

## Roebblingite, $\text{Pb}_2\text{Ca}_6(\text{SO}_4)_2(\text{OH})_2(\text{H}_2\text{O})_4[\text{Mn}(\text{Si}_3\text{O}_9)_2]$ : its crystal structure and comments on the lone pair effect

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### Abstract

Roebblingite,  $\text{Pb}_2\text{Ca}_6(\text{SO}_4)_2(\text{OH})_2(\text{H}_2\text{O})_4[\text{Mn}(\text{Si}_3\text{O}_9)_2]$ , monoclinic holosymmetric,  $a = 13.208(4)$ ,  $b = 8.287(2)$ ,  $c = 13.089(9)\text{\AA}$ ,  $\beta = 106.65(6)^\circ$ , space group  $C2/m$ , possesses a  $2[\text{Mn}(\text{Si}_3\text{O}_9)_2]^{10-}$  corner-linked sheet oriented parallel to  $c\{001\}$ , the plane of perfect micaceous cleavage.  $R = 0.066$  for 2479 nonequivalent reflections.

The large cations are tucked between the  $[\text{Mn}(\text{Si}_3\text{O}_9)_2]$  sheets. All vertices of the  $\text{MnO}_6$  octahedron link to the  $(\text{Si}_3\text{O}_9)$  radicals which are oligosilicate three-membered rings and are geometrically similar to the rings in paragenetically related margarosanite,  $\text{PbCa}_2[\text{Si}_3\text{O}_9]$ . Coordination polyhedra include  $\text{Pb}\phi_7$  (maximal point symmetry  $mm2$ );  $\text{Ca}(1)\phi_8$  distorted square antiprisms;  $\text{Ca}(2)\phi_7$  polyhedra similar to  $\text{Pb}\phi_7$ ;  $\text{MnO}_6$  octahedra;  $\text{SiO}_4$ ,  $\text{SO}_4$  tetrahedra. Mean bond distances are:  $\text{Pb}-\text{O}$  2.82 (2.22 to 3.42),  $\text{Ca}(1)-\text{O}$  2.53,  $\text{Ca}(2)-\text{O}$  2.43,  $\text{Mn}-\text{O}$  2.22,  $\text{Si}(1)-\text{O}$  1.64,  $\text{Si}(2)-\text{O}$  1.62 and  $\text{S}-\text{O}$  1.47\AA.

The packing efficiency, defined as the volume of the unit cell divided by the total number of anions in that cell, is usually close to the values of hcp or ccp oxysalt structures for most minerals which don't have channels. This value,  $V_E$ , is unusually large for  $\text{Pb}(\text{II})$  oxysalts. By including the number of lone pair cations for that cell, the value,  $V_{E+L}$ , is more reasonable and approximates the packing efficiencies for oxysalts with those cations of similar size but stripped of all valence electrons.

### Introduction

Roebblingite is an exotic phase, presently known from two localities. It was described from the type locality at Franklin, New Jersey (Penfield and Foote, 1897) as a sulfite-bearing silicate; Blix (1931) showed that it is a sulfate-bearing silicate, based on the Franklin material and a more recent find from Långban, Sweden where it occurred as fracture fillings. Foit (1966) examined its crystallographic character on coarse platy Långban material. We agree with his findings, except that the space group appears to be  $C2/m$ , not  $C2/c$ . Finally, Dunn et al. (1982) reported several new chemical analyses on roebblingite, but the differences from the Blix analysis are small. We include their chemical analysis for a Långban roebblingite in Table 1.

The senior author has long been interested in roebblingite; over fifteen years ago, crystals were secured from the Swedish Natural History Museum with plans of eventual-

ly unravelling its structure, and especially determining the role of the sulfur cation. More recently, increased interest in  $\text{Pb}(\text{II})$  from oxysalt and sulfosalt environments and the micaceous nature of the material prompted a more detailed structure investigation.

### Experimental procedure

At least ten chemical analyses have been reported in the literature, and three are selected for Table 1. One of the motivations for the present study concerns the formal charge on sulfur: is it  $\text{S}^{4+}$  or  $\text{S}^{6+}$ ? Penfield and Foote (1897) were cautious in their study and reported  $\text{SO}_2$  as the oxide. However, Blix (1931) re-investigated the problem, analyzing Franklin material and the recent find of Långban material. He concluded that sulfur occurred as  $\text{SO}_3$ , a conclusion we similarly make on the basis of structure study, for Långban material at least.

A small vial of palest pink flakes from Långban,

Moore, P.B. and Shen, J.

Table 3. Roebbingite. Structure factors.  $R=0.066$

OBSERVED AND CALCULATED STRUCTURE FACTORS FOR										ROEBBLINGITE DATA RED 2/19/82										PAGE 1					
H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC						
4	0	0	43	-31	0	4	0	545	495	13	7	7	39	-46	8	12	0	50	25	15	1	1	1	66	-64
6	0	0	164	-151	2	4	0	61	-45	15	7	0	89	-88	1	13	0	55	37	17	1	1	1	55	53
8	0	0	30	-16	4	4	0	35	-27	17	7	0	46	-35	5	13	0	86	-87	-18	2	1	1	85	-95
10	0	0	169	164	6	4	0	179	-173	0	8	0	252	249	-20	0	1	87	-80	-16	2	1	1	76	-64
14	0	0	56	-65	8	4	0	88	86	2	8	0	61	-55	-18	0	1	55	-58	-14	2	1	1	65	-72
18	0	0	71	75	10	4	0	193	191	4	8	0	53	-31	-16	0	1	192	-191	-12	2	1	1	141	134
20	0	0	119	123	12	4	0	40	28	6	8	0	100	-91	-14	0	1	77	-69	-10	2	1	1	75	69
1	1	0	163	153	14	4	0	104	-91	8	8	0	54	58	-10	0	1	65	61	-8	2	1	1	148	-145
3	1	0	173	-178	16	4	0	40	-26	10	8	0	133	129	-8	0	1	65	-63	-6	2	1	1	111	-115
5	1	0	280	-279	18	4	0	50	32	12	8	0	56	40	-6	0	1	446	-461	-4	2	1	1	112	-116
7	1	0	82	-83	1	5	0	129	110	14	8	0	76	-77	-4	0	1	178	179	-2	2	1	1	260	230
9	1	0	198	190	3	5	0	100	-78	16	8	0	42	-36	-2	0	1	235	226	0	2	1	1	282	240
11	1	0	94	95	5	5	0	306	-285	1	9	0	50	33	0	0	1	44	-14	0	2	1	1	281	-300
15	1	0	154	-151	7	5	0	54	-55	3	9	0	52	-9	2	0	1	231	-231	4	2	1	1	238	-237
19	1	0	46	32	9	5	0	169	157	5	9	0	151	-143	4	0	1	145	144	6	2	1	1	121	-125
2	2	0	411	334	11	5	0	142	-142	7	9	0	52	16	8	0	1	70	73	8	2	1	1	103	101
4	2	0	57	-49	15	5	0	43	31	9	9	0	156	152	10	0	1	36	-35	10	2	1	1	122	113
6	2	0	244	-242	19	5	0	485	471	11	9	0	135	60	12	0	1	36	-35	12	2	1	1	165	-170
8	2	0	215	211	2	6	0	137	-130	15	9	0	175	185	14	0	1	111	-124	14	2	1	1	45	-46
10	2	0	94	93	4	6	0	67	48	2	10	0	51	45	18	0	1	58	-73	16	2	1	1	51	-31
12	2	0	105	106	6	6	0	190	-183	6	10	0	125	-122	-15	1	1	71	-57	20	2	1	1	46	51
14	2	0	87	-94	8	6	0	96	88	8	10	0	97	89	-13	1	1	70	64	-17	3	1	1	73	-61
16	2	0	101	-97	10	6	0	38	31	10	10	0	78	69	-11	1	1	245	238	-13	3	1	1	149	149
18	2	0	93	93	12	6	0	69	70	12	10	0	48	33	-9	1	1	64	63	-11	3	1	1	164	161
20	2	0	45	51	14	6	0	50	-40	1	11	0	73	77	-7	1	1	206	-201	-9	3	1	1	68	-60
1	3	0	92	82	16	6	0	46	-27	3	11	0	81	-84	-5	1	1	95	-96	-7	3	1	1	257	-245
5	3	0	164	-150	18	6	0	113	113	5	11	0	79	-83	-3	1	1	180	183	-5	3	1	1	288	-285
7	3	0	61	-53	14	6	0	120	-139	7	11	0	90	-77	-3	1	1	224	226	-1	3	1	1	276	222
9	3	0	258	259	3	7	0	157	-139	9	11	0	88	80	1	1	1	31	48	3	3	1	1	239	210
11	3	0	132	129	5	7	0	101	-84	11	11	0	54	49	3	1	1	279	-281	1	3	1	1	107	-109
13	3	0	62	-51	7	7	0	89	86	2	12	0	183	208	9	1	1	141	139	5	3	1	1	31	-27
15	3	0	160	-153	9	7	0	127	123	2	12	0	42	45	9	1	1	263	253	7	3	1	1	122	121
17	3	0	51	-51	11	7	0	97	91	6	12	0	76	-75	13	1	1	136	-139	9	3	1	1	140	127

## OBSERVED AND CALCULATED STRUCTURE FACTORS FOR ROEBLINGITE DATA RED 2/19/82

PAGE 2

H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC						
11	3	3	56	-56	-10	6	6	1	58	59	8	8	1	95	84	-2	12	1	85	74	7	1	2	138	135
13	3	3	141	-145	-8	6	6	1	135	-111	2	8	1	50	-38	2	12	1	86	-89	9	1	2	42	41
15	3	3	79	-76	-6	6	6	1	142	-139	4	8	1	222	-207	4	12	1	135	-130	11	1	2	231	-234
17	3	3	87	98	-2	6	6	1	210	177	8	8	1	59	62	6	12	1	51	-37	13	1	2	96	-85
19	3	3	105	112	0	6	6	1	52	52	12	8	1	47	-58	8	12	1	52	52	17	1	2	125	115
-16	4	4	146	-149	2	6	6	1	279	-257	14	8	1	81	-84	-1	13	1	56	87	-18	1	2	117	-112
-12	4	4	95	86	4	6	6	1	239	-224	16	8	1	53	-3	3	13	1	56	-50	-14	2	2	61	65
-8	4	4	38	-41	6	6	6	1	71	-69	-13	9	1	73	58	-20	0	2	51	-43	-12	2	2	92	93
-6	4	4	277	-273	8	6	6	1	81	98	-11	9	1	170	156	-18	0	2	93	-100	-6	2	2	57	-68
-2	4	4	238	220	10	6	6	1	126	133	-9	9	1	77	-62	-14	0	2	102	98	-6	2	2	118	-121
0	4	4	105	85	12	6	6	1	110	-104	-7	9	1	133	-127	-12	0	2	338	355	-4	2	2	385	389
2	4	4	124	-118	14	6	6	1	63	-44	-5	9	1	127	-124	-10	0	2	68	-71	-2	2	2	155	137
4	4	4	358	-359	-17	7	7	1	68	-68	-1	9	1	176	176	-8	0	2	79	-72	0	2	2	51	58
8	4	4	115	120	-15	7	7	1	51	-30	3	9	1	61	49	-6	0	2	77	-80	2	2	2	379	-388
10	4	4	35	18	-13	7	7	1	72	75	9	9	1	73	-76	-4	0	2	105	108	4	2	2	187	-188
12	4	4	63	-65	-11	7	7	1	129	110	9	9	1	121	117	-2	0	2	172	192	6	2	2	284	260
14	4	4	101	-101	-9	7	7	1	70	67	11	9	1	84	-60	0	0	2	243	-249	8	2	2	137	134
18	4	4	83	90	-7	7	7	1	145	-142	13	9	1	85	-94	2	2	2	243	93	12	2	2	74	-63
-15	5	5	60	-61	-5	7	7	1	111	-111	-6	10	1	89	68	6	0	2	250	247	16	2	2	134	136
-13	5	5	55	44	-3	7	7	1	154	138	-2	10	1	89	-94	8	0	2	230	233	-13	3	3	84	80
-11	5	5	250	227	-1	7	7	1	65	67	0	10	1	113	116	10	0	2	171	-171	-9	3	3	172	-176
-9	5	5	54	25	1	7	7	1	90	84	2	10	1	56	66	10	0	2	92	-94	-7	3	3	242	-250
-7	5	5	114	-108	3	7	7	1	146	-140	4	10	1	135	-117	12	0	2	171	91	-5	3	3	298	267
-5	5	5	78	-70	5	7	7	1	51	-57	8	10	1	145	-136	18	0	2	59	-59	-3	3	3	224	184
-3	5	5	122	124	9	7	7	1	128	125	12	10	1	65	62	-17	1	2	108	-103	-1	3	3	224	-222
-1	5	5	288	239	7	7	7	1	141	123	12	10	1	73	-73	-13	1	2	143	153	1	3	3	236	-222
3	5	5	238	-216	11	7	7	1	41	35	-9	11	1	89	73	-7	1	2	325	-338	3	3	3	211	-221
7	5	5	92	96	13	7	7	1	113	-101	-7	11	1	85	55	-9	1	2	67	57	7	3	3	40	31
9	5	5	240	241	15	7	7	1	81	-73	-5	11	1	113	112	-5	1	2	325	-338	7	3	3	40	31
13	5	5	114	-113	17	7	7	1	80	77	-3	11	1	104	-104	-3	1	2	219	226	9	3	3	103	104
-13	6	6	87	-80	-16	8	8	1	94	-84	3	11	1	107	107	-3	1	2	112	-112	11	3	3	224	-223
-14	6	6	93	-91	-12	8	8	1	68	63	7	11	1	86	85	3	1	2	241	-248	13	3	3	58	-79
-12	6	6	131	-122	-6	8	8	1	183	-172	9	11	1	86	85	3	1	2	241	-248	13	3	3	58	-79
-12	6	6	55	39	-2	8	8	1	123	115	-6	12	1	83	-82	5	1	2	70	69	15	3	3	41	41

OBSERVED AND CALCULATED STRUCTURE FACTORS FOR ROEBLINGITE DATA RED 2/19/82 PAGE 3

H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC
17	3	2	107	99	-4	6	2	190	178	-3	9	2	171	163	-4	0	3	194	189	-2	2	3	66	66
-18	4	2	82	-85	0	6	2	43	15	1	9	2	55	-54	0	0	3	200	-211	0	2	3	497	-430
-12	4	2	216	211	2	6	2	174	-162	3	9	2	187	-179	2	0	3	69	-81	2	2	3	156	-150
-10	4	2	83	-79	4	6	2	44	-31	5	9	2	42	23	4	0	3	224	211	4	2	3	74	69
-8	4	2	65	-65	6	6	2	257	263	11	9	2	97	-86	6	0	3	243	243	6	2	3	266	267
-4	4	2	185	168	8	6	2	105	105	13	9	2	85	-76	8	0	3	94	-93	8	2	3	37	39
-2	4	2	319	275	10	6	2	40	-37	13	9	2	56	43	10	0	3	51	-37	10	2	3	212	-209
0	4	2	100	-82	12	6	2	97	-106	-12	10	2	109	93	12	0	3	140	-147	12	2	3	119	-121
2	4	2	351	-345	14	6	2	72	-72	-8	10	2	69	-49	14	0	3	90	82	14	2	3	58	54
4	4	2	35	25	16	6	2	58	62	-4	10	2	147	142	16	0	3	104	90	18	2	3	45	29
6	4	2	92	98	-13	7	2	110	111	-2	10	2	74	69	18	0	3	41	-10	-19	3	3	73	-56
8	4	2	198	196	-9	7	2	134	-146	2	10	2	141	-140	-15	1	3	128	127	-17	3	3	70	70
12	4	2	98	107	-7	7	2	140	146	6	10	2	105	58	-13	1	3	63	67	-15	3	3	109	109
16	4	2	68	51	-3	7	2	167	137	8	10	2	79	73	-11	1	3	66	-68	-13	3	3	76	81
18	4	2	69	69	-1	7	2	86	72	-9	11	2	119	-115	-9	1	3	66	-68	-11	3	3	75	75
-19	5	2	50	-54	1	7	2	124	-118	-7	11	2	88	-85	-7	1	3	237	-246	-11	3	3	75	75
-17	5	2	113	-114	3	7	2	116	-123	-3	11	2	81	-85	-5	1	3	118	122	-7	3	3	182	-160
-13	5	2	136	-128	7	7	2	101	91	1	11	2	61	-99	-3	1	3	250	245	-7	3	3	79	81
-9	5	2	123	-123	9	7	2	49	60	3	11	2	55	-37	-1	1	3	438	446	-5	3	3	311	284
-7	5	2	282	-280	11	7	2	205	-206	9	11	2	60	49	1	1	3	107	-114	-3	3	3	175	170
-5	5	2	53	53	13	7	2	74	-41	11	11	2	148	-138	1	1	3	132	-138	-1	3	3	127	-122
-3	5	2	194	147	15	7	2	43	-19	-4	12	2	85	-90	5	1	3	52	162	1	3	3	88	88
1	5	2	103	-82	-12	8	2	123	113	2	12	2	85	-90	7	1	3	53	51	5	3	3	95	-91
3	5	2	199	-192	-10	8	2	77	-55	6	12	2	79	96	9	1	3	83	-78	7	3	3	387	430
5	5	2	113	116	-6	8	2	49	-30	8	12	2	71	81	9	1	3	90	-93	9	3	3	195	202
7	5	2	98	98	-4	8	2	177	153	-3	13	2	61	62	11	1	3	174	173	11	3	3	41	-33
11	5	2	165	-165	3	8	2	180	159	3	13	2	111	-117	15	1	3	63	70	15	3	3	165	162
13	5	2	88	-94	2	8	2	210	-204	-18	0	2	111	-117	-20	0	3	87	-88	-20	4	3	152	152
17	5	2	110	108	-16	0	2	66	-57	-16	0	2	110	-117	-18	0	3	64	-65	-18	4	3	126	-117
-18	6	2	98	-101	-14	0	2	73	78	-14	0	2	146	159	-14	0	3	127	143	-16	4	3	61	71
-14	6	2	131	127	-12	0	2	150	-73	-12	0	2	66	-73	-12	0	3	72	69	-14	4	3	129	123
-12	6	2	197	184	-10	0	2	52	-53	-10	0	2	107	-102	-10	0	3	142	-145	-10	4	3	45	-37
-8	6	2	65	-69	-7	0	2	202	-183	-8	0	2	249	-261	-8	0	3	104	-104	-8	4	3	223	-229
-6	6	2	124	-115	-5	0	2	55	64	-6	0	2	63	68	-4	0	3	139	131	-6	4	3	139	135

## OBSERVED AND CALCULATED STRUCTURE FACTORS FOR

## ROEBLINGITE DATA RED 2/19/82

PAGE 4

H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC					
-4	4	3	134	123	12	6	3	69	-72	5	9	3	118	130	2	0	4	41	48	-6	2	4	298	299
-2	4	3	140	-119	14	6	3	66	69	7	9	3	146	144	4	0	4	165	157	-4	2	4	85	86
0	4	3	169	-164	16	6	3	49	40	11	9	3	72	-70	6	0	4	158	161	0	2	4	60	-60
2	4	3	187	-192	-15	7	3	120	118	-14	10	3	59	84	8	0	4	65	-55	2	2	4	53	67
4	4	3	98	91	-9	7	3	159	-150	-10	10	3	81	-80	10	0	4	160	-158	4	2	4	410	434
6	4	3	284	293	-7	7	3	58	24	-8	10	3	89	-79	12	0	4	76	69	8	2	4	211	-204
8	4	3	68	-78	-5	7	3	207	181	-4	10	3	61	50	14	0	4	62	55	10	2	4	112	-111
10	4	3	74	-71	-3	7	3	250	212	0	10	3	134	-136	18	0	4	65	-56	14	2	4	160	151
12	4	3	154	-154	-1	7	3	62	-47	6	10	3	132	131	-21	1	4	89	-70	16	2	4	52	60
-15	5	3	98	101	3	7	3	112	-101	10	10	3	59	-68	-19	1	4	54	-77	-19	3	4	75	-68
-13	5	3	66	67	3	7	3	60	-57	12	10	3	63	-68	-15	1	4	50	42	-15	3	4	114	115
-11	5	3	69	-75	5	7	3	188	185	-9	11	3	125	-116	-13	1	4	51	-44	-11	3	4	221	-221
-9	5	3	225	-217	7	7	3	40	31	-5	11	3	157	148	-11	1	4	157	-166	-9	3	4	89	-86
-7	5	3	124	107	9	7	3	48	-45	-3	11	3	98	100	-9	1	4	78	-74	-5	3	4	137	126
-5	5	3	202	175	11	7	3	53	-56	3	11	3	81	-77	-7	1	4	201	197	-3	3	4	77	-82
-3	5	3	347	312	13	7	3	41	-9	5	11	3	104	98	-5	1	4	239	237	-1	3	4	477	-475
-1	5	3	91	-83	15	7	3	159	158	-6	12	3	87	-87	-3	1	4	120	-124	1	3	4	109	-109
1	5	3	101	-95	-14	8	3	85	90	-4	12	3	63	69	-1	1	4	337	-356	3	3	4	81	83
3	5	3	39	-42	-8	8	3	118	-117	-2	12	3	53	69	1	1	4	149	-167	5	3	4	115	120
5	5	3	75	79	0	8	3	85	85	0	12	3	86	86	3	1	4	27	26	7	3	4	103	-59
7	5	3	46	-47	2	8	3	204	-198	6	12	3	80	94	5	1	4	148	146	9	3	4	227	-224
9	5	3	76	-85	4	8	3	110	-113	6	12	3	80	94	7	1	4	31	-33	11	3	4	55	-50
11	5	3	91	-77	4	8	3	68	64	-3	13	3	152	143	9	1	4	124	-121	13	3	4	74	77
15	5	3	126	131	6	8	3	196	192	1	13	3	60	-62	11	1	4	59	97	15	3	4	51	60
17	5	3	72	74	10	8	3	79	-79	-20	0	4	55	-62	13	1	4	97	97	-20	4	4	62	-46
-14	6	3	134	126	-12	8	3	122	-125	-16	0	4	44	33	15	1	4	56	67	-18	4	4	58	60
-10	6	3	164	-166	-15	9	3	94	41	-14	0	4	91	93	17	1	4	80	-77	-16	4	4	128	136
-8	6	3	126	-108	-13	9	3	66	92	-12	0	4	108	-115	19	1	4	80	-86	-14	4	4	92	97
-4	6	3	147	125	-9	9	3	108	-100	-10	0	4	149	-148	-20	2	4	53	-59	-12	4	4	134	-139
0	6	3	139	123	-7	9	3	132	98	-8	0	4	111	113	-16	2	4	180	188	-10	4	4	138	-141
4	6	3	263	-255	-5	9	3	86	75	-6	0	4	167	154	-14	2	4	70	-82	-8	4	4	48	48
6	6	3	75	76	-3	9	3	165	152	-4	0	4	29	34	-12	2	4	58	72	-6	4	4	91	75
6	6	3	132	140	-1	9	3	104	-103	-2	0	4	248	-236	-10	2	4	162	-167	-4	4	4	192	187
10	6	3	113	-117	1	9	3	85	-83	0	0	4	312	-314	-8	2	4	107	-107	-2	4	4	93	-91

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H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC
0	4	4	144	-136	6	6	4	66	60	-1	9	4	126	-123	-18	0	5	91	84	11	1	5	100	100
2	4	4	172	176	8	6	4	57	-59	1	9	4	99	-105	-16	0	5	73	101	13	1	5	57	100
4	4	4	193	194	10	6	4	81	-72	3	9	4	66	61	-14	0	5	49	-70	15	1	5	51	61
6	4	4	96	94	14	6	4	98	101	5	9	4	103	91	-12	0	5	96	-91	17	1	5	94	38
8	4	4	153	-153	-11	7	4	169	-156	7	9	4	98	-108	-10	0	5	38	-28	-18	2	5	64	60
10	4	4	149	-161	-7	7	4	96	104	9	9	4	74	-85	-8	0	5	106	109	-14	2	5	68	-58
12	4	4	65	69	-5	7	4	141	128	11	9	4	60	-60	-6	0	5	168	168	-12	2	5	320	-318
14	4	4	62	63	-3	7	4	45	-37	13	9	4	69	36	-4	0	5	168	-181	-8	2	5	110	100
16	4	4	82	81	-1	7	4	279	-275	-12	10	4	84	-64	-2	0	5	81	-71	-6	2	5	156	150
18	4	4	89	-82	1	7	4	83	-85	-10	10	4	84	-68	0	0	5	164	-173	-4	2	5	43	30
19	5	4	53	37	3	7	4	44	45	-6	10	4	89	89	2	0	5	205	206	-2	2	5	331	-344
15	5	4	86	-73	5	7	4	44	75	-4	10	4	58	39	4	0	5	234	225	-4	2	5	213	215
13	5	4	86	-73	5	7	4	44	75	-2	10	4	49	-45	6	0	5	158	-146	6	2	5	84	-89
11	5	4	102	-107	9	7	4	136	-138	0	10	4	42	-57	8	0	5	252	-242	8	2	5	70	-70
9	5	4	53	-47	11	7	4	41	-25	4	10	4	135	140	10	0	5	34	-29	10	2	5	292	-291
7	5	4	171	162	13	7	4	85	83	0	10	4	71	-81	12	0	5	44	30	12	2	5	47	47
5	5	4	215	200	15	7	4	52	30	8	10	4	62	-60	14	0	5	126	119	14	2	5	129	114
3	5	4	104	-101	-16	8	4	95	86	-11	11	4	116	-107	16	0	5	99	-90	16	2	5	68	-63
1	5	4	238	-223	-14	8	4	98	104	-7	11	4	67	69	-21	1	5	70	-88	18	2	5	45	-29
5	5	4	149	-150	-10	8	4	87	-71	-5	11	4	87	86	-19	1	5	62	61	18	2	5	87	-87
5	5	4	133	135	-6	8	4	133	-130	-11	11	4	87	86	-17	1	5	73	71	18	2	5	87	-87
7	5	4	35	-32	-4	8	4	107	97	-11	11	4	57	-46	-15	1	5	110	119	-17	3	5	62	77
9	5	4	73	-72	0	8	4	107	103	-11	11	4	57	-46	-13	1	5	98	-99	-13	3	5	101	-106
11	5	4	60	-60	2	8	4	121	124	3	11	4	43	16	-11	1	5	35	-28	-9	3	5	409	402
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15	5	4	73	66	4	8	4	163	169	-6	12	4	103	91	-7	1	5	220	220	-3	3	5	211	-213
17	5	4	82	-78	8	8	4	121	-121	-4	12	4	50	-77	-3	1	5	33	-28	-3	3	5	77	77
16	6	4	99	91	10	8	4	49	45	-2	12	4	81	-77	-1	1	5	261	-268	-1	3	5	224	227
10	6	4	66	-51	12	8	4	85	74	0	12	4	82	-85	1	1	5	93	-97	1	3	5	77	77
12	6	4	108	-97	14	8	4	77	74	0	12	4	92	-78	-1	1	5	100	115	-1	3	5	224	227
6	6	4	265	238	15	8	4	64	-45	-3	13	4	66	-68	3	1	5	324	333	7	3	5	37	37
2	6	4	135	-143	-13	9	4	64	-45	-3	13	4	66	-68	5	1	5	112	115	9	3	5	32	32
0	6	4	151	-151	-9	9	4	101	-98	-1	13	4	84	-78	7	1	5	110	-105	11	3	5	128	124
4	6	4	48	-55	-5	9	4	89	75	1	13	4	66	-76	7	1	5	110	-105	11	3	5	128	124
4	6	4	220	219	-3	9	4	73	-83	-2	10	5	75	-68	9	1	5	128	-129	13	3	5	123	114

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H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC
17	3	5	123	-125	-12	6	5	188	-166	-15	9	5	61	66	-12	0	6	155	-151	-14	2	6	52	-61
-18	4	5	65	87	-10	6	48	38	38	-13	9	68	-76	-10	0	6	190	189	-12	2	6	44	-20	
-14	4	5	115	-108	-8	6	62	65	65	-9	9	84	87	-8	0	6	124	115	-10	2	6	160	152	
-12	4	5	176	-161	-6	6	73	69	69	-7	9	157	151	-6	0	6	239	234	-8	2	6	325	316	
-10	4	5	97	-92	-2	6	183	-174	-34	-5	9	106	85	-4	0	6	57	-45	-6	2	6	44	-53	
-8	4	5	127	114	0	6	37	-34	195	-3	9	109	-100	-2	0	6	248	-242	-4	2	6	209	-278	
-6	4	5	188	184	2	6	189	195	66	-1	9	91	88	0	0	6	302	308	-2	2	6	30	-19	
-4	4	5	115	-105	4	6	70	66	66	3	9	86	76	2	0	6	61	52	0	2	6	82	79	
-2	4	5	124	-117	8	6	245	-250	52	9	9	86	86	8	0	6	200	-195	2	2	6	232	245	
0	4	5	130	-136	12	6	50	52	92	9	9	72	-62	10	0	6	57	-59	4	2	6	42	32	
2	4	5	190	190	-17	7	94	92	67	11	9	125	117	10	0	6	242	234	6	2	6	188	-193	
4	4	5	38	25	-15	7	78	78	67	13	9	66	45	12	0	6	192	185	8	2	6	70	67	
6	4	5	137	-145	-13	7	87	-72	72	-12	10	139	-116	14	0	6	37	32	10	2	6	149	141	
8	4	5	169	-171	-7	7	226	217	47	-8	10	71	47	18	0	6	91	-81	12	2	6	70	67	
12	4	5	85	74	-3	7	156	-157	36	-6	10	88	04	-19	1	6	85	86	14	2	6	41	-35	
14	4	5	127	129	5	7	244	251	36	-4	10	47	-23	-17	1	6	85	87	16	2	6	41	-35	
16	4	5	87	-93	5	7	40	36	36	-2	10	106	-101	-15	1	6	69	-73	-19	3	6	58	58	
-19	5	5	66	67	7	7	91	-84	36	2	10	97	106	-13	1	6	114	-119	-17	3	6	58	58	
-15	5	5	122	115	9	7	53	-43	43	8	10	145	-136	-11	1	6	75	-74	-15	3	6	65	-60	
-13	5	5	76	-79	9	7	43	-43	53	-7	11	100	-107	-9	1	6	141	-141	-13	3	6	119	-112	
-11	5	5	50	-33	11	7	52	64	64	-3	11	93	-90	-5	1	6	83	-75	-9	3	6	228	233	
-9	5	5	69	56	-14	8	114	-94	94	3	11	174	179	-3	1	6	294	-302	-7	3	6	38	-32	
-7	5	5	115	109	-12	8	187	-155	79	7	11	49	-41	-1	1	6	103	108	-5	3	6	202	-274	
-3	5	5	180	-177	-10	8	82	-72	79	9	11	47	-46	-1	1	6	251	260	-3	3	6	305	-376	
-1	5	5	135	141	-6	8	162	153	153	-8	12	68	49	3	1	6	200	-202	-1	3	6	156	153	
1	5	5	230	238	-4	8	88	-87	87	-4	12	62	-55	5	1	6	163	-157	3	3	6	141	153	
3	5	5	99	99	-2	8	88	-87	87	2	12	89	84	7	1	6	53	-59	-1	3	6	81	-77	
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7	5	5	145	-143	2	8	107	99	99	2	12	48	-43	13	1	6	44	36	-4	3	6	100	94	
9	5	5	89	91	6	8	97	-105	105	-1	13	71	-61	15	1	6	85	-85	11	3	6	89	-72	
11	5	5	44	47	8	8	131	-135	135	20	13	73	73	17	1	6	67	-67	15	3	6	63	-52	
13	5	5	62	-61	8	8	64	59	59	-18	13	66	75	-17	1	6	146	151	-20	4	6	57	43	
17	5	5	54	42	12	8	79	86	86	-14	13	66	75	-18	2	6	146	151	-20	4	6	57	43	
-18	6	5	54	42	14	8	79	86	86	-14	13	66	75	-18	2	6	146	151	-20	4	6	57	43	

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H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC					
-14	4	6	67	-63	-14	6	6	100	-89	-9	9	6	126	119	8	0	7	73	71	8	2	7	48	41
-12	4	6	76	-80	-12	6	6	76	-76	-5	9	6	151	-146	10	0	7	122	114	10	2	7	142	100
-10	4	6	220	210	-10	6	6	61	59	-3	9	6	136	-133	14	0	7	220	-210	12	2	7	40	-43
-8	4	6	179	169	-8	6	6	200	189	1	9	6	86	84	16	0	7	76	-78	14	2	7	63	-67
-6	4	6	43	47	-6	6	6	68	76	3	9	6	143	138	-19	1	7	101	78	16	2	7	83	-78
-4	4	6	147	-151	-4	6	6	85	-68	5	9	6	111	-97	-15	1	7	113	-108	-19	3	7	135	137
-2	4	6	117	-124	-2	6	6	36	-39	11	9	6	66	49	-13	1	7	90	-45	-15	3	7	111	-121
0	4	6	180	181	0	6	6	85	97	-10	10	6	66	72	-11	1	7	90	88	-11	3	7	42	51
2	4	6	99	107	2	6	6	125	131	-8	10	6	142	135	-9	1	7	222	215	-9	3	7	96	38
4	4	6	60	79	4	6	6	44	-52	-4	10	6	90	-80	-7	1	7	53	-69	-7	3	7	86	-33
6	4	6	151	-150	6	6	6	182	-183	2	10	6	87	97	-5	1	7	168	-169	-5	3	7	114	-111
8	4	6	50	-42	8	6	6	107	103	6	10	6	91	-80	-3	1	7	40	-36	-3	3	7	49	54
10	4	6	162	160	12	6	6	191	183	10	10	6	77	72	-1	1	7	259	267	-1	3	7	254	201
12	4	6	112	101	14	6	6	46	27	-9	11	6	63	60	1	1	7	149	165	3	3	7	121	152
14	4	6	85	84	16	6	6	62	50	-3	11	6	119	-121	3	1	7	67	-67	3	3	7	247	-248
16	4	6	97	85	18	6	6	137	-127	-1	11	6	58	62	5	1	7	148	-141	5	3	7	90	-89
18	4	6	91	-74	-13	7	7	120	109	1	11	6	101	83	7	1	7	36	-37	7	3	7	77	63
20	4	6	84	-70	-9	7	7	243	-239	5	11	6	51	-71	9	1	7	154	151	9	3	7	141	-128
22	4	6	104	-98	-3	7	7	92	95	7	11	6	118	-116	11	1	7	99	104	11	3	7	84	-85
24	4	6	111	108	-1	7	7	151	165	8	12	6	75	80	13	1	7	46	-44	15	3	7	46	-35
26	4	6	36	32	5	7	7	90	-87	-6	12	6	51	42	15	1	7	64	-65	-20	4	7	64	43
28	4	6	99	-95	7	7	6	124	-123	-4	12	6	44	42	15	1	7	83	48	-16	4	7	122	-117
30	4	6	170	-164	11	7	6	89	84	0	12	6	72	75	-20	2	7	83	-47	-16	4	7	55	-62
32	4	6	63	62	-10	8	6	179	174	-20	0	7	53	34	-16	2	7	145	-146	-10	4	7	130	124
34	4	6	169	163	-8	8	6	129	115	-16	0	7	66	-62	-14	2	7	72	79	-8	4	7	39	5
36	4	6	128	133	-4	8	6	140	-124	-14	0	7	243	-247	-12	2	7	152	152	-6	4	7	217	-213
38	4	6	202	-211	-2	8	6	97	-101	-10	0	7	66	-62	-10	2	7	121	-129	-4	4	7	184	-184
40	4	6	131	-133	0	8	6	123	139	-8	0	7	131	129	-6	2	7	122	-116	0	4	7	119	114
42	4	6	63	-52	2	8	6	78	84	-6	0	7	226	-225	-4	2	7	68	-74	-4	4	7	101	117
44	4	6	89	84	6	8	6	80	-78	-4	0	7	121	-120	-2	2	7	186	191	4	4	7	235	-245
46	4	6	59	49	8	8	6	41	-25	2	0	7	76	81	0	2	7	27	11	6	4	7	78	-74
48	4	6	99	-93	10	8	6	86	86	-2	0	7	334	81	2	2	7	117	124	8	4	7	56	50
50	4	6	115	123	12	8	6	72	65	4	0	7	334	-326	4	2	7	117	-124	10	4	7	77	73
52	4	6	84	-66	-15	9	6	73	-68	6	0	7	51	-46	6	2	7	141	-137	14	4	7	131	-129



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H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC
16	4	7	59	-56	-1	7	7	111	110	-9	11	7	116	115	-1	1	8	175	180	1	3	3	164	-174
-15	5	7	97	-102	1	7	7	120	126	-5	11	7	77	-78	1	1	8	63	-56	3	3	186	-137	
-13	5	7	57	-53	3	7	7	60	-62	-1	11	7	61	63	3	1	8	230	-228	5	3	97	-161	
-11	5	7	137	109	5	7	7	124	-127	1	11	7	85	-94	5	1	8	129	-126	7	3	89	85	
-9	5	7	146	145	5	7	7	46	57	5	11	7	75	-78	7	1	8	106	-100	9	3	172	168	
-5	5	7	136	-136	9	7	7	56	57	-6	12	7	80	-83	9	1	8	96	93	11	3	41	30	
-3	5	7	84	-81	11	7	7	101	100	-4	12	7	104	-107	11	1	8	48	-24	13	3	77	-57	
-1	5	7	241	241	-16	8	7	80	-77	2	12	7	67	-6	13	1	8	57	-89	15	3	79	-76	
1	5	7	109	112	-6	8	7	94	88	4	12	7	47	-71	15	1	8	84	-52	-16	4	73	-79	
5	5	7	104	-104	-10	8	7	164	-158	-18	0	8	77	66	-20	2	8	57	-76	-14	4	38	9	
5	5	7	50	-40	-4	8	7	92	-97	-16	0	8	64	-70	-16	2	8	110	-108	-12	4	185	172	
7	5	7	170	165	0	8	7	93	75	-14	0	8	45	45	-14	2	8	84	89	-10	4	185	58	
9	5	7	73	76	2	8	7	73	75	-12	0	8	229	226	-12	2	8	89	76	-8	4	63	-55	
11	5	7	63	-50	4	8	7	141	-146	-10	0	8	33	36	-10	2	8	131	139	-6	4	156	-149	
15	6	7	70	-65	6	8	7	62	-53	-8	0	8	108	-104	-8	2	8	85	-85	-2	4	156	-149	
-16	6	7	125	-116	10	8	7	58	-53	-6	0	8	221	-223	-6	2	8	223	-218	-2	4	221	-218	
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-12	6	7	195	190	-13	9	7	59	-50	-2	0	8	354	352	-2	2	8	56	51	6	4	50	-55	
-10	6	7	104	-105	-11	9	7	67	-65	0	0	8	280	284	0	2	8	214	217	2	4	213	215	
-6	6	7	249	-250	-7	9	7	47	-54	2	0	8	42	-36	2	2	8	125	-133	10	4	35	27	
-4	6	7	48	-25	-5	9	7	49	-54	4	0	8	36	-37	4	2	8	85	-85	12	4	57	-65	
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2	6	7	46	-44	1	9	7	67	74	8	0	8	246	239	8	2	8	161	157	14	4	69	-75	
4	6	7	115	-119	3	9	7	59	-54	10	0	8	47	-44	10	2	8	62	64	-15	5	73	-75	
6	6	7	81	-84	5	9	7	129	-135	12	0	8	84	-79	12	2	8	48	-38	-13	5	83	-73	
8	6	7	63	51	7	9	7	87	-88	-19	1	8	43	-28	-17	3	8	144	-135	-11	5	83	72	
8	6	7	121	131	9	9	7	87	88	-19	1	8	79	-75	-15	3	8	83	-88	-9	5	65	54	
10	6	7	61	-49	11	9	7	58	33	-17	1	8	119	-117	-15	3	8	149	-152	-7	5	271	-272	
12	6	7	116	-118	-10	10	7	98	81	-13	1	8	98	87	-13	3	8	51	57	-5	5	56	-50	
14	6	7	88	-49	-4	10	7	142	-148	-11	1	8	90	87	-11	3	8	96	95	-5	5	153	150	
-17	7	7	80	-79	0	10	7	60	79	-9	1	8	75	56	-9	3	8	102	93	3	5	214	-216	
-15	7	7	173	167	0	10	7	93	-98	-7	1	8	275	-282	-7	3	8	95	-85	5	5	82	-82	
-9	7	7	79	-77	6	10	7	63	-70	-5	1	8	80	-76	-5	3	8	77	83	7	7	79	75	
-7	7	7	116	-115	-11	11	7	65	26	-3	1	8	56	55	-3	3	8	184	191	9	5	64	51	



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H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC
-11	7	9	78	72	-4	10	9	97	99	-5	1	10	142	139	1	3	10	149	-149	-18	6	10	66	-69
-9	7	9	62	-46	-2	10	9	57	60	-3	1	10	31	-14	3	3	10	48	-53	-16	6	10	77	59
-7	7	9	75	-68	2	10	9	83	-100	-1	1	10	112	-122	5	3	10	108	101	-14	6	10	87	62
-5	7	9	54	36	4	10	9	50	-37	1	1	10	169	-177	7	3	10	38	7	-12	6	10	85	85
-3	7	9	145	135	6	10	9	41	45	5	1	10	175	170	9	3	10	133	-134	-10	6	10	93	-90
-1	7	9	40	33	8	10	9	49	47	7	1	10	46	45	11	3	10	128	-116	-8	6	10	37	-23
3	7	9	88	-87	-7	11	9	54	-48	9	1	10	67	-71	-18	4	10	61	-51	-6	6	10	109	111
5	7	9	106	-111	-5	11	9	82	82	11	1	10	161	-150	-14	4	10	133	130	-4	6	10	121	119
7	7	9	103	118	-3	11	9	86	80	15	1	10	57	37	-10	4	10	146	-142	-2	6	10	60	-53
7	7	9	92	89	1	11	9	59	-54	-18	2	10	84	-75	-8	4	10	41	33	0	6	10	95	-94
9	7	9	75	78	3	11	9	105	-98	-16	2	10	81	71	-6	4	10	47	20	0	6	10	102	-113
-14	8	9	70	54	5	11	9	86	90	-14	2	10	42	36	-4	4	10	282	291	2	6	10	142	133
-12	8	9	74	69	-4	12	9	48	56	-12	2	10	35	33	-2	4	10	34	-32	6	6	10	82	81
-8	8	9	134	-131	-2	12	9	48	56	-10	2	10	147	-145	0	4	10	141	-142	10	6	10	82	-75
-6	8	9	43	-56	-18	0	10	67	-55	-8	2	10	53	-54	2	4	10	84	-89	12	6	10	72	-70
-4	8	9	70	82	-14	0	10	179	166	-6	2	10	142	139	4	4	10	32	36	-15	7	10	56	41
-2	8	9	61	58	-12	0	10	65	57	-4	2	10	220	216	6	4	10	130	132	-13	7	10	87	88
0	8	9	53	29	-10	0	10	134	-145	-2	2	10	29	32	10	4	10	104	-94	-11	7	10	93	-92
2	8	9	125	-130	-8	0	10	45	40	0	2	10	111	-106	10	4	10	37	30	-9	7	10	92	-90
6	8	9	71	65	-6	0	10	57	46	2	2	10	208	-220	14	4	10	44	44	-7	7	10	82	-86
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-13	9	9	144	147	-2	0	10	108	-116	6	2	10	95	86	-15	5	10	76	70	-3	7	10	52	45
-11	9	9	59	44	0	0	10	164	-166	8	2	10	40	34	-13	5	10	82	75	-1	7	10	105	-110
-9	9	9	69	-68	0	0	10	44	-41	10	2	10	67	-51	-11	5	10	42	-57	1	7	10	99	-95
-7	9	9	59	-70	4	0	10	83	77	14	2	10	117	115	-9	5	10	157	-155	3	7	10	106	95
-5	9	9	59	-44	6	0	10	167	156	14	2	10	52	-37	-7	5	10	66	-63	5	7	10	106	95
-3	9	9	129	129	8	0	10	33	33	-15	3	10	80	81	-5	5	10	120	113	7	7	10	63	63
-1	9	9	36	-13	10	0	10	154	-138	-13	3	10	59	60	-3	5	10	35	-36	11	7	10	51	-08
5	9	9	123	51	-10	1	10	117	-114	-11	3	10	168	-171	-1	5	10	102	-97	11	7	10	110	-107
7	9	9	51	51	-15	1	10	50	66	-9	3	10	146	-141	1	5	10	147	-152	-14	8	10	52	61
9	9	9	39	26	-13	1	10	98	99	-7	3	10	129	-135	3	5	10	38	42	-10	8	10	106	-109
-12	10	9	73	58	-11	1	10	73	-83	-5	3	10	148	153	5	5	10	160	159	-6	8	10	37	38
-10	10	9	57	-61	-9	1	10	180	-178	-3	3	10	139	144	9	5	10	139	144	0	8	10	193	183
-8	10	9	108	-106	-7	1	10	93	-91	-1	3	10	68	-66	11	5	10	139	-134	0	8	10	87	-92

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H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC					
2	8	10	97	-92	14	0	11	120	114	-11	3	11	80	-64	9	5	11	99	-96	-1	9	11	125	-133
6	8	10	09	88	-17	1	11	76	78	-9	3	11	71	-67	-16	6	11	117	114	1	9	11	57	55
8	8	10	43	28	-15	1	11	146	143	-7	3	11	167	193	-12	6	11	93	-90	3	9	11	56	45
10	8	10	59	-60	-13	1	11	54	-60	-5	3	11	145	142	-10	6	11	109	-110	5	9	11	104	1.5
-9	9	10	144	-140	-11	1	11	121	-117	-3	3	11	59	64	-6	6	11	66	61	-10	10	11	64	-50
-7	9	10	51	-41	-9	1	11	86	-86	-1	3	11	199	-204	-4	6	11	60	62	-4	10	11	47	32
-5	9	10	97	100	-7	1	11	153	153	3	3	11	156	159	-2	6	11	116	-116	-2	10	11	102	-114
1	9	10	125	-130	-5	1	11	144	140	5	3	11	144	145	0	6	11	54	-48	0	10	11	84	-30
5	9	10	88	83	-3	1	11	74	68	9	3	11	65	-54	4	6	11	92	85	4	10	11	49	40
7	9	10	68	-38	-1	1	11	139	-137	9	3	11	53	-45	6	6	11	68	84	-7	11	11	105	93
-10	10	10	42	-77	1	1	11	33	33	13	3	11	108	103	-15	7	11	143	-148	-5	11	11	45	31
-8	10	10	41	-8	-1	1	11	95	91	-16	4	11	96	86	8	6	11	73	78	-1	11	11	53	-45
-6	10	10	116	61	3	1	11	129	129	-12	4	11	39	8	-9	7	11	57	-70	-16	0	12	42	34
-4	10	10	65	-65	5	1	11	92	-92	-10	4	11	157	-151	-7	7	11	90	-98	-16	0	12	53	95
2	10	10	70	-85	9	1	11	103	-100	-8	4	11	91	94	-9	7	11	152	153	-14	0	12	60	-62
4	10	10	63	67	-18	2	11	63	-58	-6	4	11	128	127	-5	7	11	62	76	-12	0	12	140	-141
6	10	10	49	54	-16	2	11	83	-74	0	4	11	134	-142	-3	7	11	55	58	-10	0	12	80	66
-7	11	10	49	-62	-14	2	11	44	49	-2	4	11	198	-201	-3	7	11	83	-80	-8	0	12	143	141
-5	11	10	55	38	-12	2	11	75	-68	4	4	11	118	120	3	7	11	116	110	-6	0	12	81	141
-1	11	10	108	-103	-10	2	11	75	-77	8	4	11	73	-60	5	7	11	92	97	-4	0	12	212	-284
1	11	10	55	-42	-8	2	11	54	63	10	4	11	61	-58	7	7	11	66	-67	-2	0	12	95	92
3	11	10	44	11	-6	2	11	109	111	-17	5	11	62	62	9	7	11	66	-61	2	0	12	118	107
-16	0	11	158	158	-4	2	11	76	90	-15	5	11	53	-61	-14	8	11	37	-4	4	0	12	118	107
-10	0	11	220	-223	-2	2	11	271	-290	-13	5	11	117	-115	-10	8	11	92	-92	8	0	12	109	-101
-8	0	11	54	58	0	2	11	167	-173	-9	5	11	50	-50	-8	8	11	102	-105	-15	1	12	60	-59
-6	0	11	130	127	2	2	11	35	7	-7	5	11	101	101	-2	8	11	127	-133	-13	1	12	120	-123
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-2	0	11	52	-40	6	2	11	147	-149	-3	5	11	123	-125	6	8	11	42	49	-7	1	12	164	165
0	0	11	100	-101	8	2	11	151	146	-1	5	11	62	58	8	8	11	69	-65	-5	1	12	70	65
2	0	11	48	47	10	2	11	51	-32	3	5	11	58	50	-13	9	11	56	-33	-3	1	12	136	-138
4	0	11	171	166	-14	3	11	61	47	5	5	11	102	99	7	9	11	77	83	-3	1	12	157	-156
8	0	11	126	-115	-17	3	11	86	81	5	5	11	81	-78	-5	9	11	123	120	-1	1	12	157	-156
10	0	11	63	-65	-15	3	11	86	81	7	5	11	81	-78	-5	9	11	123	120	-1	1	12	157	-156

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H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC					
1	1	1	50	46	-16	4	12	111	116	6	6	12	47	-35	-10	0	13	63	58	8	2	13	87	-82
3	1	1	60	56	-12	4	12	124	-113	8	6	12	45	-33	-8	0	13	114	112	10	2	13	100	103
7	1	1	121	-118	-8	4	12	67	68	-13	7	12	127	-127	-6	0	13	124	-132	-15	3	13	48	-109
9	1	1	56	-43	-6	4	12	93	95	-11	7	12	67	-53	-4	0	13	148	-145	-13	3	13	113	65
11	1	1	60	64	-4	4	12	94	-95	-7	7	12	97	92	0	0	13	68	-67	-11	3	13	61	145
13	1	1	81	79	-2	4	12	108	-106	-5	7	12	78	76	0	0	13	205	205	-7	3	13	125	124
18	2	1	106	111	0	4	12	61	60	-3	7	12	148	-150	2	0	13	72	-70	-5	3	13	81	-65
14	2	1	36	33	2	4	12	135	133	-1	7	12	90	-94	4	0	13	61	-55	-3	3	13	67	-63
12	2	1	95	-92	8	4	12	123	-119	5	7	12	39	50	6	0	13	48	31	-1	3	13	34	-23
10	2	1	49	50	12	4	12	53	56	7	7	12	123	123	8	0	13	139	-131	1	3	13	163	164
8	2	1	170	169	-17	5	12	58	47	9	7	12	39	-27	10	0	13	46	51	5	3	13	93	-89
6	2	1	60	54	-15	5	12	77	-78	-14	8	12	49	12	-15	1	13	34	-10	7	3	13	49	-39
4	2	1	95	-98	-13	5	12	85	-84	-12	8	12	87	-80	-13	1	13	85	-87	9	3	13	71	67
2	2	1	71	-66	-11	5	12	93	-92	-8	8	12	53	47	-11	1	13	85	79	11	3	13	110	100
2	2	1	252	254	-7	5	12	74	81	-6	8	12	77	73	-9	1	13	132	128	-16	4	13	57	-48
4	2	1	104	108	-7	5	12	165	165	-4	8	12	57	-56	-7	1	13	97	91	-14	4	13	108	-134
6	2	1	65	-65	-5	5	12	33	23	-2	8	12	91	-91	-5	1	13	137	-140	-12	4	13	103	-53
8	2	1	58	-72	-3	5	12	84	-77	0	8	12	46	61	-3	1	13	118	-115	-10	4	13	36	24
12	2	1	117	107	3	5	12	135	-135	2	8	12	134	134	3	1	13	175	170	-8	4	13	98	90
17	2	1	85	75	5	5	12	60	60	4	8	12	94	90	5	1	13	60	54	-6	4	13	46	-53
15	3	1	49	18	5	5	12	38	-34	8	8	12	91	-92	5	1	13	36	-42	-4	4	13	102	-101
13	3	1	102	-98	9	5	12	86	-79	-11	9	12	95	-102	7	1	13	74	-69	-4	4	13	45	-32
11	3	1	138	-128	11	5	12	46	-38	-7	9	12	85	73	11	1	13	105	93	-16	4	13	50	53
9	3	1	32	18	-16	6	12	42	51	-5	9	12	52	-60	-16	2	13	37	12	0	4	13	141	134
7	3	1	95	95	-12	6	12	79	-80	-3	9	12	68	-84	-14	2	13	205	-200	4	4	13	117	-120
3	3	1	181	-183	-8	6	12	122	117	3	9	12	78	79	-10	2	13	54	35	8	4	13	107	-96
1	3	1	75	-95	-6	6	12	54	-62	-8	10	12	74	76	-4	2	13	68	53	10	4	13	95	-10
3	3	1	94	80	-4	6	12	114	-105	-2	10	12	54	-58	0	2	13	194	-196	-11	5	13	82	-75
7	3	1	180	-180	0	6	12	42	-56	-3	11	12	75	-83	0	2	13	56	59	-7	5	13	87	35
9	3	1	81	-79	2	6	12	142	143	-14	0	13	41	-17	4	2	13	57	-67	-7	5	13	92	71
18	4	1	46	46	4	6	12	59	62	-12	0	13	83	-76	6	2	13	164	-157	-5	5	13	115	-116



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H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC					
-7	3	15	154	-161	-13	7	15	39	31	-8	2	16	127	-123	-12	6	16	98	109	-10	2	17	81	-72
-3	3	15	98	89	-11	7	15	72	74	-4	2	16	69	55	-7	6	16	141	-136	-8	2	17	79	-90
-1	3	15	137	138	-7	7	15	87	-86	-2	2	16	90	82	-2	6	16	63	57	-6	2	17	45	-3
1	3	15	36	38	-3	7	15	57	57	2	2	16	135	-117	0	6	16	85	82	-4	2	17	130	129
3	3	15	115	-101	-1	7	15	111	120	4	2	16	47	38	2	6	16	46	1	-2	2	17	60	-58
5	3	15	54	-49	3	7	15	88	-84	6	2	16	68	67	2	6	16	67	-55	0	2	17	37	-39
-12	3	15	41	26	-8	8	15	80	-90	8	2	16	90	81	4	6	16	58	55	2	2	17	44	-47
-10	4	15	72	64	-6	8	15	61	-65	-13	3	16	57	72	-11	7	16	52	-41	4	2	17	53	55
-8	4	15	95	90	-2	8	15	73	-69	-11	3	16	45	5	-9	7	16	39	-30	6	2	17	79	76
-6	4	15	127	-131	2	8	15	58	-63	-9	3	16	80	-59	-7	7	16	100	-101	-13	3	17	94	93
-2	4	15	95	-88	-7	9	15	82	-81	-7	3	16	80	5	-5	7	16	63	61	-9	3	17	42	-40
0	4	15	71	60	-5	9	15	50	-46	-5	3	16	109	-66	-3	7	16	62	61	-5	3	17	62	53
2	4	15	52	57	-3	9	15	97	96	-3	3	16	84	80	1	7	16	93	-89	-3	3	17	59	55
4	4	15	116	-105	-1	9	15	74	77	-1	3	16	38	28	3	7	16	70	-56	-1	3	17	87	-30
8	4	15	97	48	-14	0	16	157	156	3	3	16	163	-152	-8	8	16	58	-56	5	3	17	70	-73
-15	5	15	55	-52	-8	0	16	126	-129	7	3	16	106	99	-4	8	16	76	72	-12	4	17	114	109
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-11	5	15	63	66	-4	0	16	143	143	-12	4	16	41	41	-10	0	17	51	-194	-8	4	17	146	-139
-7	5	15	86	-79	-2	0	16	130	121	-8	4	16	80	-74	-6	0	17	90	88	-6	4	17	35	27
-5	5	15	57	-55	6	0	16	66	66	-4	4	16	63	-65	-4	4	17	106	98	-4	4	17	86	75
-3	5	15	111	115	8	0	16	103	93	-2	4	16	59	58	0	0	17	117	-107	2	4	17	105	-98
-1	5	15	87	-78	-9	1	16	83	-84	2	4	16	59	-54	4	0	17	94	-87	4	4	17	57	-33
3	5	15	51	-44	-7	1	16	141	-135	6	4	16	124	114	-13	1	17	82	71	4	4	17	86	64
5	5	15	90	96	-5	1	16	72	75	-13	5	16	89	78	-11	1	17	42	-45	-11	5	17	53	60
-12	6	15	49	44	-3	1	16	59	63	-7	5	16	115	-92	-9	1	17	63	-48	-9	5	17	39	-32
-6	6	15	118	-113	1	1	16	150	-153	-5	5	16	59	59	-5	1	17	42	36	-5	5	17	147	137
-4	6	15	57	-45	3	1	16	63	-61	-3	5	16	46	51	-3	1	17	74	66	-1	5	17	69	78
-2	6	15	83	76	7	1	16	79	66	-1	5	16	71	68	-1	1	17	76	-74	-12	6	17	72	-54
0	6	15	59	-62	-14	2	16	60	60	1	5	16	151	-145	1	1	17	84	-73	-10	6	17	111	-105
2	6	15	83	-89	-12	2	16	92	79	3	5	16	54	-48	5	1	17	137	121	-10	6	17	111	-105
4	6	15	113	-100	-10	2	16	37	-13	-14	6	16	76	79	7	1	17	50	44	-8	6	17	49	-56

OBSERVED AND CALCULATED STRUCTURE FACTORS FOR										ROEBLINGITE DATA RED 2/19/82										PAGE 15				
H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC	H	K	L	FO	FC
-6	6	17	50	45	3	1	18	92	86	-2	4	18	72	-75	-1	1	19	37	-27	-8	0	20	80	86
-4	6	17	123	122	5	1	18	73	66	-11	5	18	111	-106	1	1	19	96	93	-6	0	20	34	-4
0	6	17	61	-46	-12	2	18	65	-58	-7	5	18	46	41	3	1	19	71	69	-4	0	20	99	-84
2	6	17	76	-75	-10	2	18	128	-111	-3	5	18	56	-62	-8	2	19	105	109	-7	1	20	46	34
-9	7	17	58	-50	-8	2	18	67	65	-1	5	18	118	-112	-6	2	19	63	57	-5	1	20	50	-48
-7	7	17	56	52	-6	2	18	104	89	-10	6	18	56	-42	-4	2	19	79	-68	-3	1	20	50	-39
-5	7	17	75	65	-4	2	18	81	78	-8	6	18	64	69	-2	2	19	150	-135	-8	2	20	65	60
-3	7	17	54	53	-2	2	18	40	-37	-6	6	18	92	37	0	2	19	37	-20	-6	2	20	38	-34
1	7	17	80	-77	0	2	18	79	-74	-4	6	18	38	43	2	2	19	46	51	-4	2	20	86	-76
-12	0	18	74	-74	2	2	18	44	44	-2	6	18	81	-72	-9	3	19	122	108	-2	2	20	48	-53
-8	0	18	36	23	4	2	18	81	69	-7	3	19	82	-71	-7	3	19	43	21	0	2	20	118	112
-6	0	18	156	144	-11	3	18	126	-125	-5	7	18	65	65	-3	3	19	58	-42	-5	3	20	103	-97
-4	0	18	60	47	-5	3	18	70	69	-10	0	19	41	-40	-1	3	19	68	-67	-3	3	20	66	-65
-2	0	18	143	-136	-3	3	18	47	-44	-8	0	19	136	131	1	3	19	91	89	-1	3	20	37	34
-4	0	18	107	95	-1	3	18	81	-68	-6	0	19	52	-43	-2	4	19	130	131	-8	4	20	73	68
4	0	18	99	-106	3	3	18	53	51	-2	0	19	111	-110	-2	4	19	143	-137	-4	4	20	114	-107
-11	1	18	49	43	-10	4	18	74	-75	0	0	19	36	22	0	4	19	43	-22	-6	0	21	86	-73
-5	1	18	77	-76	-10	4	18	54	-54	2	0	19	82	79	-9	5	19	39	-2	-4	0	21	102	-87
-3	1	18	130	-122	-6	4	18	133	132	-7	1	19	91	81	-7	5	19	83	72	-4	0	21	99	-87
-1	1	18	49	-27	-4	4	18	58	49	-3	1	19	56	-46	-3	5	19	65	-49	-5	1	21	99	-84

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