NWA 779, A NEW CV-CHONDRITE WITH RELATIONS TO THE COOLIDGE-GROUPLET?

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In the Hamada de Guir, south of the oasis of Boudenib (Morocco) a carbonaeous chondrite was found in 1999, which was provisionally named Northwest Africa 779. Our analyses of 30 elements with INAA and 10 major elements with XRF (Tab.1) show a composition close to CV-chondrites, but with few exceptions, which may be due to strong weathering. A 50% reduction of Ni and Co was observed similar to the weathered Karoondite Mulga West [1], probably arising from loss of sulfide or metal, which contain the main fraction of these elements. In NWA 779 Na is a factor of 3 lower and K a factor of 2 higher than in most CV-chondrites. Anomalous concentrations of these two elements were observed in other carbonaceous chondrites [2].

A further difference to the CV-chemistry is an 8% higher Mg- and Si-abundance, on one hand, and even stronger depletion of Ca, Al and Ti on the other hand. Since we had only two small pieces of NWA 779 (~92 mg) for analysis, this may result from a low abundance of Ca-Al-rich inclusions in our sample.

Electron microprobe studies of a thin section from NWA 779 show a high proportion of well developed chondrules (~40%), up to 1mm in diameter. Most of the olivine crystals in the chondrules are slightly zoned and have a strong peak at a fayalite content of 21±3 mol%. In addition some forsteritic grains (Fa_{1-6}) are present. Since the matrix olivine has a fayalite content of around 35 mol%, the meteorite is apparently less equilibrated than HH073, a carbonaceous chondrite, which is in compositional and textural properties intermediate between the CV-group and the Coolidge grouplet [3, 4].

However, the peak of olivine compositions at Fa_{21}may be due to the beginning of thermal equilibration, which could lead to a fayalite content significantly below 30 mol %, the normal content of most of the equilibrated carbonaceous chondrites, classified as Karoondites. Only the 3 members of the Coolidge grouplet have with 12, 13 and 18 mol% fayalite equilibrated olivine compositions much lower than 30mol% possibly implying some relationship of NWA 779 to these meteorites. Some other characteristics like the presence of a few percent metal, and a mean content of refractory elements around 2xC1 show CV-values at the upper end towards the Coolidge grouplet, too.

It would be interesting to look for other CV-chondrites, which have similar or even closer relations with the three meteorites Coolidge, Loongana and Hammadah al Hamra 073, or whether they form a distinct grouplet. Specifically, the highest fractionation among the moderately volatile elements, due to difference in volatility, separates this grouplet from all other known meteorites. The moderately volatile elements are more fractionated only in samples from the mantle of earth and moon, which might suggest a relationship of terrestrial accretion material with this type of meteorites.

Tab.1: Results of XRF(=X) and INAA(=I)-analyses of a 92mg sample from NWA779 compared with the mean content of CV-chondrites [5]

		ppm ±%	/C1	CV/C1
X	Mg	159400 ±1	1.703	1.55
X	Al	14320 ±1	1.747	2.13
X	Si	169400 ±1	1.587	1.46
X	Ca	15190 ±2	1.688	2.11
X	Ti	770 ±2	1.771	2.23
I	Fe	232000 ±3	1.271	1.29
I	Na	920 ±3	0.18	0.66
X	P	1004 ±2	0.994	0.97
I	K	700 ±5	1.354	0.60
I	Sc	11 ±3	1.932	1.93
X	V	95 ±2	1.709	1.73
X	Cr	3692 ±2	1.383	1.35
X	Mn	1541 ±2	0.847	0.80
I	Co	300 ±5	0.598	1.31
X	Ni	6000 ±2	0.557	1.24
I	Cu	140 ±15	1,296	0.83
I	Zn	110 ±30	0.317	0.32
I	Ga	5.2 ±20	0.571	0.61
I	As	2.2 ± 8	1.189	0.87
I	Se	7 ±10	0.370	0.42
I	Br	1.1 ±10	0.435	0.42
I	Ru	1.2 ±15	1.730	1.59
I	Sb	0.12 ±20	0.945	0.56
I	La	0.65 ±20	2.653	2.06
I	Ce	1.7 ±20	2.665	2.09
I	Sm	0.35 ±10	2.273	1.98
I	Eu	0.1 ±30	1.724	2.02
I	Tb	0.08 ±30	2.162	1.83
I	Dy	0.7 ±20	2.756	1.94
I	Ho	0.16 ±30	2.807	2.01
I	Yb	0.3 ±20	1.818	2.03
I	Lu	0.051 ±20	2.040	1.96
I	Hf	0.2 ±20	1.667	1.62
I	W	0.2 ±30	2.247	1.90
I	Re	0.04 ±30	1.081	1.76
I	Os	0.9 ±20	1.837	1.68
I	Ir	0.74 ± 5	1.558	1.65
I	Pt	2 ±30	1.905	1.26
I	Au	0.16 ± 5	1.127	1.00

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