

### What does the CM chondrite Mineralogic Alteration Index really mean?

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**Introduction:** CM chondrites contain minerals that formed by interaction between liquid water and anhydrous minerals [1]. How this process progressed on the parent body is important for understanding how to unravel the effects of aqueous alteration in these meteorites. Studies undertaken to qualify [1] and quantify [2] the extent of alteration found in the CMs resulted in a mineralogic alteration index (MAI) [2]. The MAI is a numerical representation of the  $\text{Fe}^{3+}/\text{Si}$  ratio in matrix phyllosilicates in CM meteorite falls. It has been found to correlate with carbonate [3] and sulfate [4] oxygen isotopic composition. One key question has been determination of the extent of terrestrial contamination within these meteorites.

**Discussion and Implications:** Figure 1 is a plot of MAI vs Year of Fall [5] for all the CM chondrites for which an MAI was determined [2]. MAI has a strong positive correlation with Year of Fall ( $R^2 = 0.93$ ); that is, the more altered meteorites are older. There is no such systematic correlation between Year of Fall and matrix or bulk  $\Delta^{17}\text{O}$ ,  $\delta^{18}\text{O}$  [6], water content or  $\delta\text{D}$  [7]. Although not as robust, a correlation also exists between Year of Fall and  $\Delta^{17}\text{O}$  in sulfate and carbonate, two minerals that are susceptible to interaction with liquid water. The fact that MAI and carbonate and sulfate  $\Delta^{17}\text{O}$  track with Year of Fall indicates that interaction with the terrestrial atmosphere may take place even if the meteorite is recovered immediately after its fall. The MAI may be providing a measure of terrestrial contamination.

**References:** [1] McSween H.Y. 1979 *Geochim. Cosmochim. Acta.* 43:1761-1770. [2] Browning L.B. et al. 1996 *Geochim. Cosmochim. Acta.* 60:2621-2633. [3] Benedix et al. 2003 *Geochim. Cosmochim. Acta* 67:1577-1588. [4] Airieau S. et al. 2001. Abstract #1744 32<sup>nd</sup> Lunar Planet. Sci. Conf. [5] Grady M.M. 2000. Catalogue of Meteorites. [6] Clayton R.N. and Mayeda T. 1999. *Geochim. Cosmochim. Acta.* 63:2089-2104. [7] Eiler J.M. and Kitchen N. 2004. *Geochim. Cosmochim. Acta.* 68:1395-1411.

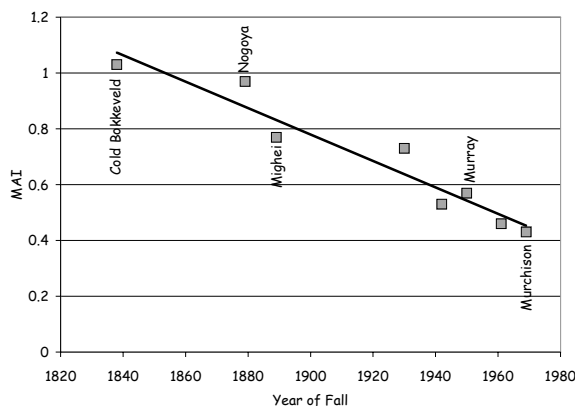


Figure 1. Mineralogic Alteration Index vs Year of Fall of CM chondrites. The line has a correlation coefficient of 0.93. The five most studied CM chondrites are labeled in the figure.