A NEW UNUSUAL BENCUBBINITE (CBa), SIERRA GORDA 013 WITH UNIQUE V-RICH SULFIDES.

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Introduction: The metal-rich (>20 vol% Fe,Ni-metal) carbonaceous chondrites include CH chondrites, CB chondrites [1] and the Isheyevo CH/CBb chondrite [2]. The CB chondrites are rare and divided into two subgroups based on their petrologic characteristics: CBa (e.g., Bencubbin, Weatherford, Gujba) and CBb (e.g., Hammadah al Hamra (HH) 237 and Queen Alexandra Range (QUE) 94411/94627) [1]. A recently described chondrite, Quebrada Chimborazo (QC) 001 is similar to CBa but unusual in containing shock melt and high pressure mineral phases [3]. Here we present preliminary results of study of unusual CB chondrite from Chile, Sierra Gorda (SG) 013, and describe V-rich sulfides which have not previously been found in the meteorite material.

Results and Discussion: SG 013 was found 300 km from QC 001. It contains two lithologies presented by separated samples of the meteorite. The first lithology is typical for CBs and consists of Fe,Ni-metal nodules (~80 vol%), up to 0.5 cm, BO, CC and POP chondrules, and their fragments up to 0.4 cm, matrix is absent; minerals are olivine, pyroxene, anorthite, Fe,Ni-metal (kamacite only), daubreelite, V-rich sulfides, schreibersite and magnesiochromite. Glassy mesostasis in chondrules is represented by nonstoicheometric anorthite and clynopyroxene. Many chondrule-like objects contain tiny simplectites consisting of chromite enriched in Al and Mg, clinopyroxene and olivine. There is assemblage of daubréelite with chromite. Shock stage of most chondrules is S2, but several fragments have stage S3-4, abundant melt pockets enclosing tiny blebs of Fe,Ni-metal occur.

The second lithology consists of less abundant Fe,Ni-metal (~50 %) and unevenly grained silicates (~50%, olivine, pyroxene, anorthite and chromite) and very rare unclear relic chondrules. Many fractures filled by Fe,Ni-metal and products of Fe,Ni-metal oxidation crosscut the lithology. in the second lithology any sulfides and schreibersite were absent. Unlike the first lithology, in the second lithology Fe,Ni-metal is represented by kamacite and taenite (23 wt% of Ni).

Olivine (Fa2.23), orthopyroxene (Fs3.37), clinopyroxene representing by diopside (Fs1.91, Wo45.74), plagioclase (An 95.78, Ab4.04) in both lithology are typical for CBs. Fe,Ni-metal is not zoned, kamacite contains 6.90 wt% of Ni, 0.39 wt% of Co, 0.16-0.39 wt% of P, magnesiochromite contains up to 15.0 wt% of Al_2O_3, 18.0 wt% of MgO and 7.5 wt% of FeO, having an empirical formula of (Mg0.81Fe0.19)(Cr1.38Al0.62)O4. Oxygen isotopic compositions of the first lithology are in the range of CBs (‰) ($\delta^{17}O$ -1.889, -1.9; $\delta^{18}O$ 0.65, 0.59; $\Delta^{17}O$ -2.226, -2.206).

The sulfide assemblage in the first lithology is representated by daubréelite $FeCr_2S_4$, V-rich daubréelite enriched in V (up to 2.0 wt%, Fe(Cr,V)2S4), V-rich brezinaite (Cr2.05V0.62Fe0.33)S4 and probably an unknown V,Fe,Cr-rich sulfide presented as tiny mineral phases (< 1 μm) in the V-rich daubrelite (Table 1). All minerals were confirmed by crystal structure using EBSD investigations. Based on the EPMA and EBSD analyses, chemical composition of the unknown V,Fe.Cr-sulfide corresponds to mineral formula (based on 5 S): (V1.55Fe1.52Cr0.92)S5, e.g., $(V,Fe,Cr)_4S_5$.

Table 1. Chemical composition (wt%) and formulae units of sulfids from a new bencubbinite (CBa), SG 013.

	S	V	Cr	Fe	Total	S	V	Cr	Fe	Sum
daubreelite	44.65	0.01	35.43	19.92	100.01	4.00	0.00	1.96	1.02	6.98
V-daubreelite	44.09	6.22	29.74	18.54	98.6	4.00	0.36	1.66	0.97	6.98
V-brezinaite	44.14	10.64	36.90	6.27	98.26	4.00	0.62	2.05	0.33	7.00
unknown V-sulfide	43.56	21.61	13.05	21.49	99.71	5.00	1.55	0.92	1.52	8.99

Conclusions: SG 013 is an unusual bencubbinite with affinity to the CBa subtype. Unlike most known CBs it contains two texturally and mineralogically different lithologies and doesn't contain in Fe,Ni-metal any troilite blebs typical for CBs. Similar to QC 001 [3] it records impact event. Probably the second lithology represents slowly crystallized melt. Simlectites from the first lithology may be also a result of melting event. V-rich brezinaite and unknown V,Fe,Cr-sulfide, simplectites and magnesiochromite-daubreelite assemblage have never been described in the CBs chondrite material. V-rich brezinaite and unknown V,Fe,Cr-sulfide were not observed in the meteorite material.

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References: [1] Weisberg M. K. et al. (2001) *Meteoritics & Planet. Sci.*, 36, 401–418. [2] Ivanova M. et al. (2008) *Meteoritics and Planetary Science* 43:915-940. [3] Koch T. E. et al. (2016) *LPS XLVII*, Abstract #1968.