MINERALOGIC AND Δ^{17}O-ε^{54}Cr ISOTOPIC COMPOSITION OF BRACHINITE NORTHWEST AFRICA 13489: A NEW METACHONDRITE WITH 'CX' CHONDRITE AFFINITY?

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Introduction: In recent years, the number of meteorites representing highly recrystallized products, filling the gap between chondritic protoliths and primitive achondrites, has increased. These meteorites, nowadays identified as metachondrites, show compositional affinity with different meteorite groups, such as H ordinary chondrites [1], CV-CR-CO carbonaceous chondrites [1,2,3,4,5] and acapulcoite-lodranite/winonaite [8], by means of oxygen and chromium iostopes. Moreover, detailed isotopic studies on Cr-Ti-O systems highlighted the occurrence of common reservoirs for carbonaceous chondrites and some differentiated achondrite meteorites, i.e., irons and silicate-irons [9,10,11], thus outlining the origin from common parent bodies. A further finding is the existence of ungrouped chondrites/achondrites showing carbonaceous affinity, but not related to any previously recognized groups [6,7,11], allowing to study possible new parent bodies unrepresented in meteorite collections. While studying possible genetic relationships between brachinites and ungrouped achondrites with brachinite-like affinity [12], NWA 13489 brachinite [13] revealed a metachondrite nature possibly consistent with 'CX' chondrites [14].

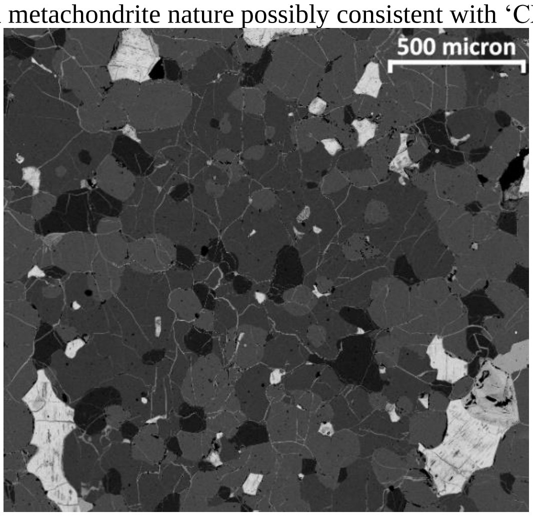

Figure 1. Back-scattered image of NWA 13489.

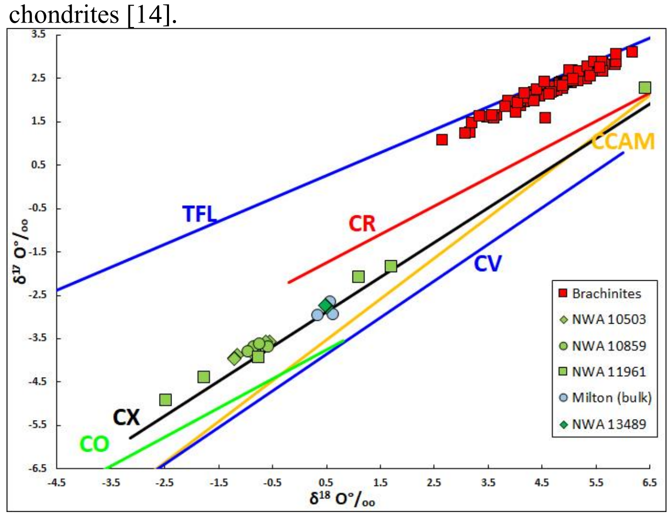

Figure 2. Oxygen isotope diagram for NWA 13489, compared with brachinites and other carbonaceous meteorite groups.

Petro-mineralogy and isotopic composition: The sample has a recrystallized texture with mean grain-size of 0.2-0.6 mm with rare poikilitic areas (Figure 1). Olivine is the main phase (63.7 vol%, mean $Fa_{31.1}$, FeO/MnO=82.9), followed by plagioclase (13.5 vol%, mean $An_{35.4}Or_{2.9}$) and clinopyroxene (7.4 vol%, mean $Fs_{10.7}Wo_{43.9}$, FeO/MnO = 44.7). Accessory phases are chromite, troilite, FeNi alloy altered in Fe-oxy/hydroxides and rare phosphate. Three acid-washed aliquots analyzed with IR laser-assisted fluorination system gave these mean oxygen isotopic compositions: $\delta^{17}O = -2.749$, $\delta^{18}O = +0.491$ and $\Delta^{17}O = -3.010$, while $^{54}Cr = +1.50$**.**

Discussion: The bulk major elements composition is compatible with a carbonaceous-like source (higher Fe/Mn and Al/Mn compared to ordinary chondrites). Texture, modal mineralogy and mineral chemistry are similar to NWA 10503 (personal data and [10]). NWA 13489 defines a linear trend in the δ^{18}O-δ^{17}O space (Figure 2), together with NWA 11961 chondrite [14], the paired NWA 10503-10859 ungrouped achondrites [10,14] and Milton pallasite [15], informally named 'CX' by [14].

References:

[1] Irving A. J. et al. (2005) *AMSM 68th*, Abstract #5218. [2] Schoenbeck T. W. et al. (2006) *LPS XXXVII*, Abstract #1550. [3] Bunch T. E. et al. (2005) *LPS XXXVI*, Abstract #2308. [4] Irving A. J. et al. (2004) *EOS, Trans. AGU*, Abstract #P31C-02. [5] Sanborn M. E. et al. (2015) *LPSC XLVI*, Abstract #2259. [6] Wittke J. H. et al. (2011) *AMSM 74th*, Abstract #5222. [7] Sanborn M. E. et al. (2018) *AMMS 81st*, Abstract #6279. [8] Rumble III D. et al. (2005) *AMSM 68th*, Abstract #5138. [9] Kuehner S. M. et al. (2013) *AMSM 76th*, Abstract #5269. [10] Irving A. J. et al. (2016) *AMMS 79th*, Abstract #6461. [11] Sanborn M. E. et al. (2019) *LPSC L*, Abstract #1498. [12] Cuppone T. et al. (2024) *in preparation*. [13] Gattacceca J. et al. (2021) *MAPS 56(8)*, 1626-1630. [14] Irving A. J. et al. (2019) *LPSC L*, Abstract #2542. [15] Jones R. H. et al. (2003) *LPSC XXXIV*, Abstract #1683.