

INSTITUTE OF THEORETICAL ASTROPHYSICS
BLINDERN - OSLO

REPORT No. 49

COMPILATION OF SOLAR ABUNDANCE DATA

by

Ø. HAUGE AND O. ENGVOLD

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Abstract

Solar abundance data of 67 elements are tabulated. In addition upper limits for the abundances of 5 elements are listed. References are made to 167 papers. A recommended abundance value is given for each element.

Introduction

In 1970 and 1974 the authors published compilations of solar abundance data (Reports No. 31 and 39 from Institute of Theoretical Astrophysics, Oslo). Stimulated by the interest aroused by these reports, a third revised edition is presented.

It is our intention to provide a relatively comprehensive compilation of recent abundance results. In the cases when an author has repeated his work on a particular element, using the same type of data, we refer only to his most recent paper.

Many investigators working with abundance problems want to know the most likely abundance values. Therefore recommended values are given, even though with some hesitation. Such values must be used with caution. We emphasize that close agreement in values given by different authors do not exclude systematic errors in the results. This may be the case when only lines from one stage of ionization and one source of transition probabilities are available, as for instance for the elements Gd and Dy. All Be abundance determinations are based on the Be II resonance lines. The Be I resonance line at 2348 Å appears to give a significantly smaller value (Canfield, Engvold and Kjeldseth Moe, unpublished).

Several authors have given abundance values relative to another element. In these cases, we have used our recommended value for reference.

Earlier compilations given by Ross and Aller (ref. 135) and Withbroe (ref. 160) have been of great help. We are grateful to authors who have supplied us with preprints.

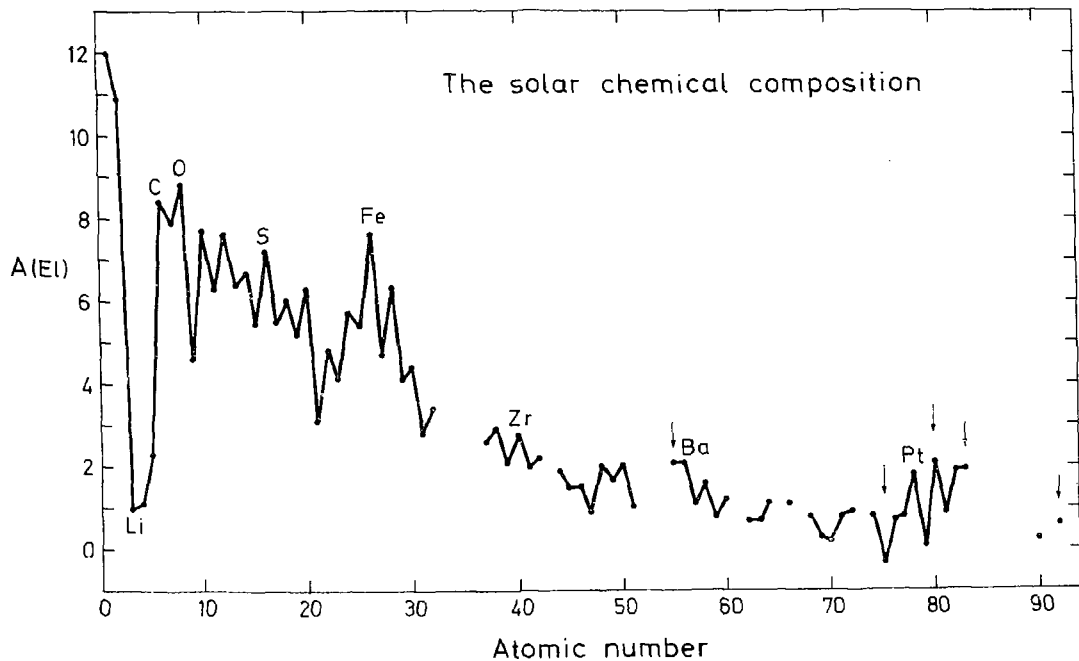


Figure 1. The graph shows the recommended values of Table 1 for solar abundances. Arrows denote the cases where only an upper limit for the abundance is known.

TABLE 1

Z	EL	A(EL) RECOMMENDED	N(EL) 6 10 N(SI)	A(EL)	REF.	COMMENTS
1	H	12,0				REFERENCE ELEMENT
2	HE	10,9	.20E+10	10,90 10,60 > 10,70 10,80 10,80 11,00 11,00 10,43	10 31 77 73 89 116 118 158	SOLAR MODEL SOLAR FLARE PARTICLES SOLAR PROMINENCES PROM. CORONA COSMIC RAYS CORONA XUV SOLAR WIND COSMIC RAYS REL, SI
3	LI	1,0	.25E+00	0,80 1,00 1,10 0,68	40 112 146 151	SUNSPOT LI I PHOTOSPHERE LI I SUNSPOT LI I SUNSPOT LI I
4	BE	1,1	.32E+00	1,15 1,17 0,96 1,08	26 50 69 133	PHOTOSPHERE BE II PHOTOSPHERE BE II PHOTOSPHERE BE II PHOTOSPHERE BE II
5	B	2,3	.50E+01	< 2,50 < 2,80 < 2,08 2,60 < 2,30	39 50 61 87 163	SUNSPOT BH PHOTOSPHERE B I PHOTOSPHERE B I PHOTOSPH. B I 2497A PHOTOSPHERE B I
6	C	8,4	.63E+07	8,88 8,34 8,33 8,55 8,78 8,61 8,44 8,66 8,30 8,60 8,30 8,55 8,60 8,68 8,05	8 31 32 37 48 53 83 91 108 115 116 136 150 159 167	CORONA XUV REL. SI SOLAR FLARE PARTICLES PHOTOSPHERE C ₂ EUV SPECTRA PHOTOSPHERE PHOTOSPHERE CORONA XUV ADOPTED BY D.L. LAMBERT PHOTOSPHERE CN PHOTOSPH. FORB. LINES CORONA XUV PHOTOSPH. MOLECULES REVISED F-VALUES CORONA XUV REL, SI PROMINENCE, CORONA

TABLE 1 (CONT.)

2	EL	A(EL) RECOMMENDED	N(EL) 6 10 N(SI)	A(EL)	REF.	COMMENTS
7	N	7.9	.20E+07	9,13 7,70 7,78 8,18 8,19 7,81 7,93 7,93 7,50 7,95 7,75 7,78	8 24 31 37 53 83 90 91 116 154 162 167	CORONA XUV REL, SI CHROM, CORONA REL, C SOLAR FLARE PARTICLES COR. CHROM. XUV PHOTOSPHERE CORONA XUV PHOTOSPH, ATOMS, MOLEC. ADOPTED BY D.L. LAMBERT CORONA XUV ACTIVE COR. XUV CORONA XUV REL, SI PROMINENCE, CORONA
8	O	3.8	.16E+08	8,71 8,72 8,70 8,64 8,27 8,77 8,90 8,84 8,77 8,88 8,85 8,83 8,93 8,80 8,45 8,87 8,85 8,60 8,42 8,02	8 11 24 31 33 37 53 83 90 91 103 110 115 116 119 150 154 158 162 167	CORONA XUV REL, SI SOLAR WIND CHROM, CORONA REL, C SOLAR FLARE PARTICLES XUV ACTIVE REGION COR. CHROM. XUV PHOTOSPHERE CORONA XUV PHOTOSPH, ATOMS, MOLEC. ADOPTED BY D.L. LAMBERT CORONA XUV REL, FE PHOTOSPH, ATOMIC LINES PHOTOSPH, FORB. LINES CORONA XUV CORONAL X-RAY REVISED F-VALUES ACTIVE COR. XUV COSMIC RAYS REL, SI CORONA XUV REL, SI PROMINENCE, CORONA
9	F	4.6	.10E+04	4,56	62	SUNSPOT HF MOLECULES
10	NE	7.7	.13E+07	8,13 7,60 7,73 7,45 7,45 7,95 8,26 7,50 7,65 7,77 7,48 7,73 7,83 8,30 7,31	1 8 31 33 37 83 103 116 119 123 124 154 158 159 162	CORONA XUV REL, O CORONA XUV REL, SI SOLAR FLARE PARTICLES XUV ACTIVE REGION COR. CHROM. XUV CORONA XUV CORONA XUV REL, FE CORONA XUV CORONAL X-RAY CORONA XUV XUV EM, LINES REL, SI ACTIVE COR. XUV COSMIC RAYS REL, SI CORONA XUV REL, SI CORONA XUV REL, SI

TABLE 1 (CONT.)

Z	EL	A(EL) RECOMMENDED	N(EL) 6 10 H(SI)	A(EL)	REF.	COMMENTS
11	NA	6.3	.50E+05	6.48	8	CORONA XUV REL, SI
				6.38	37	COR. CHROM, XUV
				6.30	74	PHOTOSPHERE NA I
				6.29	91	ADOPTED BY D,L, LAMBERT
				6.18	96	PHOTOSPHERE NA I
				6.50	119	CORONAL X-RAY
				6.18	150	REVICED F-VALUES
				6.29	153	CORONA XUV REL, SI
				6.92	158	COSMIC RAYS REL, SI
				6.36	162	CORONA XUV REL, SI
				6.33	165	PHOTOSPHERE NA I
				5.48	166	SOLAR PROMINENCES
12	MG	7.6	.10E+07	7.60	8	CORONA XUV REL, SI
				7.84	31	SOLAR FLARE PARTICLES
				7.48	37	COR. CHROM, XUV
				7.75	83	CORONA XUV
				7.56	91	ADOPTED BY D,L, LAMBERT
				7.48	98	PHOTOSPHERE
				8.02	103	CORONA XUV REL, FE
				7.60	116	CORONA XUV
				7.65	119	CORONAL X-RAY
				7.85	124	XUV EM. LINES REL, SI
				7.60	135	PHOTOSPHERE
				7.53	136	CORONA XUV REL, NE
				7.48	150	REVICED F-VALUES
				7.48	154	ACTIVE COR, XUV
				7.92	158	COSMIC RAYS REL, SI
				8.00	159	CORONA XUV REL, SI
				7.40	161	COR. CHROM, XUV
				7.30	166	SOLAR PROMINENCES
13	AL	6.4	.63E+05	6.40	8	CORONA XUV REL, SI
				6.57	37	COR. CHROM, XUV
				6.40	91	ADOPTED BY D,L, LAMBERT
				6.40	96	PHOTOSPHERE
				6.26	99	PHOTOSPHERE AL I
				6.70	123	CORONA XUV
				6.40	150	REVICED F-VALUES
				6.46	153	CORONA XUV REL, SI
				7.88	158	COSMIC RAYS REL, SI
				6.35	162	CORONA XUV REL, SI

TABLE 1 (CONT.)

Z	EL	A(EL) RECOMMENDED	N(EL) 6 10 N(SI)	A(EL)	REF.	COMMENTS
14	SI	7.5	.10E+07	7.88	11	SOLAR WIND
				7.70	24	CHROM, CORONA REL, C
				7.55	37	COR. CHROM, XUV
				7.50	60	PHOTOSPH, FORB, LINES
				7.65	76	PHOTOSPHERE SI I
				7.70	81	CORONA XUV
				7.65	83	CORONA XUV
				7.60	91	ADOPTED BY D.L. LAMBERT
				7.55	97	PHOTOSPHERE SI I, SI II
				7.86	103	CORONA XUV REL, FE
				7.50	116	CORONA XUV
				7.65	119	CORONAL X-RAY
				7.56	150	REVICED F-VALUES
				7.50	161	COR, CHROM, XUV
				7.55	167	PROMINENCE, CORONA
15	P	5.5	.79E+04	5.45	8	CORONA XUV REL, SI
				5.45	91	ADOPTED BY D.L. LAMBERT
				5.43	96	PHOTOSPHERE P I
				5.90	123	CORONA XUV
				5.50	135	PHOTOSPHERE P I
16	S	7.2	.40E+06	7.39	8	CORONA XUV REL, SI
				7.20	24	CHROM, CORONA REL, C
				6.83	31	SOLAR FLARE PARTICLES
				7.31	37	COR, CHROM, XUV
				7.11	83	CORONA XUV
				7.25	91	ADOPTED BY D.L. LAMBERT
				7.21	96	PHOTOSPHERE S I
				6.80	102	CORONA REL, FE
				7.00	103	CORONA XUV REL, FE
				7.00	116	CORONA XUV
				7.10	122	CORONA FORB, LINES
				7.20	135	PHOTOSPHERE S I
				7.21	149	PHOTOSPH, FORB, LINES
				7.23	150	REVICED F-VALUES
				7.01	153	CORONA XUV REL, SI
				7.53	167	PROMINENCE, CORONA
17	CL	5.5	.79E+04	5.40	63	SUNSPOT HCL
				5.50	91	ADOPTED BY D.L. LAMBERT
				5.50	93	PHOTOSPHERE CL I

TABLE 1 (CONT.)

Z	EL	A(EL) RECOMENDED	N(EL) 6 10 V(SI)	A(EL)	REF.	COMMENTS
18	AR	6.0	.25E+05	6,20 5,50 6,50 6,84	31 34 117 153	SOLAR FLARE PARTICLES COR, FORB, LINES CORONA CORONA XUV REL, SI
19	K	5.2	.40E+04	5,14 5,15 5,05 5,90 5,16	35 91 96 122 135	PHOTOSPHERE K I ADOPTED BY D,L, LAMBERT PHOTOSPHERE K I COR, FORB, LINES PHOTOSPHERE K I
20	CA	6.3	.50E+05	6,45 6,40 7,65 6,36 6,32 6,33 7,05 6,60 6,21 6,33 6,33 6,28	31 34 42 75 91 98 102 117 139 142 150 166	SOLAR FLARE PARTICLES COR, FORB, LINES CORONA PHOTOSPH, CA I, CA II ADOPTED BY D,L, LAMBERT PHOTOSPH, CA I, CA CORONA REL, FE CORONA PHOTOSPH, FORB, LINE CHROMOSPHERE REVICED F-VALUES SOLAR PROMINENCES
21	SC	3.1	.32E+02	3,04 2,82 3,10 3,10 2,90 4,08 3,30 3,04 3,20	15 48 53 54 114 120 143 156 166	REVICED F-VALUES PHOTOSPHERE SC I PHOTOSPH, SC I AND SC II ADOPTED BY GREVESSE CHROMOSPHERE AT 500 KM CHROMOSPHERE REVICED F-VALUES SC II PHOTOSPHERE SC II SOLAR PROMINENCES

TABLE 1 (CONT.)

2	FL	A(EL) RECOMMENDED	N(EL) 6 10 N(SI)	A(EL)	REF.	COMMENTS
22	TI	4.8	.16E+04	4.74	13	REVICED F-VALUE TI I
				4.88	14	REVICED F-VALUES, TI I
				4.82	17	PHOTOSPH. IR=LINES
				< 5.83	31	SOLAR FLARE PARTICLES
				4.82	44	PHOTOSPHERE
				4.68	48	PHOTOSPHERE TI I
				4.74	53	PHOTOSPHERE TI I
				5.00	54	ADOPTED BY GREVESSE
				4.70	114	CHROMOSPHERE AT 500 KM
				5.32	120	CHROMOSPHERE
				5.02	143	REVICED F-VALUES TI II
				4.50	156	PHOTOSPHERE TI II
				4.78	164	PHOTOSPHERE TI I, TI II
				4.94	166	SOLAR PROMINENCES
23	V	4.1	.32E+03	4.12	3	PHOTOSPHERE V I
				4.10	53	PHOTOSPH. V I AND V II
				4.00	54	ADOPTED BY GREVESSE
				5.80	117	CORONA
				4.21	143	REVICED F-VALUES V II
				3.92	156	PHOTOSPHERE V II
24	CR	5.7	.13E+05	5.69	17	PHOTOSPH. IR=LINES
				5.31	19	REVICED F-VALUES
				5.33	22	PHOTOSPHERE
				5.85	28	REVICED F-VALUES
				5.80	29	PHOTOSPHERE CR I
				6.80	34	COR. FORB. LINES
				5.75	45	PHOTOSPHERE CR I
				5.70	53	PHOTOSPHERE CR I
				5.70	54	DOPTED BY GREVESSE
				4.80	114	CHROMOSPHERE AT 500 KM
				5.71	135	PHOTOSPHERE
				6.12	143	REVICED F-VALUES CR II
				5.65	157	PHOTOSPHERE CR I, CR II
25	MN	5.4	.63E+04	5.37	16	PHOTOSPHERE MN I
				5.42	20	PHOTOSPHERE MN I
				6.90	34	COR. FORB. LINES
				5.20	53	PHOTOSPHERE MN I
				5.40	54	ADOPTED BY GREVESSE
				5.41	105	PHOTOSPHERE MN I
				5.70	117	CORONA
				5.34	121	REVICED F-VALUES
				4.84	143	REVICED F-VALUES MN II

TABLE 1 (CONT.)

Z	EL	A(EL) RECOMMENDED	N(EL) 6 10 N(SI)	A(EL)	REF.	COMMENTS
26	FE	7.6	.10E+07	6.68	8	CORONA XUV REL. SI
				7.72	11	SOLAR WIND
				7.63	12	PHOTOSPHERE FE II
				7.57	18	PHOTOSPHERE
				7.60	21	PHOTOSPHERE FE I
				7.00	30	PHOTOSPHERE FE I
				7.54	31	SOLAR FLARE PARTICLES
				7.68	33	XUV ACTIVE REGION
				8.00	34	COR. FORB. LINES
				7.30	37	COR. CHROM. XUV
				7.10	41	COSMIC RAYS
				7.28	43	PHOTOSPHERE FE I, FE II
				7.60	47	PHOTOSPHERE FE I
				7.50	53	PHOTOSPHERE
				7.50	54	ADOPTED BY GREVESSE
				7.50	57	PHOTOSPHERE FORB. FE I
				7.50	59	SPOTS, FORB. FE I LINES
				7.64	79	PHOTOSPHERE FE I
				7.70	82	COR. FORB. LINES
				7.65	83	CORONA XUV
				7.20	101	PHOTOSPHERE FE I
				7.78	104	CORONA IR FE XIII
				7.45	106	PHOTOSPHERE FE I
				6.90	114	CHROMOSPHERE AT 500 KM
				7.30	117	CORONA
				7.65	119	CORONAL X-RAY
				7.60	124	XUV EM. LINES REL. SI
				7.55	125	PHOTOSPHERE FE I
				6.85	127	PHOTOSPHERE FE I
				7.40	129	PHOTOSPHERE FE I
				7.10	143	REVICED F=VALUES FE II
				7.31	144	PHOTOSPHERE FE II
				7.76	147	CORONAL CONDENSATION
				7.48	150	REVICED F=VALUES
				7.60	154	ACTIVE COR. XUV
				7.78	159	CORONA XUV REL. SI
				7.40	166	SOLAR PROMINENCES
27	CO	4.7	.13E+04	6.00	34	COR. FORB. LINES
				4.65	53	PHOTOSPHERE
				5.00	54	ADOPTED BY GREVESSE
				4.50	77	PHOTOSPHERE CO I
				4.97	84	REVICED F=VALUES PHOT.
				4.40	111	PHOTOSPHERE
				5.30	117	CORONA
				4.46	143	REVICED F=VALUES CO II
				3.53	156	PHOTOSPHERE CO II

TABLE 1 (CONT.)

Z	EL	A(EL) RECOMMENDED	N(EL) 6 10 N(SI)	A(EL)	REF.	COMMENTS
28	NI	6.3	.50E+05	6.21	17	PHOTOSPH. IR-LINES
				5.6R	22	PHOTOSPHERE NI I
				6.30	31	SOLAR FLARE PARTICLES
				6.72	34	COR. FORB. LINES
				6.25	46	PHOTOSPHERE NI I
				6.32	53	PHOTOSPH. FORB. NI II
				6.30	54	ADOPTED BY GREVESSE
				6.30	58	PHOTOSPH. FORB. NI II
				6.70	81	CORONA XUV
				6.25	83	CORONA XUV
				6.28	100	PHOTOSPHERE NI I
				6.35	102	CORONA REL. FE
				6.30	103	CORONA XUV REL. FE
				6.30	117	CORONA
				6.40	119	CORONAL X-RAY
				5.30	143	REVICED F=VALUES NI II
				6.80	147	CORONAL CONDENSATION
				6.41	150	REVICED F=VALUES
				6.90	159	CORONA XUV REL. SJ
29	CU	4.1	.32E+03	4.60	34	COR. FORB. LINES
				4.16	86	PHOTOSPHERE CU I
				4.06	135	PHOTOSPHERE
				4.22	140	PHOTOSPHERE
30	ZN	4.4	.63E+03	4.42	95	PHOTOSPHERE ZN I
				4.45	135	PHOTOSPHERE
31	GA	2.8	.16E+02	1.43	27	SUNSPOT GA I
				2.72	85	PHOTOSPHERE GA I
				2.83	113	PHOTOSPHERE GA I
				2.80	128	PHOTOSPHERE GA I
32	GE	3.4	.63E+02	3.32	95	PHOTOSPHERE GE I
				3.50	132	PHOTOSPHERE GE I
33	AS					NO LINES IDENTIFIED
34	SE					NO LINES IDENTIFIED

TABLE 1 (CONT.)

Z	EL	A(EL) RECOMMENDED	N(EL) 6 10 N(SI)	A(EL)	REF.	COMMENTS
35	BR					NO LINES IDENTIFIED
36	KR					NO LINES IDENTIFIED
37	RB	2.6	.10E+02	2.60 2.63 < 2.80	65 92 145	PHOTOSPHERE RB I PHOTOSPHERE RB I SUNSPOT REL, ZR
38	SR	2.9	.20E+02	2.86 2.90 2.60 3.00 2.93	49 66 114 120 166	PHOTOSPHERE SR I, SR II PHOTOSPHERE SR I CHROMOSPHERE AT 500 KM CHROMOSPHERE SOLAR PROMINENCES
39	Y	2.1	.32E+01	2.18 2.10 2.10	2 135 155	PHOTOSPHERE Y II PHOTOSPHERE PHOTOSPHERE Y II
40	ZR	2.8	.16E+02	2.80 2.60 2.75	56 114 135	PHOTOSPHERE ZR I, ZR II CHROMOSPHERE AT 500 KM PHOTOSPHERE
41	NB	2.0	.25E+01	2.13 1.90	71 135	PHOTOSPHERE NB I, NB II PHOTOSPHERE
42	MD	2.2	.40E+01	2.52 2.16	56 135	PHOTOSPHERE MD I PHOTOSPHERE
43	TC					RADIOACTIVE
44	RU	1.9	.20E+01	1.98 1.83	56 135	PHOTOSPHERE RU I PHOTOSPHERE
45	RH	1.5	.79E+00	1.37 1.55	3 56	PHOTOSPHERE RH I PHOTOSPHERE RH I

TABLE 1 (CONT.)

Z	EL	A(EL) RECOMMENDED	N(EL) b $10^{-N}(SI)$	A(EL)	REF.	COMMENTS
46	PD	1,5	.79E+00	1,21	48	PHOTOSPHERE PD I
				1,37	56	PHOTOSPHERE PD I
				1,64	109	PHOTOSPHERE PD I
				1,50	135	PHOTOSPHERE
47	AG	0,9	.20E+00	0,58	22	PHOTOSPHERE AG I
				1,12	56	PHOTOSPHERE AG I
				0,85	131	PHOTOSPHERE AG I
48	CD	2,0	.25E+01	1,86	64	PHOTOSPHERE CD I
				2,07	95	PHOTOSPHERE CD I
49	IN	1,7	.13E+01	1,71	95	PHOTOSPHERE IN I
				1,65	145	SUNSPOT REL, ZR
50	SN	2,0	.25E+01	1,32	56	PHOTOSPHERE SN I
				1,71	95	PHOTOSPHERE SN I
				2,00	135	PHOTOSPHERE
51	SB	1,0	.25E+00	1,04	56	PHOTOSPHERE SB I
				1,00	135	PHOTOSPHERE
52	IE					NO LINES IDENTIFIED
53	I					NO LINES IDENTIFIED
54	XE					NO LINES IDENTIFIED
55	CS	< 2,1	< .32E+01	< 2,07	145	SUNSPOT REL, TI
56	BA	2,1	.32E+01	2,06	56	PHOTOSPHERE BA II
				2,11	78	PHOTOSPHERE BA I, BA II
				1,90	98	PHOTOSPHERE BA II
				2,10	114	CHROMOSPHERE AT 500 KM
				2,61	120	CHROMOSPHERE
				2,08	141	PHOTOSPHERE BA II
				2,07	152	SUNSPOTS BA I
				2,59	166	SOLAR PROMINENCES

TABLE 1 (CONT.)

Z	EL	A(EL) RECOMENDED	N(EL) 6 10 N(SI)	A(EL)	REF,	COMMENTS
57	LA	1,1	.32E+00	1,13 1,81 2,61 2,06	7 55 107 155	REVICED F=VALUES PHOTOSPHERE LA II SUNSPOTS LA I, LA II PHOTOSPHERE LA II
58	CE	1,6	.10E+01	1,55 1,40 1,88	7 25 55	REVICED F=VALUES PHOTOSPHERE CE II PHOTOSPHERE CE II
59	PR	0,8	.16E+00	0,99 1,63 0,66 1,45	7 55 88 126	REVICED F=VALUES PHOTOSPHERE PR II REVICED F=VALUES PHOTOSPHERE PR II
60	ND	1,2	.40E+00	1,23 1,82 1,93	7 55 126	REVICED F=VALUES PHOTOSPHERE ND II PHOTOSPHERE ND II
61	PM					RADIOACTIVE
62	SM	0,7	.13E+00	0,72 1,54 1,66 2,30 1,62	7 38 55 107 126	REVICED F=VALUES PHOTOSPHERE SM II PHOTOSPHERE SM II PHOTOSPH, SPOT SM I, II PHOTOSPHERE SM II
63	EU	0,7	.13E+00	1,00 0,49 0,70 0,70 0,96	9 55 67 107 126	PHOTOSPH., SPOTS EU II PHOTOSPHERE EU II PHOTOSPHERE EU II PHOTOSPH, SPOTS EU II PHOTOSPHERE EU II
64	GD	1,1	.32E+00	1,12 1,13	55 126	PHOTOSPHERE GD II PHOTOSPHERE GD II
65	TB					NO F=VALUES

TABLE 1 (CONT.)

Z	EL	A(EL) RECOMMENDED	N(EL) b 10 N(S1)	A(EL)	REF.	COMMENTS
66	DY	1.1	.32E+00	1.11 1.00	55 126	PHOTOSPHERE DY I I PHOTOSPHERE DY I I
67	HJ					NO F-VALUES
68	ER	0.8	.16E+00	1.75 0.76	22 55	PHOTOSPHERE ER I I PHOTOSPHERE ER I I
69	TM	0.3	.50E-01	0.26 0.43 0.80	7 55 134	REVISED F-VALUES PHOTOSPHERE TM I I PHOTOSPHERE TM I I
70	YB	0.2	.40E-01	1.51 0.23 0.82 0.81	7 7 22 55	REVISED F-VALUES YB I REVISED F-VALUES YB I I PHOTOSPHERE YB I I PHOTOSPHERE YB I I
71	LU	0.8	.16E+00	0.76 0.68 0.84	7 22 55	REVISED F-VALUES PHOTOSPHERE PHOTOSPHERE LU I I
72	HF	0.9	.20E+00	0.88 0.90	5 137	PHOTOSPHERE HF I I PHOTOSPHERE
73	TA					NO LINES IDENTIFIED
74	w	0.8	.16E+00	0.75 1.70 0.70	4 135 137	PHOTOSPHERE w I PHOTOSPHERE PHOTOSPHERE
75	RE	<0.3	<-.13E-01	<0.30	148	PHOTOSPHERE RE I
76	DS	0.7	.13E+00	0.75 0.70	56 80	PHOTOSPHERE PHOTOSPHERE DS I
77	IR	0.8	.16E+00	0.82	36	PHOTOSPHERE IR I

TABLE 1 (CONT.)

Z	EL	A(EL) RECOMMENDED	N(EL) 6 10 N(SI)	A(EL)	REF.	COMMENTS
78	PT	1.8	.16E+01	1.75 2.10	23 137	PHOTOSPHERE PT I PHOTOSPHERE
79	AU	0.1	.32E+01	0.13	130	PHOTOSPHERE AU I
80	HG	< 2.1	< .32E+01	< 2.10	52	PHOTOSPHERE HG I
81	TL	0.9	.20E+00	0.90	94	SUNSPOTS TL I
82	PB	1.9	.20E+01	1.83 1.90	51 70	PHOTOSPHERE PB I PHOTOSPHERE PB I
83	BI	< 1.9	< .20E+01	< 1.90	68	PHOTOSPHERE BI I
90	TH	0.2	.40E+01	0.20 0.82 0.85	6 51 70	REVISED F-VALUES PHOTOSPHERE TH II PHOTOSPHERE TH II
92	U	< 0.6	< .10E+00	< 0.60	51	PHOTOSPHERE

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