A LARGE, LIGHT FRAGMENT IN THE MURCHISON (CM) BRECCIA - A UNIQUE, HIGHLY-METAMORPHOSED CHONDRITE AS A XENOLITH IN A CM CHONDRITE.

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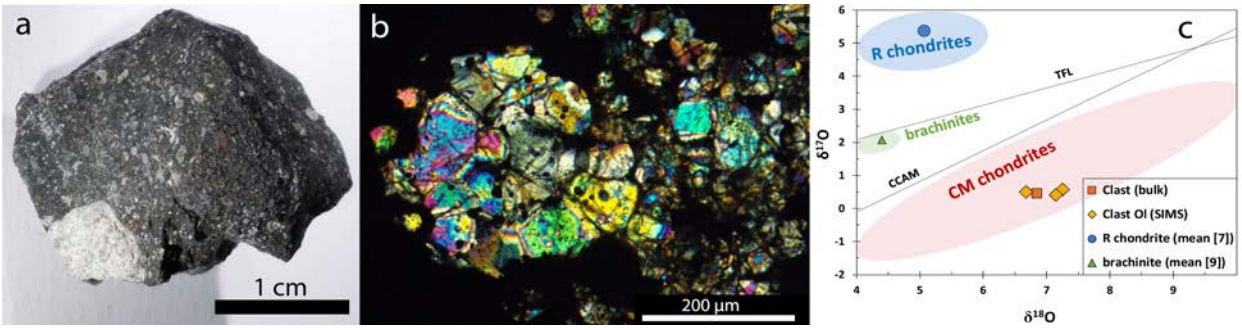
Introduction: CM chondrites like Murchison are breccias typically consisting of a mixture of CM-related fragments that experienced different degrees of aqueous alteration (e.g., [1-4]). Within one sample from the Murchison CM2 chondrite a huge white clast was detected (Fig. 1a) earlier described by [5]. A thin section was prepared and the clast was studied by microscopic techniques, electron microprobe, and ion probe. The O-isotope composition of a small bulk sample was also obtained by laser fluorination gas mass spectrometry.

Results. The rock clast shows a chondritic texture having relic chondrules (Fig. 1b) and well-recrystallized areas with 120° triple junctions between neighboring minerals. The clast is rich in olivine (~Fa_{38}) and the pyroxene is Ca-rich (~$Fs_{11}Wo_{48}$; see also [6]). The data are similar to those in R chondrites, however the olivine has low NiO (<0.1 wt%), whereas typical olivines in R chondrites have 0.2-0.3 wt% NiO [7]. The common plagioclase in R chondrite is quite albitic (<An_{12}); however, in the Murchison clast of our section most plagioclase grains are close to An_{38}. The mineral chemical data for olivine, pyroxene, and many plagioclases of the clast are similar to those in the brachinite EET 99402 [8], however the composition of Cr-spinel (chromite in EET 99402 with 51% Cr_2O_3) is significantly different. Cr-rich spinels within this clast are variable in composition (Cr_2O_3: 24-46 wt%) and most of the grains have - compared to those in R chondrites - relatively low TiO_2-concentrations (~3 wt%; range: 1.3-5 wt%) and high Al_2O_3 (>25 wt%). The sample contains intergrowths of three sulfides (pentlandite, troilite, and (perhaps) pyrrhotite), which may result from exsolution of pentlandite from troilite as the temperature dropped below the stability field for a high temperature phase. One small (<1 µm) PGE-rich particle was detected. O-isotope analyses of olivines ("Clast Ol"; Fig. 1c) clearly show that the sample is not related to R chondrites [7]. The data (SIMS) fall below the terrestrial fractionation line (TFL) in the field of CM chondrites (Fig. 1c). Bulk O-isotope data is indistinguishable from the SIMS data on olivines, but different to those of brachinites [9].



Conclusion: The clast in Murchison has some (minor) affinities to R chondrites (compositions of olivine and pyroxene, occurrence of PGE-rich particle), but the O-isotope data clearly rule out an R chondrite relationship as suggested by [5] and indicates a closer relationship to CM chondrites. This may indicate that the fragment might have formed on a separate parent body in close vicinity of the CM parent bodies or it represents (less-likely) a completely different, highly-recrystallized chondritic lithology of a CM parent body. Similarly, granite-like clasts in the ordinary chondrite Adzhi-Bogdo (LL3-6) have O-isotope compositions indistinguishable from those of ordinary chondrites [10-12] that may also result from fragmentation of a differentiated parent body in the neighborhood of the ordinary chondrite parent bodies.

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