**ARE CM, CI CHONDRITES SAMPLES FROM JUPITER FAMILY COMETS?**

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**Introduction & Methods:** It has long been suggested that CM and CI (Mighei- and Ivuna-type, respectively) chondrites might derive – directly or indirectly – form comets (e.g., [1]). Here I review the status of this hypothesis in the light of recent advances in the field of meteoritics. Antarctic micrometeorites (AMMs) are dominated by CI- and CM-like material (75%), while ordinary chondritic (OC) material contributes <10% [2]. These fractions are remarkably similar to the ones contributed to the zodiacal cloud by cometary (<95%) vs. asteroidal (<10%) sources [3]. The same model suggests that a majority of the cometary dust falling to Earth as micrometeorites is produced by the disruption of Jupiter family comets (JFCs), rather than representing material from comet tails. The disruption of JFCs, some of which are on Earth-crossing, low-inclination orbits, is likely to produce m-sized fragments which can then collide with the Earth and potentially deliver meteorites to its surface. The pre-atmospheric orbits of such meteorites should thus resemble JFCs, and their cosmic-ray exposure (CRE) ages should be low (<10 Ma) due to the instability of such orbits. In the last 15 years, the database of meteorites with known orbits has been extended by four carbonaceous chondrites (CC), two CM and one CI. I discuss the implications of their orbit for the title question.

**Results & Discussion:** Out of the four CC with known orbits (Tagish Lake, C-ungr. [4]; Maribo, CM2 [5]; Sutter's Mill CM2 [6]; Orgueil, CI [7]; the Orgueil orbit was determined based on eye-witness accounts), three (all except Tagish Lake) are compatible with a JFC orbit. The orbits have a Tisserand-parameter (relative to Jupiter) between 2 and 3, like JFCs and unlike virtually all OC and asteroid orbits. Such a high agreement between meteoroid and JFC orbits would be highly fortituous if not at least a significant fraction of CM and CI chondrites delivered to Earth were originally on orbits similar to JFCs. The possible association of Maribo with comet Encke and the Taurids stream has already been pointed out by [8]. CM and CI chondrites have very short CRE ages of 1-10 Ma [9], compatible with the time a meteoroid is likely to survive on a planet-crossing orbit [10]. Comets should dominate the largest impactors on Earth [11], and indeed, both archean spherule layers [12] as well as the Chicxulub impactor [13] hint at impactors with CC-like Cr isotopic compositions. CM and CI chondrites therefore fit the requirements for being derived directly from JFC disruptions. Since JFCs come from the Kuiper belt, CM and CI chondrites might be our only samples (apart from the grains returned by *Stardust*) of the solar systems' largest reservoir of small bodies.

**References:** [1] Lodders K. & Osborne R. 1999. Space Science Reviews 90:289-297. [2] Taylor S. et al. 2012. *Meteoritics & Planetary Science* 47:550-564. [3] Nesvorný D. et al. 2010. *The Astrophysical Journal* 713:816-836. [4] Brown P. G. et al. 2000. *Nature* 290:320-325. [5] Haack H. et al. 2012. *Meteoritics & Planetary Science* 47:30-50. [6] Jenniskens P. et al. 2012. *Science* 338:1583-1587. [7] Gounelle M. et al. 2006. *Meteoritics & Planetary Science* 41:135-150. [8] Haack H. et al. 2011. Abstract #9100, Formation of the First Solids in the Solar System. [9] Herzog G. 2014. Treatise on Geochemistry 2nd Edition, 1.13, p.419-454. [10] Gladmann B. J. et al. 1997. Science 277:197-201. [11] Shoemaker E. M. et al. 1990. Geological Society of America, Special Paper 247. [12] Kyte F.T. et al. 2003. Geology 31:283-286. [13] Trinquier A. et al. 2006. Earth and Planetary Science Letters 241:780-788.