

THE MARIBO CM FALL AND ITS POSSIBLE RELATIONSHIP TO COMET ENCKE AND THE TAURID METEOR COMPLEX.

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Introduction: The Maribo meteorite is the first carbonaceous chondrite with an instrumental record of its fall [1]. The orbit of Maribo is also the only meteorite orbit to fall within the Taurid complex, a massive swarm of objects including Comet Encke, several other large NEOs as well as fireball producing objects. If Maribo is genetically related to these objects it implies that CM chondrites are related to comets.

CMs and comets: Shortperiod comets remain active for approximately 10 ky. After the comet has depleted its source of volatiles the now extinct cometary nucleus remains in the inner Solar System as a member of the near Earth population. NEOs have dynamical lifetimes of ca. 100 My and are likely sources of meteorites. We should therefore expect to see samples of extinct nuclei in our collections of meteorites. Studies comparing the available information on chemistry and petrology of comets and chondrites have suggested that CI and CM chondrites could represent samples of extinct cometary nuclei [2,3].

Recent astronomical observations and space missions to comets have provided new data supporting a connection to chondrites. D/H ratios in water detected in the tails of Halley and Hyakutake are ca. $30 \cdot 10^{-5}$ [5]. This is within error of the D/H ratios measured in CM chondrites ($18\text{-}20 \cdot 10^{-5}$) [6]. Spitzer Space telescope observations of the Deep Impact ejecta from comet 9P/Tempel 1 gave the first data on the mineralogy in the interior of comets. The observations demonstrated the presence of crystalline silicates, carbonates and phyllosilicates [7] The crystalline silicates (olivine and pyroxene) require annealing temperatures up to 1400 K and thus demonstrate the presence of materials processed at high temperatures. The detection of carbonates and phyllosilicates implies that liquid water was present in the comet at some point in time.

The age of the Taurid complex: Peaks in the cosmic ray exposure ages of CM chondrites suggest their parent body suffered several large disruption events 0.2, 0.6, and 1.5 My ago [8]. This is difficult to reconcile with the proposed origin of the Taurid complex. It has been suggested that the source of the Taurid complex was a large comet disruption event 20-30 ky ago [9]. If the CM chondrites come from the Taurid complex its age must be at least a few million years.

Conclusion: The petrology of CM chondrites and the orbit determined for Maribo suggest that CM chondrites are related to the Taurid complex and comet Encke.

References: [1] Haack et al., (2009) Abstract # 5085. Meteoritical. Soc. Conf.. [2] Lodders K. and Osborne R. (1999) Space Sci. Rev. 90, 289-297. [3] Weisberg M.K. and Connolly H.C. (2008) LPS XLIX, Abstract # 1981. [5] Irvine et al. (1998) in Protostars and Planets IV, 1159-1200. [6] Zinner E. (1988) in Meteorites and the Early Solar System, 956-983. [7] Lisse C.M. et al. (2006) Science 313, 635-640. [8] Nishiizumi (2009) Abstract # 5358. Meteoritical Soc. Conf. [9] Asher, D.J. et al (1993) Mon. Not. R. Astron. Soc. 264, 93-105.