.S. Murty*, V.K. Rai, A. D. Shukla, G. Srinivasan, P.N. Shukla, K.M. Suthar and N. Bhandari, Physical Research Laboratory, Navrangpura, Ahmedabad 380009, India. (*e-mail: murty@prl.ernet.in).

A stony meteorite fell in the village Devgaon, Bastar district, Chattisgarh, Central India on 2001 February 12. The meteorite was fully covered with fusion crust and weighed about 12 kg. Chemical composition, cosmogenic nuclear tracks, radionuclides and noble gases have been studied to determine its classification, the preatmospheric size and the irradiation history.

Chemical composition and petrography: Several major, minor and trace elements were measured using ICPAES, AAS and INAA techniques. Based on elemental concentrations of siderophile elements Fe (26.65%), Ni (1.75%), Co (821 ppm), Ir (824 ppb), Os (824 ppb) and Au (170 ppb), the meteorite is classified as H group chondrite[1]. Other elements such as Mg, Al and K also lie within the range observed for H chondrites[1]. The meteorite contains numerous chondrules varying in size between 0.2 to 1 mm. Many chondrules have metallic rim, some of which are degraded, indicating metamorphic grade 4. Irregular fractures have been noticed within the olivine grains inside the chondrules suggesting S2 stage of shock.

Noble gases: He and Ne are mainly cosmogenic with $(^{22}Ne/^{21}Ne)_c = 1.182$, indicative of small shielding. $(^{3}He/^{21}Ne)_c = 4.5$ and $(^{21}Ne/^{38}Ar)_c = 5.3$ indicating partial loss of He and Ne. Using the chemical composition of Devgaon and adopting the production rates [2, 3] we obtain the following cosmic ray exposure ages (Ma): T_3 (43.4), T_{21} (63.8) and T_{38} (69.4). Exposure ages based on spallogenic ^{83}Kr, and ^{126}Xe yield T_{83} = 103.5 Ma and T_{126} = 111 Ma. Excesses at ^{80}Kr, ^{82}Kr and ^{128}Xe accompanied by high $^{129}Xe/^{132}Xe$ values have been observed suggesting neutron produced contributions from Br and I respectively. Assuming normal chondritic ratio of $^{35}Cl/^{81}Br \sim 3000$ [4], we estimated the $^{36}Ar_{Cl}$ from $^{82}Kr_{Br}$ and recalculated the value of T_{38} to be 88.4 Ma in agreement with T_{83} and T_{126}, within experimental uncertainities. The average of T_{38}, T_{83} and T_{126} of 101 Ma may represent the integrated cosmic ray exposure age of Devgaon meteorite. Very few chondrites have such large exposure ages. The elemental ratios of trapped noble gases $^{84}Kr/^{132}Xe = 0.85$ and $^{36}Ar/^{132}Xe = 53.6$ are in the range observed for ordinary chondrites, and the absolute amount of $^{132}Xe = 1180 \times 10^{-12}$ ccSTP/g is consistent with its metamorphic class as H4[5].

Radionuclides and nuclear tracks: Twelve radionuclides including short-lived ^{52}Mn (5.3 d) were measured using their characteristic γ-rays on a large volume hyper-pure Ge-detector. ^{60}Co activity is low (≤0.5 dpm/kg) indicating low thermal neutron fluxes and hence it can be inferred that the meteoroid was a small object during the terminal phase of its cosmic ray exposure. Olivines from five spot samples below the crust were studied for nuclear tracks. The track density varies between (4.6 to 9) $\times 10^{6}$ cm^{-2}, showing a small gradient within the meteorite and ablation of about 4.8 to 6.8 cm, if we assume single stage exposure of 101 Ma. However, low ^{60}Co, high $(^{22}Ne/^{21}Ne)_c$ coupled with large neutron produced excesses at ^{80}Kr, ^{82}Kr and ^{128}Xe suggest a complex exposure history possibly involving a long duration shielded exposure followed by a shorter duration recent exposure as a small object. Therefore the estimated cosmic ray exposure age may represent an integrated exposure during various stages.

References: [1] Wasson J.T. and Kallemeyn G.W. (1988) *Phil. Trans. R. Soc. Lond. A 325, 535-544*. [2] Eugster O. (1988) *GCA 52*, 1649-1662. [3] Marti K and Graf Th. (1992) *Ann. Rev. Earth Planet. Sci. 20*, 221-243. [4] Mason B. (1979) *USGS Prof. Paper 440-B-1*. [5] Schultz L. et al., (1990) *Meteoritics 25, 405-406*.