SHOCK- THERMAL HISTORY OF KAVARPURA (IVA) IRON: EVIDENCES FROM MICROTEXTURES AND NICKEL PROFILING

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Introduction: Kavarpura iron meteorite fell in India in August, 2006. Limited information on Kavarpura iron presently exists except that it hosts solar wind noble gases [1]. Based on micro-texture, phase and bulk composition, present study suggests Kavarpura is a Group IVA, fine octahedrite (Of) iron. We furthermore attempted to infer the shock-thermal history through shock-pressure metallography and nickel profiling across cloudy taenites and plessites.

Results: Fine kamacite bands (mean width: 0.266 mm) of Widmanstätten texture in association with plessites classify Kavarpura as Fine Octahedrite (Of) [2]. Absence of silicate and sulphide inclusions, large abundance of cellular and finger plessites [2], bulk composition of Ni: 9.5 wt%, Co: 0.45 wt%, Ga: 2.06 ppm, Ge: 0.5 ppm, Ir: 1.06 ppm, Cr: 51.4 ppm and Cu: 224 ppm and estimated metallographic cooling rate, 320^{o}C/ Ma classify Kavarpura as member of very low P bearing, high Ni- IVA group [3]. Moderate to high degree of shock (130-600 kb) is inferred based on shock-induced micro-textures, Neumann lines and ε-kamacites; the latter closely resembling experimentally produced matte texture of 400-600 kb shock pressure [4]. Notable post-shock annealing textures include plastic flowage of taenite lamellae, bending of finger plessites and degeneration of cellular plessites. Effects of shock followed by annealing in Kavarpura have been further confirmed through Ni profiling across the cloudy taenite zone (CTZ), finger plessites (FP) and cellular plessites (CP) under high shock pressure domain [5]. Small scale fluctuation below 15 wt% Ni of typical M- shaped Ni profile across CTZ indicates fast disequilibrium cooling in the residual phase in response to sudden rapid heating. Typical U pattern between two high-Ni spikes (36.3 wt%) of normal finger plessite (2-4 μ width) is modified to asymmetric M pattern between Ni-spikes at 20 wt% and 27 wt% respectively under high shock strain and related annealing. In case of cellular plessites, post shock effects soften the high-Ni taenite (HNT) particles to spheroidal beads that show symmetrical, narrow to wide M- profiles with sharp Ni peak at 42 wt% and shallower trough at 30 wt%.

Discussion: We assign Kavarpura to inclusion-free, fine octahedrite, a member of high-Ni IVA group. Symmetric as well as truncated textural sequence between two outer taenite rims, CTZ-FP-CP-FP-CTZ of Kavarpura refers to martensitisation process over a long duration following the mechanism V [6]. Kavarpura also suffered high shock alteration, maximum up to 600 kb shock pressure similar to other IVA members. Variable shock pressure domains and shock heat alteration due to high strain in a single meteorite are documented in shock-pressure metallography. Textural evidence of shock annealing is well supported by closely spaced Ni-profiling performed on cloudy taenites and plessites under high shock pressure domain.

References: [1] Murty S.V.S et al. 2008. *MAPS* 43: A106. [2] Buchwald V.F. 1975. *Handbook of Iron Met.* 1426pp. [3] Wasson J.T and Richardson J.W. 2001. *GCA* 65(6):951-970. [4] Jaeger R.R. and Lipschutz M.E. 1967. *GCA* 31:1811-1832. [5] Goldstein J.I. et al. 2009. *MAPS* 44(3):343-358. [6] Yang J. and Goldstein J.I. 2005. *MAPS* 40:239-253.