	Hask	Waki	Masu	Naka	Even	Laul	A&E	Boyn
	68/71	1971	1973	1974	1978	1979	1982	1985
	OC	OC	OC(L6)	OC	CI	OC	CI	vfCI
Y	1.96						1.44	
La	0.332	0.34	0.378	0.329	0.2446	0.34	0.236	0.31
Ce	0.876	0.91	0.976	0.865	0.6379	0.85	0.616	0.808
Pr	0.112	0.121			0.09637	0.12	0.0929	0.122
Nd	0.6	0.64	0.716	0.63	0.4738	0.64	0.457	0.6
Sm	0.183	0.195	0.23	0.203	0.154	0.195	0.149	0.195
Eu	0.0685	0.073	0.0866	0.077	0.05802	0.073	0.056	0.0735
Gd	0.252	0.26	0.311	0.276	0.2043	0.26	0.197	0.259
Tb	0.047	0.047			0.03745	0.047	0.0355	0.0474
Dy	0.317	0.3	0.39	0.343	0.2541	0.3	0.245	0.322
Ho	0.07	0.078			0.0567	0.078	0.0547	0.0718
Er	0.201	0.2	0.255	0.225	0.166	0.2	0.16	0.21
Tm	0.03	0.032			0.02561	0.032	0.0247	0.0324
Yb	0.207	0.22	0.249	0.22	0.1651	0.22	0.159	0.209
Lu	0.0325	0.034	0.0387	0.0339	0.02539	0.034	0.0245	0.0322

1) Haskin L. A., Wildeman T. R., and Haskin M. A. (1968) "An accurate procedure for the det

Haskin L. A., Helmke P. A., Paster T. P., and Allen R. O. (1971) "Rare earths in meteoritic, ter
Composite of nine (ordinary?) chondrites; error-weighted mean of 1968 and 1971 analyses

2) Wakita H., Rey P., and Schmitt R. A. (1971) Elemental abundances of major, minor, and tr

"composite of 12 chondrites," data in caption to Fig. 1

3) Masuda A., Nakamura N., and Tanaka T. (1973) "Fine structure of mutually normalized rar

"Leedy" (Leedey) chondrite (L6). Note that LL chondrites have high REE concentrations compared to H

4) Nakamura N. (1974) "Determination of REE, Ba, Fe, Mg, Na, and K in carbonaceous and c

Average of ten ordinary chondrites

5) Evensen N.M., Hamilton P.J., and O'Nions R.K. (1978) "Rare-earth abundances in chondrit

"CI avg.", best estimate of unfractionated chondrites, many literature analyses. The data averag

6) Laul J.C. (1979) "Neutron activation analysis of geologic materials" *Atomic Energy Review*

Same as values of Wakita et al. (1971), except for Ce

7) Anders E. and Ebihara M. (1982) "Solar-system abundances of the elements"
Geochimica et Cosmochimica Acta **46**, 2363-2380. (Table 6)

Essentially, values of Evensen et al. (1978) divided by 1.0366, except Tb (/1.055)

These values also favored by Wasson J.T. (1985) *Meteorites: Their Record of Early Solar-Syst*

8) Boynton W. V. (1985) Chapter 3. Cosmochemistry of the rare earth elements: Meteorite stu

Values of Evensen et al. multiplied by 1.267 to be consistent with the average values of Haskir

9) Taylor S. R. and McClennan S. M. (1985) *The Continental Crust: Its Composition and Evo*

Values of Evensen et al. multiplied by 1.5 ["type 1 carbonaceous chondrite (volatile-free: 1.5×
These values are are distinctly higher than any of the other "volatile-free" values (Fig. 2).

10) Wasson J. T. and Kallemeyn G. W. (1988) "Compositions of chondrites" *Philosophical Tr*

I never actually seen these values used; I include them here only for reference. W&K (1988) list means

11) Anders E. and Grevesse N. (1989) "Abundances of the elements: Meteoritic and solar"
Geochimica et Cosmochimica Acta **53**, 197-214.

"Mean C1 Chondr." of Table 1

12) Values of Anders & Grevesse times 1.3596.
This factor gives Sm = 0.2000 µg/g and results in values for all REE in the vicinity those for th

Some references in which this approach is taken are listed below:

Korotev R. L. (1996) A self-consistent compilation of elemental concentration data for 93 geo

Korotev R. L. (1996) On the relationship between the Apollo 16 ancient regolith breccias and f
" Chemical abundances in meteorites"
Reviews in Modern Astronomy (G. Klare, editor), Springer, Berlin pp. 28-51.

These are the author's data for the Orgueil CI chondrite.

14) McDonough W. F. and Sun S.- s. (1995) " The composition of the Earth" *Chemical Geolo*

These data are averages for CI chondrites based on data of the previously publshed means and

T&M	W&K	A&G	A&G	Palm	M&S
1985	1988	1989	×1.36	1988	1995
vfCI	OC	CI	vfCI	CI	CI
2.1	1.8	1.56	2.12	1.57	1.57
0.367	0.29	0.2347	0.319	0.245	0.237
0.957	0.763	0.6032	0.82	0.638	0.613
0.137	0.117	0.0891	0.121	0.096	0.0928
0.711	0.572	0.4524	0.615	0.474	0.457
0.231	0.183	0.1471	0.2	0.154	0.148
0.087	0.069	0.056	0.0761	0.058	0.0563
0.306	0.249	0.1966	0.267	0.204	0.199
0.058	0.043	0.0363	0.0493	0.037	0.0361
0.381	0.302	0.2427	0.33	0.254	0.246
0.0851	0.0693	0.0556	0.0755	0.057	0.0546
0.249	0.198	0.1589	0.216	0.166	0.16
0.0356	0.03	0.0242	0.0329	0.026	0.0247
0.248	0.2	0.1625	0.221	0.165	0.161
0.0381	0.03	0.0243	0.033	0.025	0.0246

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rrestrial, and lunar matter" In *Activation Analysis in Geochemistry and Cosmochemistry* , A. Br

ace elements in Apollo 11 lunar rocks, soil and core samples. *Proceedings of the Apollo 11 Lur*

e-earth patterns of chondrites" *Geochimica et Cosmochimica Acta* **37**, 239-248.

and L chondrites [Fig. 1, W&K (1988)].

rdinary chondrites" *Geochimica et Cosmochimica Acta* **38**, 757-775.

tic meteorites" *Geochimica et Cosmochimica Acta* **42**, 1199-1212.

ed include data for normalized ordinary chondrites.

17, 603-695. (Fig. 20 caption, p. 683)

tem History , 267 pp., Freeman, New York. (Table D-1) and Wasson and Kallemeyn (1988) "C

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olution Blackwell, Oxford. 312 pp.

original data)"]

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new data.

37-348.

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ɔmposition of chondrites," *Philosophical Transactions of the Royal Society A* **325**, 535-544.

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nds of the Moon. *Meteoritics and Planetary Science* **31**, 403–412. **13)** Palme. H. (1988)

1-218, Universitetsforlaget, Oslo.

atios at this writing for ~32,000 ordinary chondrites listed in the Meteoritical Bulletin Database of the Met

eoritical Society. Note that the agreement is good with the original OC data of columns 1 and 2.

ELEMENT	SiO2	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2
SAMPLES	%	%	%	%	%	%	%	%
MB1-1	75.72	13.60	.62	.02	.94	4.03	4.69	.03
MB1-52	74.90	14.09	.71	.02	1.11	4.21	4.61	.03
MB1-55	74.61	13.83	.93	.03	1.10	3.82	4.94	.03
WILK	48.17	10.37	7.44	13.03	9.12	1.11	5.80	.97
RE WILK	48.10	10.31	7.58	13.06	9.04	1.09	5.73	.97

ELEMENT	Ba	Be	Co	Cs	Ga	Hf	Nb	Rb
SAMPLES	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
MB1-1	16.9		3 <.5	3.9	18.0	4.5	28.0	182.0
MB1-52	3.7		3 <.5	3.1	18.5	6.3	11.2	180.3
MB1-55	30.9		3 <.5	2.9	18.0	6.8	12.8	170.4
WILK	1052.8		5 35.9	12.7	11.7	1.7	5.3	582.3
RE WILK	1075.5		7 36.8	12.7	11.8	1.7	5.7	599.9

P2O5 %	MnO %	Cr2O3 %	Ni ppm	Sc ppm	LOI %	TOT/C %	TOT/S %	SUM %
.02	.12	.002	6	2	.4	.03	<.01	100.19
.04	.13	<.001	7	2	.3	.03	.03	100.15
.05	.32	<.001	8	3	.5	.05	<.01	100.17
2.46	.11	.143	28	29	1.3	.03	<.01	100.04
2.50	.11	.144	27	29	1.4	.03	<.01	100.04

Sn ppm	Sr ppm	Ta ppm	Th ppm	U ppm	V ppm	W ppm	Zr ppm	Y ppm
2	13.3	4.0	12.5	6.9	<5	.4	66.9	45.5
2	13.4	2.0	14.5	5.8	<5	.4	101.6	64.3
2	21.6	2.1	18.0	7.9	<5	.2	107.7	116.0
2	181.5	.3	7.8	3.4	341	.2	60.3	26.8
2	185.6	.3	5.9	3.5	347	.2	60.4	27.4

La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm	Dy ppm
2.3	5.7	.75	3.4	1.85	.14	2.91	.76	5.79
2.3	5.9	.92	4.9	2.15	.17	3.58	.94	7.56
3.0	8.5	1.25	5.9	2.93	.18	5.62	1.66	12.97
25.5	64.8	9.51	43.8	10.14	1.47	7.85	1.08	5.36
26.5	68.0	9.71	47.3	10.45	1.53	8.06	1.09	5.74

Ho	Er	Tm	Yb	Lu
ppm	ppm	ppm	ppm	ppm
1.35	4.91	1.02	7.30	1.35
1.90	7.34	1.47	10.42	1.95
3.14	11.32	2.24	15.90	2.75
.88	2.27	.33	1.77	.27
.96	2.32	.35	1.78	.28

normalizace prvků vzácných zemin
normalizace chondritem

obsahy REE a Y v chondritu

			mol hm
La	0.237	ppm	138.91
Ce	0.613	ppm	140.12
Pr	0.093	ppm	140.91
Nd	0.457	ppm	144.24
Sm	0.148	ppm	150.36
Eu	0.056	ppm	151.96
Gd	0.199	ppm	157.25
Tb	0.036	ppm	158.93
Dy	0.246	ppm	162.5
Ho	0.055	ppm	164.93
Er	0.160	ppm	167.26
Tm	0.025	ppm	16893
Yb	0.161	ppm	173.04
Lu	0.025	ppm	174.96
Y	1.570	ppm	88.91

monazit

P2O5	CaO	ThO2	UO2	SiO2	PbO	Y2O3	La2O3	Ce2O3
30.817	1.657	8.131	0.946	0.3	0.166	0.866	11.803	27.101
30.813	2.654	10.439	0.926	0.306	0.219	0.992	10.775	25.221
30.439	0.262	1.097	0.186	0.375	0.051	0.075	23.803	33.711
30.211	3.341	16.036	2.251	0.423	0.334	2.21	7.366	19.947
30.79	1.667	8.734	0.644	0.359	0.173	0.946	10.6	23.302
25.722	0.275	13.523	0.746	3.252	0.211	0.115	18.58	26.921

xenotim

Comment	P2O5	SO3	CaO	La2O3	Ce2O3	PbOcorr	ThO2	UO2 korr
P136	32.187	0.203	0.81	0	0.028	0.050785	0	0.679525
P136	31.366	0.205	0.793	0.012	0.03	0.03757	0.021	0.709931
P136	30.867	0.181	0.785	0.009	0.017	0.012593	0.009	0.632919
P136	30.525	0.171	0.784	0.026	0.022	-0.00094	0	0.66024
P136	30.965	0.197	0.784	0	0.015	0.014241	0.021	0.665699

Pr2O3	Nd2O3	Sm2O3	Eu2O3	Gd2O3	Dy2O3	Er2O3	Yb2O3
3.142	10.777	2.186	0.035	1.168	0.385	0.068	0.02
2.835	10.42	2.461	0.045	1.603	0.558	0.031	0.015
2.639	6.898	0.51	0.02	0.159	0	0.066	0.022
2.445	9.111	2.789	0.117	1.745	1.041	0.146	0.05
2.728	10.406	2.315	0.095	1.484	0.605	0.098	0.03
2.185	6.699	0.661	0.02	0.124	0	0.034	0.015

Y2O3	As2O5	ZrO2	Al2O3	SiO2	Yb2O3	Er2O3	Dy2O3	Gd2O3
37.5	1.099	0.505	0	0.252	2.238	3.071	6.848	5.306
37.103	1.106	0.486	0	0.352	2.125	2.962	6.696	5.2
37.565	1.108	0.449	0	0.259	2.163	3.045	6.806	5.304
36.925	1.111	0.472	0	0.331	2.173	2.964	6.646	5.097
37.488	1.038	0.468	0	0.217	2.203	3.079	7.013	5.313

Sm2O3	Nd2O3	MnO	Fe2O3	Sc2O3	Tb2O3	Ho2O3	Tm2O3	Lu2O3
1.3	0.337	0.01	3.256	0.084	0.986	1.156	0.572	0.401
1.276	0.341	0.014	5.495	0.07	0.92	1.14	0.522	0.373
1.299	0.305	0.011	3.046	0.077	1.002	1.114	0.563	0.35
1.274	0.365	0.009	4.435	0.074	0.973	1.193	0.567	0.379
1.301	0.356	0.072	2.235	0.07	1.039	1.125	0.622	0.431

zivce

Na2O	SiO2	Al2O3	BaO	P2O5	K2O	CaO	SrO
3.14	49.84	31.38	0.00	0.00	0.12	14.35	0.32
2.94	49.60	31.83	0.00	0.00	0.15	15.00	0.36
2.96	50.22	31.46	0.00	0.00	0.14	14.52	0.32
6.13	56.89	27.01	0.00	0.00	0.25	8.84	0.31
5.40	55.38	27.68	0.00	0.02	0.18	10.25	0.26
0.34	43.42	36.04	0.00	0.02	0.03	19.80	0.28
0.85	44.73	34.97	0.00	0.02	0.00	18.44	0.26
0.57	44.12	35.56	0.00	0.02	0.03	19.42	0.23
4.64	53.82	29.01	0.00	0.01	0.11	11.57	0.23
6.63	56.95	26.70	0.11	0.00	0.22	8.59	0.41
7.31	59.38	25.90	0.12	0.00	0.24	7.27	0.41

slidy dopocet OH

DataSet/Pc	TiO2	K2O	FeO	MnO	Na2O	SiO2	Al2O3	MgO
1 / 1 .	2.03	9.71	21.20	0.20	0.10	34.63	20.09	7.72
2 / 1 .	2.02	10.00	20.91	0.14	0.08	34.38	20.31	7.59
13 / 1 .	2.61	9.80	23.55	0.23	0.16	34.13	20.34	5.58
48 / 1 .	0.64	9.36	0.99	0.02	1.67	46.07	36.14	0.57
49 / 1 .	3.18	9.82	19.02	0.13	0.13	34.70	19.66	8.50
50 / 1 .	2.45	9.97	18.39	0.09	0.09	35.48	20.01	9.03

dopocet CO2

CaO	FeO	MgO	MnO	SrO	SiO2	Total
0.670	8.889	40.385	0.000	0.000	0.000	49.944
0.812	8.486	40.527	0.000	0.000	0.000	49.825
54.349	1.439	0.446	0.143	0.068	0.000	56.445
54.235	1.556	0.310	0.074	0.093	0.000	56.268
54.287	1.232	0.357	0.143	0.000	0.000	56.019
56.006	0.201	0.145	0.000	0.129	0.000	56.481
30.255	0.240	21.723	0.000	0.000	0.000	52.218
9.088	16.958	2.159	32.290	0.000	0.000	60.495

Total
99.17
99.93
99.66
99.45
99.18
99.98
99.26
99.93
99.40
99.78
100.73

F	Total
0.25	95.93
0.20	95.63
0.25	96.66
0.12	95.58
0.29	95.42
0.38	95.90