THE CHEMICAL COMPOSITION OF MATRIX, CHONDRULES AND BULK OF THE CM CHONDRITE JBILET WINSELWAN

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INTRODUCTION

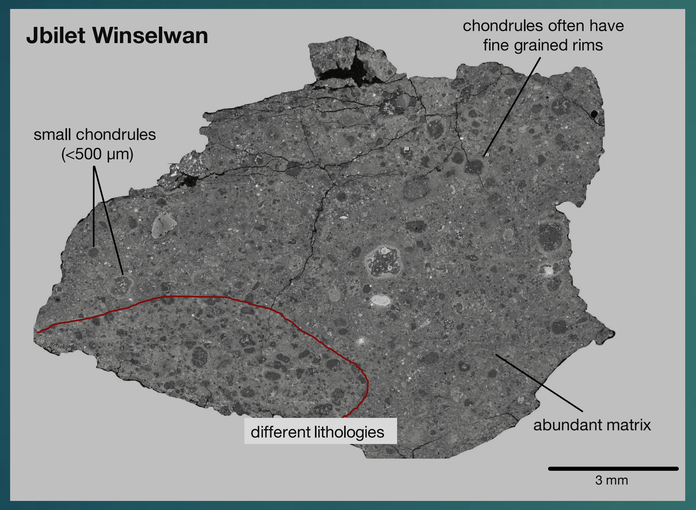
The chemical composition of chondrules and matrix is **complementary** in carbonaceous chondrites (e.g.[1,2,3]. For example, chondrules are Mg-rich and Fe-poor and matrix is Si- and Fe-rich. Also refractory refractory element ratios,Ca/Al and Ti/Al are often complementary [e.g. 1,3]. However, bulk chondrites have in all cases CI chondritic element ratios.
These complementarities are best explained by a process in which chondrules and matrix formed from the same elemental reservoir in the protoplanetary disk.

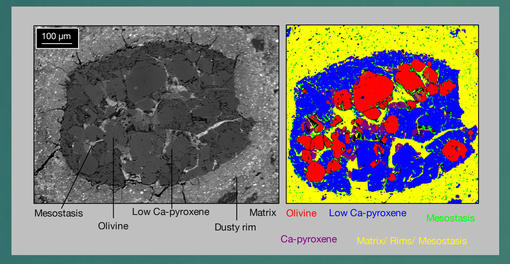
CM chondrites have about 30 vol.% chondrules and 70 vol.% matrix. Chondrules consist of abundant forsteritic olivine, low-Ca pyroxene, and a Al,Ca-rich mesostasis.

We analysed the composition of bulk chondrules, matrix, fine grained rims around chondrules (fgr) and bulk meteorite of **Jbilet Winselwan (JW)**, a recently found CM2 chondrite [4]. JW is mostly devoid of significant aqueous alteration [5].

RESULTS

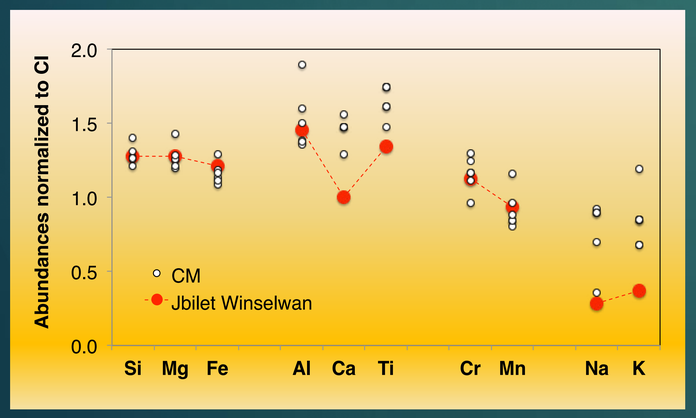
Petrography





All studied chondrules are porphyritic, mainly POP.
Most chondrules (>70 %) are mineralogically zoned, with olivine in the core and low Ca-Pyroxene at the rim [cf. 6].

Bulk meteorite composition

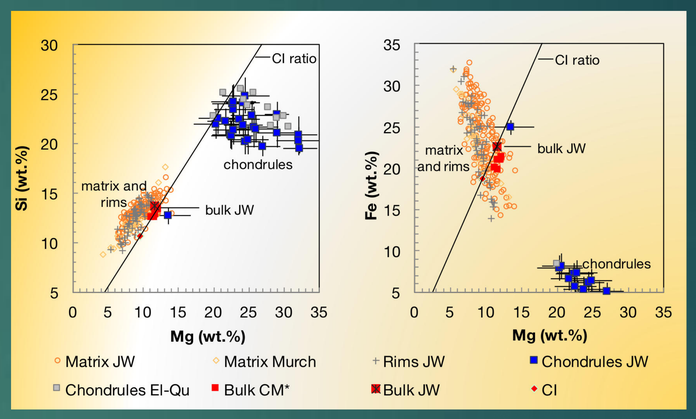


Major and minor elements are in good agreement with data from other CM.

Except for slight depletion of Na and K,and depletion of Ca.

The cause of the depletions is yet unclear.

Complementarities

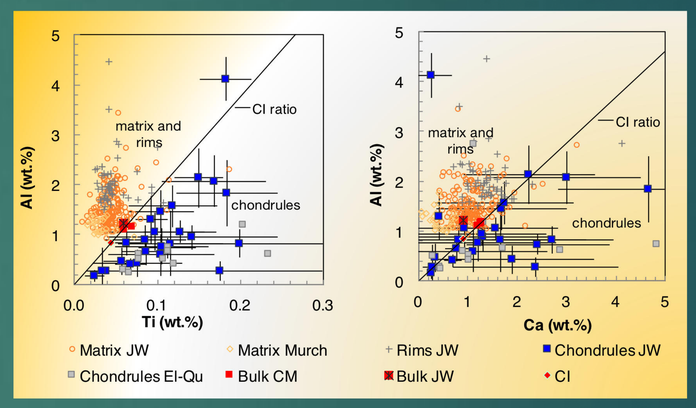


Errors are from using the 2D bulk chondrules compositions relative to the true 3D bulk compositions and were calculated using the method of [7]

Si/Mg
Chondrules: sub-chondritic
Matrix & fgr: super chondritic

Fe/Mg
Chondrules: sub-chondritic
Matrix & fgr: super chondritic

Bulk JW is in both cases CI-chondritic.



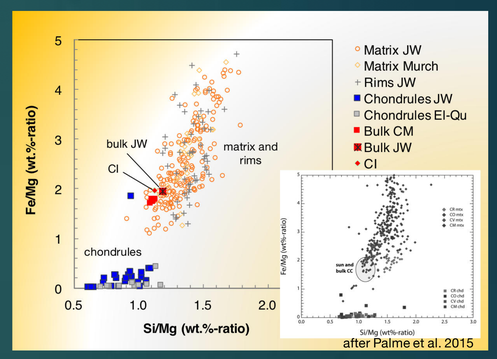
Errors are from using the 2D bulk chondrules compositions relative to the true 3D bulk compositions and were calculated using the method of [7]

Al/Ti
Chondrules: sub-chondritic
Matrix & fgr: super chondritic

Al/Ca
Chondrules: sub-chondritic
Matrix & fgr: super chondritic

Bulk CMs are CI-chondritic.
JW is CI chondritic for Al/Ti.

Matrix material is, in comparison to the bulk meteorite and CI-chondrites, enriched in Fe and Si; chondrules have the complementary composition, they are depleted in Fe and Si
This is generally observed in CM chondrites.



after Palme et al. 2015

DISCUSSION

- JW is a primitive CM chondritic breccia with comparatively little terrestrial alteration.
- Chondrules in JW are often mineralogically zoned with olivine in the center and low Ca-pyroxenesat the rim. This indicates open system conditios [6],
- So far there only exist bulk chondrule data in combination with matrix data from one CM meteorite [2].
- In JW chondrules and matrix are complementary with regard to Mg/Si, Fe/Mg, Al/Ti ratios .
- Especially the complementary distribution from the two refractory elements Al and Ti with the well defined CI chondritic bulk meteorite composition of JW for Al/Ti can not be explained from any parent body processes, but from the preferred incorporation of Ti bearing phases (e.g. perovskite) in chondrules or chondrule precursors in the solar nebular
- All findings hint to a common formation of chondrules and matrix from a single chondritic reservoir

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[7] Hezel & Kießwetter (2010). *MAPS, 45,* 555-571. [7] Hezel D.C. & Palme H. (2008). *EPSL, 265,* 716-725. [8] Pernet-Fischer et al. (2014). *45th LPSC,* 2386.