DAR AL GANI 400: CHEMISTRY AND PETROLOGY OF THE LARGEST LUNAR METEORITE. J. Zipfel[1], B. Spettel[1], H. Palme[2], D. Wolf[2], I. Franchi[3], A.S. Sexton[3], C.T. Pillinger[3], and A. Bischoff[4], [1]Max-Planck-Institut für Chemie, Saarstrasse 23, 55020 Mainz, Germany (zipfel@mpch-mainz.mpg.de), [2]Institut für Mineralogie und Geochemie, Universität zu Köln, Zülpicherstrasse 49b, 50674 Köln, Germany, [3]Planetary Sciences Research Institute, Open University, Milton Keynes, MK7 6AA, UK, [4]Institut für Planetologie, Wilhelm-Klemm-Strasse 10, 48149 Münster, Germany.

In March of 1998, only one year after the first lunar meteorite was found in the northern hemisphere, another lunar meteorite was recovered from the Libyan desert. With a mass of 1425 g Dar al Gani (DaG) 400 is the largest lunar meteorite known so far [1]. Chemically and petrographically it is similar to DaG262, anorthositic highland regolith breccia [2]. Abundances of noble gases, however, are lower in DaG400 and solar wind implanted gases are missing [3]. Bulk chemical data were obtained by INAA and XRF on 3 samples weighing ~120 mg. Two aliquots have been analyzed for oxygen isotopes. Two thin sections were prepared for petrological studies. Full characterization of clasts present is still in progress.

The meteorite is partly covered with a brownish fusion crust. On freshly cut surfaces it appears grey to dark grey. DaG400 consists of a fine-grained matrix which is well-consolidated. Most clasts are subophitic and fine-grained to microporphyritic impact melt breccias, granulitic fragments, intergranularly recrystallized anorthosites, and mineral fragments. Mafic lithologies are rare. Melt spherules and impact melt veins are present. The meteorite is crosscut by carbonate veins which are due to terrestrial alteration.

Major and trace element composition is characteristic of lunar highland meteorites (Table 1). Manganese concentrations are low and the Fe^*/Mn ratio is 70 (Fe^*=corrected for meteoritic Fe). The rare earth abundance pattern is rather flat (La 5.7 × CI, Sm 4.2 × CI, Yb 3.2 × CI), but with the typical Eu anomaly (Eu 11.4 × CI). Trace elements susceptible to terrestrial alteration are enriched over average lunar highland meteorites concentrations. One aliquot of a powdered sample was etched with a diluted HNO_3 solution and analyzed by XRF. In comparison to an untreated aliquot, concentrations of K and P are reduced after etching (Table 1). A similar procedure was adopted to an irradiated sample from which residue and leachate were analyzed by INAA. Trace elements preferentially concentrated in the leachate are, in decreasing order: Ba, As, K, Sr, and Br. The lower concentrations of these elements in residues are in agreement with compositions of Antarctic lunar meteorites [4] which are much less affected by terrestrial weathering.

As expected oxygen isotope composition ($\delta^{17}O$ = + 3.38 ‰, $\delta^{18}O$ = + 6.48 ‰ and $\Delta^{17}O$ = +0.01 ‰) falls on the terrestrial fractionation line, at the heavy $\delta^{18}O$ end of lunar samples. Among lunar meteorites DaG400 is highest in $\delta^{18}O$, possibly reflecting the presence of terrestrial weathering products.

With DaG400 the number of non-Antarctic lunar meteorites increases from two to three. Although, chemistry, texture, and mineralogy of DaG400 and DaG262 are very similar, pairing of these two meteorites is not supported by noble gas systematics [3].

References: [1] Grossman J. N. (1998)) *Meteoritics and Planet. Sci.*, this issue. [2] Bischoff A. and Weber D. (1997) *Meteoritics and Planet. Sci., 32*, A13–A14. [3] Scherer P. et al. (1998) *Meteoritics and Planet. Sci.*, this issue. [4] Palme et al. (1991) *GCA, 55,* 3105–3122.

Table 1. Selected major and trace elements of DaG400 compared to average lunar highland composition.

	DaG400	DaG400	Lunar highland meteorites
	bulk sample	etching residue	average [4]
Mg wt%*	3.1	3.3	3.7
Al wt%*	15.3	14.9	13.8
Si wt%*	21.0	21.1	-
Ca wt%*	12.4	11.6	11.0
Ti wt%*	0.11	0.12	0.16
Fe wt%*	2.94	3.20	4.07
Na ppm#	2400	2370	2484
P ppm*	480	190	103
K ppm*	620	100	203
Sc ppm#	5.4	6.3	11
Cr ppm#	550	508	843
Mn ppm#	400	400	574
Co ppm#	14		18
Ni ppm#	113		152
As ppm#	0.3	0.18	-
Br ppm#	0.45	<0.40	0.07
Sr ppm#	190	173	138
Ba ppm#	140	<212	28
Ir ppb #	4		6

*XRF analyses; # INAA; < upper limit.