

High temperatures in the solar nebula: Evidence from chondrules and matrix

P. FRIEND*¹, D. C. HEZEL¹, J. A. BARRAT², J. ZIPFEL³
AND H. PALME³

¹Universität zu Köln, 50937 Köln, Germany (*correspondence: piafriend13@gmail.com)

²University of Western Brittany, Brest, France.

³Senckenberg Research Institute, 60325 Frankfurt, Germany

Most chondritic meteorites contain chondrules, once molten spherical silicate droplets. It is likely that all solar system materials underwent the chondrule formation stage, a short heating event that produced melt droplets from aggregated dust balls.

We provide evidence for high temperature fractionation experienced by components shortly before or during chondrule formation. A hot solar nebula must have prevailed for some time even at distances as far away from the sun as the asteroid belt.

The chemistry of matrix, chondrules and bulk were studied in Jbilet Winselwan a recently found CM meteorite with clearly defined Mg-rich chondrules set in a fine grained, Fe-rich matrix [1].

Matrix has super-chondritic Fe/Mg (av. 21.66) and Si/Mg (av. 1.39) ratios with little spread. The bulk is chondritic and chondrules, presently analyzed, must have complementary ratios. The refractory element pair Al-Ti has chondritic ratios in bulk meteorite but is often fractionated between matrix and chondrules [2] [3]. Formation of Ti-rich phases at high temperatures and incomplete incorporation into chondrules is required.

Chondrules and matrix of chondritic meteorites must have formed in a closed system involving extended time periods at high temperatures to produce the observed fractionations.

[1] Russell et al. (2014) *MetSoc* **77** 5377. [2] Palme et al. (2015) *Chemie der Erde* **74**, 507-516. [3] Hezel & Palme (2010) *EPSL* **294**:85-93.