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## The crystal structure of eakerite, a calcium-tin silicate

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### Abstract

Eakerite,  $\text{Ca}_2\text{SnAl}_2\text{Si}_6\text{O}_{18}(\text{OH})_2 \cdot 2\text{H}_2\text{O}$ , contains crankshaft-like chains, similar to those in feldspars, of composition  $\text{AlSi}_3\text{O}_9(\text{OH})$ , which are cross-linked to form a kinked sheet. Al is ordered, and the OH is bonded to it. Ca and Sn ions lie in sheets between the kinked aluminosilicate network. The Ca ions are coordinated by 4O, 2OH, and 2H<sub>2</sub>O in a square antiprism; these are edge-linked into chains which run across the aluminosilicate chains and which are cross-linked by Sn octahedra. The OH and H<sub>2</sub>O are bonded to Ca and, by hydrogen bonds, to other O; this strong bonding prevented their being distinguished by thermogravimetric analysis.

### Introduction

Eakerite (Leavens *et al.*, 1970) is a rare tin silicate found in hydrothermal fissures in spodumene-bearing pegmatite at King's Mountain, North Carolina. The formula was given as  $\text{Ca}_2\text{Al}_2\text{SnSi}_6\text{O}_{18}(\text{OH})_6$  on the basis of wet-chemical analysis of an 11 mg sample and from thermogravimetric analysis, which showed that all water is tightly bound.

The structural analysis described in this paper shows that the chemical analysis is correct but that the formula should be written  $\text{Ca}_2\text{SnAl}_2\text{Si}_6\text{O}_{18}(\text{OH})_2 \cdot 2\text{H}_2\text{O}$ .

### Experimental

Eakerite is monoclinic and crystallizes in space group  $P2_1/a$ ; the cell parameters in Ångströms are  $a = 15.892(7)$ ;  $b = 7.721(3)$ ;  $c = 7.438(3)$ ;  $\beta = 101.34^\circ(3)$ ; and the volume =  $891.35 \text{ \AA}^3$ . The calculated density is 2.65 with  $Z = 2$  molecules/unit cell (Leavens *et al.*, 1970).

Three-dimensional intensity data were collected using a four-circle Picker card-automated diffractometer with filtered (0.002" Zr foil) MoK $\alpha$  radiation. The crystal was ground to a 0.25 mm diameter sphere and mounted with the  $b^*$  axis along the direction of the

instrument. The linear absorption coefficient ( $\mu_{\text{MoK}\alpha}$ ) is  $15.5 \text{ cm}^{-1}$ , giving a transmission factor of 0.69 for a 0.25 mm sphere. The moving crystal, moving counter-measurement technique ( $\theta$ - $2\theta$  coupling) was used. Integrated intensities were measured over a scan range taken  $0.9^\circ$  on both sides of the  $K\alpha_1$ - $K\alpha_2$  splitting at a rate of  $2^\circ/\text{min}$ . Individual background intensities were determined by 30-second stationary background counts taken on both sides of the peak. Three standard reflections were measured every 60 reflections to monitor crystal alignment and instrument stability.

In all, 1791 independent reflections were measured, of which 1687 were considered statistically observable using the criterion  $F_o \geq 3\sigma(F)$ ;  $\sigma(F)$  was calculated from counting statistics and an instrumental instability constant of 2 percent. The raw intensity data of each reflection were corrected for background, Lorentz, and polarization effects. Absorption corrections were not necessary, due to the spherical shape of the crystal and its low linear absorption coefficient. Corrections for the effects of secondary extinction and anomalous dispersion were calculated to be small and were ignored.

### Solution of the structure

The crystal structure of eakerite was determined using heavy-atom and vector superposition tech-

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H, 1, 6			H, 2, 6			H, 3, 6			H, 4, 6		
0	7.33	6.45	-15	12.39	10.94	0	23.99	25.54	-15	10.26	10.64
-1	47.89	45.40	-14	0.80	3.39	-1	47.12	45.58	-14	50.81	50.53
-2	51.64	50.47	-13	20.61	20.56	-2	27.27	27.84	-13	20.72	19.59
-3	41.62	38.57	-12	48.22	48.55	-3	82.34	83.10	-12	50.83	49.38
-4	31.34	29.25	-11	26.44	26.34	-4	12.07	12.96	-11	18.24	17.88
-5	92.56	91.84	-10	10.32	8.40	-5	40.93	42.79	-10	12.76	11.53
-6	29.64	31.39	-9	12.04	12.03	-6	27.55	28.02	-9	4.57	2.78
-7	58.24	59.70	-8	84.45	86.33	-7	86.76	89.29	-8	96.34	97.17
-8	50.54	53.86	-7	13.95	11.91	-8	8.13	4.99	-7	2.82	3.91
-9	35.05	37.01	-6	8.05	5.07	-9	39.16	41.51	-6	61.17	60.64
-10	5.93	0.75	-5	12.79	14.84	-10	8.93	8.26	-5	5.15	6.87
-11	54.03	55.82	-4	24.08	20.90	-11	55.36	56.93	-4	66.00	65.68
-12	20.71	20.04	-3	21.33	20.70	-12	16.41	16.78	-3	28.73	30.22
-13	3.56	2.99	-2	4.83	4.02	-13	63.33	65.38	-2	65.33	65.81
-14	26.34	27.50	-1	27.87	27.68	-14	13.58	14.45	-1	11.27	12.07
-15	66.74	65.23	0	21.52	19.30	-15	73.04	74.52	0	68.65	68.37

H, 5, 6			H, 6, 6			H, 7, 6			H, 7, 7		
0	6.52	1.63	-15	10.16	11.02	0	14.97	18.37	-15		
-1	40.25	42.03	-14	17.16	15.99	-1	57.27	58.26	-14		
-2	4.44	2.86	-13	0.90	0.07	-2	19.35	18.66	-13	42.83	40.80
-3	32.98	33.57	-12	40.72	40.98	-3	51.15	52.31	-12	3.69	2.03
-4	17.38	17.26	-11	26.68	26.84	-4	22.18	19.51	-11	9.12	5.86
-5	66.85	67.88	-10	35.28	34.77	-5	55.31	55.11	-10	2.86	0.30
-6	20.15	20.30	-9	58.11	56.71	-6	32.14	32.11	-9	12.75	11.93
-7	38.67	38.29	-8	1.15	2.75	-7	59.54	61.89	-8	16.09	11.95
-8	14.57	13.85	-7	23.98	24.03	-8	50.65	46.87	-7	56.11	56.17
-9	42.66	42.77	-6	18.15	19.61	-9	25.88	26.12	-6	44.61	44.68
-10	6.00	7.95	-5	12.19	11.73	-10	0.89	1.15	-5	18.10	16.17
-11	24.52	25.63	-4	25.51	23.41	-11	55.13	56.26	-4	13.44	10.51
-12	14.26	16.10	-3	10.19	8.01	-12	24.20	23.24	-3	22.36	22.83
-13	8.68	6.82	-2	10.60	9.69	-13	39.12	37.09	-2	20.09	22.08
-14	43.34	41.38	-1	14.78	14.49	-14	20.37	14.92	-1	18.40	20.31
-15	50.16	48.72	0	64.10	63.31	-15	33.10	30.82	0	8.94	3.60

H, 6, 7			H, 5, 7			H, 4, 7			H, 3, 7		
0	93.64	92.36	-15	64.92	61.75	0	39.29	39.05	-15	16.71	13.51
-1			-14	31.26	31.42	-1	8.69	8.07	-14	0.86	1.09
-2	52.29	52.33	-13	25.61	23.78	-2	13.59	13.70	-13	15.06	15.43
-3	25.08	23.25	-12	7.64	4.91	-3	49.41	51.98	-12	4.43	3.43
-4	38.92	40.80	-11	60.37	61.01	-4	29.11	29.17	-11	0.81	7.95
-5	5.28	2.12	-10	8.99	6.91	-5	19.01	19.91	-10	20.23	20.05
-6	55.97	56.25	-9	55.58	55.14	-6	45.00	45.05	-9	10.88	11.05
-7	8.06	5.98	-8	15.38	16.94	-7	22.18	24.54	-8	6.67	5.76
-8	7.45	5.86	-7	29.74	31.52	-8	30.62	31.33	-7	47.62	48.85
-9	6.47	3.51	-6	33.99	32.13	-9	55.11	56.05	-6	8.49	6.13
-10	32.94	31.47	-5	51.59	50.33	-10	79.82	83.11	-5	8.48	7.15
-11	29.59	28.35	-4	7.32	7.38	-11	14.66	12.46	-4	6.46	4.50
-12	14.51	12.99	-3	23.43	22.87	-12	7.73	6.85	-3	95.70	96.85
-13	5.40	4.09	-2	8.81	6.43	-13	40.80	39.03	-2	12.93	12.64
-14	42.00	41.51	-1	48.30	48.57	-14	22.07	23.67	-1	6.61	1.33
-15	1.60	0.49	0	22.34	22.21	-15	4.69	1.94	0	9.94	7.93

H, 2, 7			H, 1, 7			H, 0, 7			H, 1, 0		
0	46.64	48.00	-15	44.23	42.33	0	121.12	123.51	15	53.71	55.05
-1	5.54	3.51	-14	44.22	43.17	1			14	76.49	76.48
-2	62.90	65.24	-13	53.08	54.07	2	66.18	68.04	13	20.14	17.83
-3	37.20	37.50	-12	31.95	32.50	3			12	8.15	13.45
-4	52.61	53.68	-11	24.92	26.22	4	202.05	215.40	11	73.76	76.08
-5	9.13	5.02	-10	5.19	1.50	5			10	21.43	19.15
-6	75.82	76.26	-9	56.36	57.20	6	144.34	148.46	9	44.88	45.97
-7	16.95	15.58	-8	4.61	6.97	7			8	28.82	27.40
-8	60.24	61.87	-7	58.66	60.92	8	42.81	43.91	7	58.17	58.55
-9	46.89	47.59	-6	84.15	85.01				6	75.27	77.31
-10	75.39	77.25	-5	12.69	17.11		96.34	98.95	5	44.95	50.52
-11	11.23	10.84	-4	14.26	17.11				4	57.52	56.92
-12	52.38	52.76	-3	30.74	31.11		27.59	28.69	3	19.94	26.17
-13	8.79	6.95	-2	21.12	20.46				2	26.59	30.25
-14	81.58	82.51	-1	43.29	46.45		60.37	71.39	1	73.33	75.78
-15	19.32	18.87	0	24.32	23.41	15					

H, 2, 0			H, 3, 0			H, 4, 0			H, 5, 0		
0	4.21	5.72	15	56.39	56.55	0	131.20	136.09	15	50.09	51.59
1	68.56	63.41	14	22.17	23.38	1	76.42	74.97	14	51.56	54.70
2	38.84	27.31	13	33.76	36.11	2	87.38	87.82	13	6.21	0.72
3	57.09	51.72	12	12.91	12.09	3	107.67	108.67	12	5.14	1.03
4	60.44	65.56	11	9.40	13.49	4	129.28	132.99	11	52.73	54.86
5	13.55	13.89	10	12.87	15.00	5	8.79	6.43	10	24.51	23.92
6	42.16	43.53	9	67.58	67.84	6	39.25	38.45	9	42.72	40.34
7	27.03	22.81	8	17.45	14.62	7	31.49	31.15	8	7.70	5.25
8	136.6	135.5	7	103.21	106.34	8	116.77	115.28	7	42.18	37.36
9	69.60	66.83	6	41.72	37.81	9	55.74	58.12	6	2.46	1.75
10	27.97	30.94	5	29.94	25.23	10	101.41	98.48	5	14.48	5.08
11	27.02	29.86	4	28.91	30.22	11	36.23	34.80	4	46.39	44.02
12	70.09	66.97	3	139.47	148.87	12	71.12	75.07	3	25.86	26.94
13	34.56	33.79	2	35.33	29.75	13	42.09	45.20	2	22.09	19.75
14	24.44	26.05	1	52.97	56.35	14	63.39	65.63	1	29.75	34.35
15	1.98	1.89				15	0.78	2.38			

H, 6, 0			H, 7, 0			H, 7, 1			H, 6, 1		
0	169.1	167.6	15	33.42	33.48	0	8.92	8.27	15	15.74	17.96
1	15.26	16.88	14	30.01	28.31	1	18.62	18.08	14	41.92	41.61
2	28.19	23.46	13	61.70	61.04	2	28.38	28.09	13	4.77	6.42
3	27.56	26.66	12	4.58	0.74	3	60.94	63.83	12	47.42	48.22
4	74.48	69.37	11	56.04	57.32	4	10.14	10.27	11	48.02	48.24
5	62.19	60.27	10	1.45	2.88	5	43.46	45.96	10	43.97	46.69
6	69.74	69.25	9	24.17	25.26	6	19.18	19.45	9	28.97	28.97
7	35.93	38.96	8	10.60	9.59	7	13.16	13.72	8	19.84	20.02
8	20.61	21.39	7	75.86	77.55	8	14.41	12.79	7	51.05	53.48
9			6	57.06	60.06	9	59.95	64.28	6	37.25	31.59
10	20.38	20.46	5	44.48	46.73	10	34.22	34.71	5	65.42	66.47
11	0.77	2.42	4	13.87	12.47	11	27.33	28.82	4	64.17	60.39
12	10.73	12.16	3	58.40	59.09	12	2.75	2.97	3	5.79	3.15
13	28.63	26.26	2	27.15	28.14	13	17.23	16.63	2	21.67	14.85
14	23.46	23.00	1	54.38	52.72	14	35.41	34.08	1	78.56	80.65
15	10.47	8.27	0	8.92	8.27	15	19.57	19.68	0	87.13	81.68

H, 5, 1			H, 4, 1			H, 3, 1			H, 2, 1		
0	21.36	18.98	15	4.12	4.12	0	41.31	40.37	15	32.50	32.71
1	111.58	115.51	14	33.09	32.95	1	4.69	3.38	14	16.28	16.82
2	88.86	85.94	13	12.04	13.10	2	33.54	28.85	13	0.70	1.49
3	49.20	50.20	12	62.37	64.07	3	10.75	14.07	12	92.58	89.79
4	3.29	5.01	11	44.82	43.79	4	58.09	59.14	11	43.38	46.75
5	145.74	144.59	10	19.46	14.92	5	43.82	39.34	10	2.18	2.02
6	20.78	20.28	9	31.68	29.90	6	8.71	4.85	9	52.08	49.88
7	48.89	44.16	8	120.64	117.78	7	63.90	66.87	8	83.69	84.59
8	39.24	38.68	7	55.80	54.34	8	47.90	47.23	7	18.41	19.66
9	81.68	82.25	6	90.16	89.80	9	41.72	38.26	6	82.57	84.13
10	11.19	9.16	5	31.38	27.46	10	30.94	32.63	5	70.42	67.18
11	28.19	30.40	4	21.81	22.40	11	7.76	2.39	4	16.35	5.78
12	24.08	24.39	3	28.03	24.18	12	19.90	20.58	3	22.65	22.69
13	11.60	12.38	2	76.87	78.56	13	119.63	124.32	2	180.46	197.97
14	0.81	1.23	1	33.02	32.00	14	42.99	43.47	1	12.87	14.55
15	65.71	64.11	0	34.07	32.97	15	36.73	37.07	0	83.57	86.69

H, 1, 1			H, 0, 1			H, 0, 2			H, 1, 2		
0	42.70	38.63	15			0	56.12	45.69	15	59.19	60.17
1	132.33	145.50	14	32.93	33.13	1			14	4.93	1.06
2	52.35	55.57	13			2	104.28	106.78	13	67.51	68.23
3	66.68	70.66	12	54.97	50.54	3			12	68.41	72.65
4	84.94	82.74	11			4	20.19	21.43	11	19.08	14.40
5	166.45	173.48	10	89.24	90.11	5			10	17.70	19.11
6	12.66	9.94	9			6	88.94	89.50	9	99.54	101.23
7	43.98	45.35	8	34.97	35.55	7			8	5.42	3.21
8			7			8	12.92	14.60	7	67.69	67.41
9			6	162.49	159.12	9			6	110.73	110.09
10	64.91	60.55	5			10	75.47	73.62	5	130.44	133.23
11	54.92	52.65	4	81.60	85.63	11			4	92.13	87.99
12	13.06	41.83	3			12	19.21	17.69	3	79.86	83.04
13	13.04	14.97	2	67.69	60.96	13			2	53.86	55.46
14	39.05	38.93	1			14	64.51	65.01	1	112.11	115.70
15	73.05	75.20	0	91.47	95.17	15			0	75.74	75.54

H, 2, 2			H, 3, 2			H, 4, 2			H, 5, 2		
0	34.20	38.51	15	15.35	15.30	0	97.94	99.29	15	72.66	71.46
1	89.84	91.35	14	1.34	2.43	1	49.46	47.70	14	36.72	36.26
2	77.82	84.88	13	82.39	86.13	2	42.36	44.06	13	51.06	52.54
3	38.54	35.87	12	4.57	2.90	3	8.80	9.81	12	19.77	20.23
4	10.08	14.52	11	57.64	57.46	4	10.56	11.77	11	54.87	58.24
5	3.87	2.84	10	40.42	39.44	5	29.70	30.71	10	13.06	11.00
6	108.50	109.32	9	43.61	39.39	6	56.90	53.01	9	87.72	91.27
7	42.91	43.74	8	17.90	16.97	7	61.67	61.24	8	22.64	24.39
8	67.69	70.56	7	71.32	71.96	8	28.15	31.68	7	15.76	13.42
9	13.95	12.65	6	36.76	33.68	9	21.93	20.64	6	21.91	21.13
10	27.93	22.26	5	75.37	74.57	10	19.30	15.96	5	147.36	147.76
11	14.31	17.92	4	14.22	11.80	11	22.98	23.66	4	95.49	94.40
12	43.84	42.93	3	80.42	80.57	12	18.87	20.51	3	47.72	45.34
13	6.06	4.93	2	69.97	67.21	13	18.78	18.75	2	46.34	46.00
14	54.99	56.33	1	28.31	22.20	14	39.48	40.02	1	72.26	71.83
15	36.45	36.09	0	36.73	33.77	15	28.72	28.61	0	4.62	3.95

H, 6, 2

0	9.94	6.62
1	21.89	19.91
2	39.64	32.75
3	20.70	19.20
4	45.31	43.50
5	5.21	1.30
6	82.31	85.24
7	28.46	28.26
8	64.02	66.70
9	6.53	4.33
10	83.20	87.13
11	7.22	6.61
12	25.33	26.05
13	0.85	3.20
14	57.60	57.40
15	21.15	20.69

H, 7, 2

15	23.06	22.80
14	13.86	12.18
13	27.03	24.56
12	47.71	47.81
11	20.47	17.30
10	9.05	9.04
9	34.53	36.11
8	14.38	12.93
7	44.31	47.20
6	1.32	0.01
5	0.74	3.67
4	47.84	46.63
3	63.90	67.56
2	0.72	0.48
1	33.82	36.61
0	40.36	40.58

H, 7, 3

0	17.75	17.44
1	63.33	64.57
2	21.84	23.00
3	45.23	46.85
4	19.78	21.30
5	57.99	59.48
6	45.62	44.34
7	92.17	94.30
8	16.26	16.25
9	16.71	18.42
10	48.06	47.53
11	67.90	70.06
12	8.80	6.18
13	69.19	68.29
14	5.45	6.15
15	32.11	32.85

H, 6, 3

15	14.90	15.19
14	25.87	26.61
13	11.04	10.88
12	15.42	14.31
11	4.44	7.84
10	36.62	37.73
9	27.44	27.75
8	22.09	21.74
7	18.85	18.52
6	63.44	65.08
5	22.62	23.80
4	63.14	63.52
3	24.09	24.00
2	41.38	41.65
1	3.26	1.97
0	88.84	89.95

H, 5, 3

0	5.60	6.76
1	15.86	17.31
2	55.16	54.90
3	22.28	24.75
4	24.84	22.04
5	37.17	36.09
6	7.29	6.91
7	4.32	0.08
8	3.05	5.62
9	18.29	18.70
10	7.03	5.06
11	63.49	64.00
12	37.81	37.97
13	4.97	1.84
14	39.95	40.26
15	66.76	65.48

H, 4, 3

15		
14	69.61	69.12
13	20.90	21.32
12	38.70	39.94
11	14.98	12.28
10	76.51	78.44
9	52.42	53.37
8	68.59	69.19
7	12.67	13.25
6	51.63	46.52
5	4.54	4.27
4	100.23	97.48
3	25.99	26.21
2	27.09	29.27
1	45.99	45.50
0	59.43	61.36

H, 3, 3

0	9.40	7.31
1	81.91	32.99
2	27.79	27.10
3	200.87	209.64
4	5.58	0.61
5	60.69	61.77
6	2.90	0.96
7	101.89	98.43
8	40.07	40.72
9	26.24	25.43
10	11.33	9.62
11	71.12	71.97
12	17.68	16.50
13	6.56	3.17
14	16.89	18.32
15	45.43	45.66

H, 2, 3

15	5.38	3.34
14	57.38	57.90
13	30.56	29.88
12	53.05	53.45
11	26.96	29.55
10	21.45	23.87
9	74.95	74.47
8	46.69	3.37
7	5.98	3.92
6	25.52	21.97
5	18.11	16.55
4	86.56	85.35
3	41.14	39.05
2	78.19	78.50
1	41.48	41.13
0	14.64	17.71

H, 1, 3

0	44.89	41.19
1	19.82	11.11
2	33.86	29.88
3	28.46	30.89
4	27.61	23.86
5	37.67	40.77
6	88.75	89.23
7	97.58	97.30
8	28.48	26.67
9	18.40	19.47
10	63.33	67.27
11	90.64	91.40
12	61.38	64.37
13	44.88	44.80
14	8.97	6.50
15	53.90	55.84

H, 0, 3

15		
14	42.69	43.93
13		
12	51.49	50.49
11		
10	93.24	91.12
9		
8	101.54	100.15
7		
6	150.99	152.80
5		
4	107.28	107.70
3		
2	69.49	70.00
1		
0	110.68	120.51

H, 0, 4

0	123.82	124.89
1		
2	24.04	20.34
3		
4	109.85	111.31
5		
6	12.79	13.11
7		
8	28.76	33.48
9		
10	56.56	57.81
11		
12	22.53	21.08
13		
14	52.39	54.94

H, 1, 4

15		
14	53.73	54.07
13	35.98	35.37
12		
11	62.27	64.68
10	35.39	36.09
9	59.66	58.73
8	34.09	31.86
7	7.53	11.05
6	47.24	45.94
5	128.08	129.05
4	11.15	10.21
3	9.40	8.15
2	60.59	60.23
1	56.54	57.24
0	24.03	22.33

H, 2, 4

1	4.12	6.20
2	120.90	123.78
3		
4	111.68	113.40
5	44.74	43.96
6	59.09	54.91
7	9.63	10.86
8	138.35	138.77
9		
10		
11		
12	88.73	88.95
13	12.77	12.26
14	22.60	23.25
15	42.41	42.43

H, 3, 4

15	20.49	21.48
14	16.10	17.09
13	61.71	63.38
12	7.68	6.87
11	11.37	10.24
10		
9	25.47	25.55
8	44.03	45.20
7	36.16	37.16
6	22.68	22.30
5	12.48	9.89
4		
3	31.45	30.41
2	1.49	2.95
1		
0	6.38	5.92

H, 4, 4

0	28.14	23.45
1	28.63	28.15
2	84.54	81.82
3	38.25	40.64
4		
5	0.67	2.88
6	40.27	40.28
7	7.6	6.7
8	56.56	59.36
9	.7	3.0
10	22.9	22.6
11	52.1	53.4
12	55.78	56.17
13	26.6	26.6
14	44.7	44.9
15	45.21	45.15

H, 5, 4

15	37.58	37.09
14	4.48	2.51
13	16.77	16.94
12	21.96	20.65
11	53.33	54.02
10	19.49	20.90
9	41.81	41.58
8	5.38	0.89
7	26.13	28.46
6	16.92	17.85
5	90.22	91.71
4	12.25	10.70
3	3.49	3.28
2	70.08	70.27
1	79.74	78.66
0	21.82	22.09

H, 6, 4

0	81.02	82.55
1	57.20	58.85
2	13.47	14.70
3	12.76	12.28
4	54.65	54.23
5	5.59	1.29
6	26.27	27.89
7	30.78	30.39
8	11.51	12.98
9	11.54	13.04
10	57.33	56.42
11	62.60	60.12
12		
13	5.12	6.81
14	28.59	27.58
15	13.11	13.47

H, 7, 4

15		
14	23.76	22.25
13	31.87	29.69
12	6.05	2.13
11	56.96	56.15
10	11.49	12.23
9	34.06	33.86
8	4.06	1.03
7	16.55	16.12
6	7.58	6.62
5	54.47	55.30
4	13.59	13.52
3	21.98	22.32
2	4.57	1.70
1	21.73	20.75
0	44.79	43.95

H, 7, 5

0	9.20	8.52
1	26.07	24.63
2	23.99	22.69
3	74.09	74.45
4	52.43	52.07
5	7.23	6.00
6	1.86	2.94
7	28.91	27.59
8	32.78	33.27
9	42.87	42.05
10	28.22	30.13
11	2.10	1.08
12	0.96	1.64
13		
14		
15		

H, 6, 5

15		
14	60.11	60.49
13	39.77	39.03
12	28.97	29.46
11	2.02	1.85
10	66.38	64.61
9	7.52	9.16
8	21.95	21.62
7	17.18	17.49
6	27.52	27.84
5	4.82	4.80
4	26.34	27.69
3	48.98	50.25
2	29.11	29.74
1	10.21	7.71
0	22.22	23.16

H, 5, 5

0	32.38	29.95
1	99.15	103.89
2	21.78	23.12
3	45.95	47.83
4	30.78	30.09
5	62.87	67.02
6	9.56	7.68
7	32.81	35.42
8	13.46	12.39
9	35.57	36.01
10	39.04	39.22
11	51.81	49.02
12	9.83	7.29
13	25.98	27.42
14	14.10	14.20
15	33.74	31.18

H, 4, 5

15	22.20	21.49
14	14.35	12.54
13	21.51	21.19
12	29.51	29.53
11	7.59	8.18
10	44.42	43.88
9	37.61	36.80
8		
7	27.85	28.78
6	56.24	57.96
5	6.10	3.72
4	26.11	24.27
3	28.17	27.46
2	57.31	56.87
1	10.01	10.21
0	36.73	34.79

H, 3, 5

0	14.14	13.86
1	6.54	11.40
2	5.33	6.59
3	47.38	45.18
4	3.09	4.72
5	23.11	20.81
6	27.70	27.41
7	80.26	84.50
8	3.58	5.75
9	31.30	31.70
10	25.88	24.73
11	41.56	42.10
12	18.54	18.67
13	88.60	90.14
14	4.06	3.29
15	18.68	18.28

H, 2, 5

15	23.08	22.90
14	35.77	36.38
13	5.34	0.10
12	51.97	51.85
11	10.22	8.22
10	44.96	47.87
9	14.56	15.50
8	41.69	43.34
7	34.33	34.40
6	77.44	76.47
5	3.22	2.44
4	67.57	63.97
3	17.58	16.25
2	129.02	125.63
1	31.89	32.96
0	22.10	21.63

H, 1, 5

0	22.14	21.30
1	83.73	83.11
2	50.66	50.90
3	102.8	97.6
4	79.56	80.29
5	46.02	41.76
6	13.51	14.33
7	25.16	23.28
8	9.36	7.79
9	67.15	69.33
10	35.21	35.54
11	28.14	29.30
12	20.45	20.81
13	31.74	32.31
14	5.86	3.15
15	31.38	32.32

H, 0, 5

14	51.18	52.78
12	8.23	4.96
10	94.74	95.95
8	7.90	6.63
6	5.10	5.20
4	14.57	13.07
2	17.87	20.64
0	27.23	33.48

H, 0, 6

0	154.92	157.17
2	65.50	64.27
4	86.64	87.39
6	114.57	118.27
8	31.00	30.91
10	74.53	74.90
12	19.24	23.99
14	48.66	47.53

H, 1, 6

15	52.14	50.82
14	15.89	12.58
13	23.48	23.19
12	32.13	31.20
11	41.15	41.39
10	7.18	4.87
9	24.80	24.36
8	30.36	28.61
7	55.20	55.88
6	55.38	59.26
5	17.78	19.41
4	26.66	25.72
3	35.82	34.20
2	8.11	5.38
1	92.62	91.54
0	8.42	6.45

H, 2, 6

0	20.90	19.30
1	27.31	27.29
2	5.10	2.97
3	0.70	1.62
4	6.98	1.20
5	24.68	25.15
6	6.09	5.25
7	13.08	13.56
8	16.55	16.31
9	34.45	33.91
10	38.54	37.37
11	6.45	4.34
12	13.40	12.37
13	26.84	26.36
14	26.43	24.78
15	35.97	35.16

H, 3, 6

15	16.31	16.25
14	9.41	6.60
13	41.02	41.01
12	12.36	-11.97
11	70.33	69.48
10	8.76	6.90
9	64.14	63.07
8	4.60	1.72
7	90.34	92.41
6	4.94	-5.66
5	27.14	26.83
4	6.68	3.26
3	131.97	136.72
2	37.46	-38.77
1	14.09	13.94
0	25.35	25.54

H, 4, 6

0	68.45	68.37
1	51.51	-52.48
2	40.13	41.43
3	8.28	-5.80
4	65.11	65.31
5	11.04	-10.70
6	28.50	28.64
7	4.77	-4.20
8	33.33	33.82
9	52.89	52.11
10	63.22	61.79
11	13.20	-11.62
12	15.24	16.21
13	34.35	33.84
14	41.52	40.29
15	20.75	20.68

H, 5, 6

1	16.41	16.73
13	6.57	2.26
12	33.07	32.99
11	29.15	28.29
10	4.29	3.52
9	23.60	22.31
8	8.76	5.55
7	13.85	14.28
6	20.64	20.24
5	31.51	31.38
4	12.45	10.73
3	21.21	22.98
2	37.53	37.08
1	30.53	31.94
0	5.49	1.63

H, 6, 6

0	63.24	63.31
1	9.80	6.27
2	27.39	26.64
3	4.73	7.85
4	42.64	42.00
5	27.01	27.11
6	49.50	48.99
7	5.13	1.03
8	28.10	28.10
9	16.62	15.72
10	40.25	37.42
11	21.72	24.34
12	18.09	17.41

H, 7, 6

10	10.45	10.93
9	27.99	26.02
8	10.15	12.44
7	71.44	69.11
6	34.95	32.91
5	6.56	1.07
4	47.25	48.42
3	60.65	60.45
2	9.81	5.40
1	75.77	76.40
0	16.90	18.37

H, 7, 7

0	7.68	3.60
1	3.00	4.09
2	17.70	14.50
3	7.34	4.84
4	9.22	8.83
5	32.93	34.28
6	38.16	32.60
7	31.83	29.30
8	9.47	8.99

H, 6, 7

10	27.15	24.15
9	33.46	31.88
8	14.07	12.80
7	50.18	47.52
6	41.83	40.07
5	6.04	7.43
4	64.50	62.37
3	4.98	4.69
2	37.21	35.97
1	21.66	20.80
0	92.98	92.36

H, 5, 7

0	22.47	22.21
1	58.42	57.45
2	27.58	31.09
3	25.59	27.94
4	40.79	41.42
5	59.30	59.33
6	24.04	25.60
7	15.79	15.30
8	9.14	7.78
9	62.39	60.53
10	25.69	27.83
11	34.89	31.98

H, 4, 7

13	6.16	8.57
12	46.13	45.37
11	20.44	19.22
10	25.60	22.31
9	9.47	9.46
8	74.47	73.63
7	10.63	10.42
6	19.45	18.88
5	0.83	1.27
4	28.79	28.84
3	3.13	3.21
2	26.68	27.76
1	33.51	34.05
0	40.39	39.05

H, 3, 7

0	5.71	7.93
1	49.53	50.74
2	0.77	0.26
3	57.60	58.23
4	47.74	46.84
5	15.42	14.67
6	9.21	6.72
7	39.71	39.52
8	11.43	11.70
9	34.55	34.65
10	14.64	13.82
11	7.59	6.62
12	5.45	1.01
13	26.66	24.97

H, 2, 7

14	20.33	20.26
13	22.96	22.01
12	63.64	61.43
11	21.00	20.80
10	0.88	3.05
9	4.27	1.15
8	89.00	86.35
7	0.82	1.84
6	21.08	19.41
5	18.53	16.73
4	43.55	43.43
3	4.48	2.89
2	38.99	39.90
1	5.04	0.36
0	47.14	48.00

H, 1, 7

0	24.76	23.41
1	52.77	55.47
2	11.79	12.07
3	9.71	9.10
4	16.49	14.41
5	63.90	66.54
6	10.83	9.77
7	31.14	30.30
8	21.34	19.70
9	44.12	44.54
10	13.79	13.83
11	46.98	45.69
12	17.62	17.64
13	20.72	20.87
14	43.35	40.53

H, 0, 7

14	18.93	22.37
12	35.87	35.79
10	43.81	42.14
8	6.14	5.72
6	51.64	54.89
4	70.87	72.08
2	28.55	30.63
0	122.28	123.51