

AM-76-030

American Mineralogist, Volume 61, pages 1241-1248, 1976

## The crystal structure of bermanite, a hydrated manganese phosphate

ANTHONY R. KAMPF AND PAUL B. MOORE

Department of the Geophysical Sciences

The University of Chicago  
Chicago, Illinois 60637

### Abstract

Bermanite,  $Mn^{2+}(H_2O)_4[Mn^{3+}(OH)_2(PO_4)_2]$ ,  $a = 5.446(3)$ ,  $b = 19.25(1)$ ,  $c = 5.428(3)\text{\AA}$ ,  $\beta = 110.29(4)^\circ$ , monoclinic, space group  $P2_1$ ,  $Z = 2$ , is a novel structure type based on dense-packed  $[Mn^{3+}(OH)_2(PO_4)_2]^{2-}$  slabs parallel to the  $\{010\}$  plane linked by tetrahedral corner-sharing to insular *trans*- $[Mn^{2+}(Op)_2(H_2O)_4]$  octahedra. Chains of edge-sharing  $Mn^{3+}-O$  octahedra, expressed as  $[\text{Mn}^{3+}(OH)(Op)]_n$ , run parallel to the  $[101]$  direction and are corner-linked by the  $(PO_4)$  tetrahedra to form the slabs. A compact slab approximates local  $[C \cdot A \cdot B \cdot C]$  anion packing where the  $A$  and  $B$  layers are fully occupied and the  $C$  layers only one-quarter occupied.

$R(hkl) = 0.059$  for 1254 independent reflections. The average interatomic distances are  $Mn^{3+}(1)-O = 2.020\text{\AA}$ ,  $Mn^{3+}(2)-O = 2.023\text{\AA}$ ,  $Mn^{2+}(3)-O = 2.186\text{\AA}$ ,  $P(1)-O = 1.550\text{\AA}$  and  $P(2)-O = 1.548\text{\AA}$ . Local dense-packing and pseudo-orthogonal character of the structure allow several kinds of twinning, which are explicable on the basis of local structure geometry.

### Introduction

Bermanite occurs in moderate abundance at several pegmatites (Moore, 1973) as a late-stage hydrothermally reworked product of primary manganese-iron phosphates, in particular triplite,  $(Mn,Fe)_2^+(F,OH)(PO_4)$ . Originally described by Hurlbut (1936) from a pegmatite on the 7-U-7 Ranch, west of Hillside, Bagdad district, Arizona, it occurred in veinlets and cavities which cut and line triplite. Hurlbut established orthorhombic holosymmetry from single-crystal goniometric and X-ray study which afforded  $a = 6.25\text{\AA}$ ,  $b = 8.92\text{\AA}$ ,  $c = 19.61\text{\AA}$ , and he proposed the composition  $(Mn,Mg)_2^+(Mn,Fe)_8^+(PO_4)_8(OH)_{10} \cdot 15H_2O$  based on the analysis of F. A. Gonyer. A space group was not proposed. Leavens (1967), upon reexamining bermanite from the type locality as well as from other hitherto unrecorded locations, confirmed the orthorhombic symmetry and determined the cell constants  $a = 6.20\text{\AA}$ ,  $b = 8.92\text{\AA}$ ,  $c = 19.20\text{\AA}$  with space group  $C222_1$ . From space-group restrictions and an electron microprobe analysis, he proposed the ideal formula  $Mn^{2+}Mn^{3+}(PO_4)_2(OH)_2 \cdot 4H_2O$ ,  $Z = 4$ . Hurlbut and Aristarain (1968) studied bermanite from the triplite-bearing El Criollo pegmatite near Córdoba, Argentina, and detected persistent twinning which they sub-

sequently confirmed from restudy of the type material. The twin laws observed as well as non-orthorhombic orientation of the optical indicatrix forced them to conclude that bermanite is sensibly monoclinic with the cell constants  $a = c = 5.426\text{\AA}$ ,  $b = 19.206\text{\AA}$ ,  $\beta = 110^\circ 30'$  (on crystals from Argentina) and the space group  $P2_1$ . A new analysis of bermanite from the type locality confirmed the ideal formula proposed by Leavens with  $Z = 2$ .

Recently, Mr. J. E. Johnson of the South Australian Museum sent us several specimens of bermanite crystals from the McMahon pegmatite near Olary, South Australia. The mineral replaces triplite along fracture surfaces and occurs in association with phosphosiderite, strengite, siderite, hureaulite, rock-bridgeite, manganese oxides, and an unknown yellow fibrous mineral. The bermanite crystals are of exceptional quality and up to 1 mm in maximum dimension. Twinning is prevalent; however, a small untwinned individual, eminently suitable for crystal structure analysis, was recovered with little difficulty. Knowledge of the crystal structure would establish the true symmetry and ideal chemical formula of bermanite and would explain the various twin laws determined by Hurlbut and Aristarain.

Our principal motivation for determining crystal

## BERMANITE

SHEET NO. 1 PART 1

H	K	L	FO	FC	ALPH	H	K	L	FO	FC	ALPH	H	K	L	FO	FC	ALPH
0	1	1	49.2	55.9	-85.4	1	9	-1	62.5	60.8	118.6	1	1	6	19.9	19.8	-58.2
0	3	1	15.7	17.6	103.2	1	10	1	54.9	56.5	182.4	1	1	-6	10.5	9.0	161.9
0	5	1	73.7	75.9	88.9	1	12	-1	21.6	22.6	4.0	1	2	-6	18.3	17.1	5.2
0	9	1	12.7	11.8	64.9	1	12	1	4.8	6.6	-74.2	1	2	6	19.9	20.4	-57.1
0	10	1	29.7	32.1	-17.1	1	14	1	73.4	77.4	162.2	1	3	6	6.4	5.2	42.4
0	11	1	39.1	41.4	-88.2	1	17	1	42.2	44.5	269.5	1	3	-6	7.2	8.2	213.0
0	12	1	41.6	43.4	209.6	1	19	-1	27.5	29.6	89.9	1	4	-6	28.8	28.4	188.9
0	13	1	20.2	21.2	-76.2	1	21	1	5.1	7.1	-87.1	1	4	6	14.6	15.9	218.3
0	14	1	37.1	39.0	-19.8	1	22	1	14.5	13.9	208.8	1	5	6	16.1	14.3	71.2
0	15	1	22.8	23.5	84.6	1	23	-1	13.4	18.8	100.3	1	5	-6	8.8	7.2	42.0
0	18	1	18.8	18.6	30.0	1	24	-1	24.9	24.5	5.0	1	6	-6	4.7	2.5	140.7
0	20	1	15.4	14.8	149.1	1	1	2	22.1	22.4	-45.1	1	6	6	5.2	2.8	90.8
0	4	2	16.6	14.4	260.3	1	2	-2	-12.8	11.7	01.2	1	7	-6	11.8	13.0	-10.0
0	5	2	58.8	58.5	14.5	1	2	2	40.1	44.3	16.3	1	8	-6	18.6	19.1	183.6
0	6	2	79.5	82.9	188.1	1	3	2	43.4	43.3	133.3	1	9	-6	6.6	6.1	-5.6
0	7	2	27.4	26.5	1.1	1	3	-2	29.8	28.7	142.5	1	10	-6	15.4	13.2	-0.1
0	8	2	39.3	35.5	185.4	1	4	-2	42.4	45.0	179.9	1	11	-6	11.0	10.5	163.6
0	10	2	102.5	109.1	184.2	1	4	2	57.4	59.6	177.0	1	12	-6	6.4	9.1	-6.5
0	12	2	54.1	53.1	176.3	1	5	-2	10.4	9.8	266.0	1	0	0	100.6	111.8	180.9
0	13	2	24.0	25.8	153.3	1	6	-2	53.9	55.0	1.2	1	1	0	32.0	32.9	67.2
0	16	2	6.9	5.3	-84.9	1	6	2	15.4	14.4	25.0	1	3	0	20.3	19.7	-88.0
0	17	2	14.0	14.0	-16.7	1	7	2	5.7	6.4	104.6	1	7	0	34.6	33.0	255.0
0	18	2	54.1	56.4	190.3	1	7	-2	5.5	3.5	33.2	1	8	0	10.4	12.2	174.1
0	22	2	56.3	57.9	185.3	1	8	-2	43.6	46.6	189.9	1	10	0	12.3	12.1	-29.1
0	3	3	32.2	32.7	256.3	1	8	2	15.9	15.8	223.0	1	11	0	12.9	11.8	56.1
0	7	3	21.5	21.4	251.8	1	9	2	18.3	18.0	11.5	1	12	0	59.9	61.8	186.9
0	8	3	18.5	19.9	180.5	1	9	-2	12.8	12.7	-22.4	1	13	0	23.6	23.9	30.8
0	9	3	10.9	9.6	71.2	1	10	-2	71.4	74.1	-0.5	1	14	0	29.2	29.1	-6.5
0	10	3	28.6	30.7	49.2	1	10	2	33.0	34.6	-25.9	1	15	0	5.7	7.8	-35.1
0	11	3	38.9	40.1	88.7	1	11	2	30.1	31.5	-59.6	1	17	0	8.1	10.1	-82.2
0	12	3	22.1	21.0	107.8	1	11	-2	21.4	22.5	223.4	1	19	0	16.0	16.5	126.4
0	13	3	10.2	11.3	-46.9	1	12	-2	13.7	15.3	174.1	1	20	0	26.5	26.8	178.1
0	14	3	18.9	19.4	19.3	1	12	2	16.6	16.9	-73.8	1	0	-1	43.5	43.8	3.1
0	15	3	28.2	28.5	266.9	1	13	2	20.2	20.7	26.9	1	1	1	8.2	8.3	209.8
0	17	3	19.0	20.6	260.8	1	13	-2	20.5	19.9	159.8	1	1	1	8.2	8.3	78.3
0	18	3	20.5	21.1	-55.9	1	14	-2	15.6	16.0	174.2	1	3	-1	85.9	85.2	78.3
0	20	3	17.4	15.7	220.2	1	14	2	8.2	4.5	252.8	1	4	-1	102.0	103.7	11.1
0	22	3	18.1	16.3	17.0	1	15	2	17.2	17.8	114.1	1	4	1	24.0	20.7	145.8
0	21	3	9.3	9.2	106.4	1	15	-2	19.3	20.4	141.2	1	6	1	60.2	63.2	192.9
0	1	4	24.1	23.1	-57.1	1	16	-2	43.9	45.6	187.2	1	7	1	71.1	73.0	-80.4
0	2	4	18.9	16.9	-11.4	1	16	2	27.1	27.4	181.2	1	7	-1	71.4	72.4	103.5
0	3	4	22.1	24.2	3.6	1	17	2	3.6	5.4	218.2	1	8	1	7.0	6.2	163.4
0	4	4	37.4	38.1	-6.8	1	18	-2	6.4	6.6	-62.5	1	9	1	49.5	50.9	266.4
0	5	4	18.9	19.4	-80.5	1	18	2	28.6	27.6	25.9	1	10	-1	41.2	41.7	256.3
0	6	4	22.0	22.4	11.7	1	19	2	16.9	17.9	209.2	1	11	-1	22.0	24.7	117.3
0	9	4	25.5	23.5	230.7	1	19	-2	5.6	8.5	13.3	1	11	1	25.6	28.6	-60.4
0	12	4	73.3	74.5	4.0	1	20	-2	9.1	9.9	255.5	1	13	1	75.2	77.1	269.7
0	13	4	15.2	14.1	-29.7	1	20	2	6.2	5.6	24.6	1	13	-1	31.9	35.4	94.1
0	14	4	4.3	0.9	-81.8	1	21	2	16.2	18.2	264.6	1	14	-1	24.2	25.6	40.8
0	15	4	9.7	9.3	-21.3	1	21	-2	8.2	8.1	-21.9	1	15	1	66.6	71.1	-77.8
0	16	4	26.2	26.9	15.4	1	22	-2	29.8	28.3	-0.5	1	15	-1	73.4	76.2	85.6
0	17	4	13.0	12.5	240.3	1	22	2	27.6	27.3	1.5	1	16	-1	39.4	41.2	30.6
0	18	4	22.0	24.6	21.5	1	23	2	7.8	9.0	241.1	1	16	1	17.3	20.6	189.8
0	19	4	11.1	11.3	246.0	1	1	3	24.5	27.5	131.2	1	17	-1	43.3	46.7	95.4
0	1	5	5.4	3.9	244.6	1	1	-3	43.9	44.2	262.7	1	18	-1	3.6	5.4	85.3
0	2	5	20.8	22.0	-36.3	1	2	-3	45.6	47.6	203.8	1	18	1	30.6	30.9	193.1
0	3	5	15.2	14.2	121.8	1	2	3	21.3	16.4	-14.2	1	19	1	20.0	20.8	-59.5
0	4	5	13.7	13.4	196.1	1	4	-3	23.3	12.3	-53.2	1	20	-1	25.6	26.1	-1.4

0	6	5	15.8	15.6	38.6	1	4	3	72.1	73.0	8.0	1	20	1	3.5	2.3	13.1
0	7	5	6.9	5.8	-73.5	1	5	-3	104.2	109.0	-88.9	1	21	-1	20.9	21.1	120.9
0	8	5	23.4	23.2	147.1	1	6	-3	55.0	54.6	178.4	1	22	-1	15.6	14.8	199.8
0	9	5	19.4	18.7	-51.9	1	6	3	35.9	32.8	30.1	1	23	1	16.7	19.4	-67.4
0	11	5	13.2	11.0	257.7	1	7	-3	64.0	67.4	-83.7	1	24	1	11.4	14.3	183.1

(n)

0	12	5	14.0	13.9	222.5	1	8	-3	23.0	19.0	30.0	1	0	-2	62.8	58.7	-1.0
0	13	5	14.1	12.6	99.1	1	8	3	55.0	55.7	21.7	1	0	2	31.9	31.0	181.7
0	14	5	16.6	16.2	-6.1	1	9	3	25.0	24.6	74.9	1	1	-2	21.7	20.5	233.7
0	15	5	22.2	23.8	88.1	1	9	-3	44.2	47.8	-86.1	1	5	2	8.7	6.7	107.1
0	16	5	9.4	6.7	72.9	1	10	-3	25.7	25.9	189.4	1	17	-2	5.5	10.5	49.6
0	17	6	26.0	25.7	122.1	1	10	3	16.8	16.8	117.8	1	23	-2	5.6	4.7	239.6
0	18	6	23.5	24.8	140.5	1	11	3	15.7	15.4	56.1	1	0	-3	16.4	17.4	2.4
0	19	6	15.0	16.7	158.1	1	11	-3	6.7	1.8	-19.1	1	0	3	28.7	31.6	5.0
0	20	6	16.4	17.7	65.0	1	12	-3	20.5	20.6	-42.6	1	3	3	57.2	57.5	84.7
0	21	6	14.1	12.7	211.4	1	12	3	31.5	32.7	-0.7	1	3	-3	81.6	84.3	-86.8
0	22	6	10.5	11.4	94.5	1	13	3	33.1	34.1	126.3	1	5	3	50.8	52.5	91.0
0	23	6	44.7	42.7	189.0	1	14	-3	24.7	24.1	218.8	1	7	3	53.6	54.5	71.9
0	24	0	88.0	87.9	2.5	1	15	3	41.9	43.0	91.9	1	13	-3	18.2	20.2	262.0
0	25	0	97.1	97.2	4.0	1	16	-3	16.8	10.3	111.8	1	14	3	21.6	18.8	-20.1
0	26	0	2.6	12.0	168.7	1	18	3	53.4	54.9	2.7	1	15	-3	55.9	57.1	-85.5
0	27	0	8.7	9.9	58.5	1	18	3	10.5	10.6	0.9	1	17	-3	38.0	40.3	-80.4
0	28	0	72.6	71.6	0.3	1	19	3	15.1	16.1	50.6	1	17	3	33.0	35.7	107.9
0	29	0	114.3	117.5	4.8	1	19	-3	35.7	38.4	-80.7	1	18	-3	22.3	23.2	152.5
0	30	0	20.0	21.5	-7.6	1	20	3	23.1	22.8	23.3	1	20	-3	12.6	9.8	53.5
0	31	0	54.2	54.8	6.9	1	21	3	9.3	10.2	99.2	1	0	-4	63.1	63.8	181.3
0	32	0	18.0	8.2	-1.7	1	21	-3	18.6	21.2	-80.6	1	0	4	36.8	38.8	181.8
0	33	0	25.2	27.6	10.7	1	22	-3	19.9	20.1	209.1	1	11	4	17.1	16.5	96.4
0	34	0	33.1	33.8	10.0	1	1	-4	22.1	22.5	14.4	1	0	-5	11.3	7.9	8.6
0	35	1	53.8	58.3	181.4	1	2	-4	11.0	9.9	-4.6	1	0	5	3.7	1.7	214.0
0	36	1	38.0	44.1	-12.8	1	2	4	25.3	27.3	-45.1	1	3	-5	55.1	56.5	91.4
0	37	1	21.4	26.3	197.6	1	3	4	25.8	26.2	195.6	1	7	-5	45.4	47.0	94.6
0	38	1	26.0	28.0	-5.1	1	3	-4	26.5	27.4	-3.1	1	0	-6	3.5	2.0	-21.7
0	39	1	23.6	22.5	59.1	1	4	-4	7.7	6.4	236.9	1	0	6	9.3	9.1	-3.1
0	40	1	18.4	20.9	194.8	1	4	4	14.1	14.5	132.9	2	1	0	94.4	94.1	-81.2
0	41	1	28.1	27.6	194.1	1	5	4	10.4	9.2	262.6	2	2	0	56.5	47.3	-43.5
0	42	1	5.7	6.1	-44.6	1	5	-4	8.5	8.9	-53.2	2	3	0	46.7	47.1	-30.5
0	43	1	11.0	11.7	-56.9	1	6	-4	40.2	41.9	9.7	2	4	0	70.8	68.5	-45.5
0	44	1	14.8	16.9	-74.4	1	6	4	10.8	9.9	27.0	2	5	0	50.9	47.6	-68.2
0	45	1	12.1	11.2	82.9	1	7	4	10.5	10.9	66.6	2	6	0	42.3	39.8	259.3
0	46	1	9.8	8.6	-65.9	1	7	-4	17.0	18.4	173.7	2	10	0	25.9	17.4	43.2
0	47	1	5.1	5.4	165.9	1	8	-4	15.0	13.9	167.4	2	15	0	13.0	10.3	-20.0
0	48	2	77.5	76.2	181.4	1	8	4	21.8	21.6	216.4	2	16	0	21.5	25.2	-20.8
0	49	2	27.8	22.2	52.9	1	9	4	14.3	14.6	31.5	2	19	0	31.7	36.3	-60.5
0	50	2	105.6	109.8	184.7	1	9	-4	32.1	33.1	195.9	2	23	0	29.6	34.1	269.3
0	51	2	60.1	58.8	7.6	1	10	-4	10.3	7.5	98.5	2	1	-1	35.8	34.0	83.9
0	52	2	26.1	28.0	99.0	1	10	4	6.4	7.2	214.6	2	1	1	11.8	10.4	-32.9
0	53	2	26.6	22.4	160.3	1	11	-4	14.8	14.8	143.7	2	2	1	40.2	39.8	-6.1
0	54	2	43.1	46.4	189.2	1	12	4	18.5	19.0	161.0	2	2	-1	41.1	39.8	-31.7
0	55	2	10.3	11.2	45.5	1	13	4	8.3	8.0	-86.7	2	3	-1	57.5	55.1	231.8
0	56	2	20.4	21.1	45.6	1	13	-4	8.5	9.3	-0.3	2	3	1	36.5	35.2	151.2
0	57	2	31.0	36.2	190.4	1	14	-4	19.4	19.6	10.4	2	4	1	16.1	10.8	241.3
0	58	2	8.6	5.1	173.1	1	14	4	34.3	34.9	25.7	2	4	-1	50.4	50.0	175.1
0	59	2	15.6	16.8	164.4	1	15	4	33.1	34.5	246.6	2	5	-1	30.7	29.1	63.6
0	60	3	23.0	24.6	182.7	1	15	-4	7.1	7.1	-73.4	2	5	1	12.4	15.0	45.8
0	61	3	52.4	50.9	83.9	1	16	-4	5.4	8.1	18.8	2	6	1	35.4	38.8	2.2
0	62	3	38.9	40.9	-7.6	1	16	4	8.6	9.6	48.3	2	6	-1	44.8	45.3	-6.0
0	63	3	35.0	38.6	191.6	1	17	4	8.1	10.5	-34.4	2	7	-1	17.2	19.2	240.2
0	64	3	5.7	2.9	94.1	1	17	-4	6.4	5.0	110.6	2	7	1	17.1	18.5	150.5
0	65	3	23.8	23.3	-30.6	1	18	-4	19.2	17.8	19.0	2	8	1	21.9	23.5	183.5
0	66	3	24.5	23.6	213.5	1	18	4	12.4	13.2	2.9	2	9	-1	18.4	22.7	35.2
0	67	3	11.0	10.9	236.0	1	19	-4	7.4	7.5	241.3	2	9	1	31.0	32.4	-6.3
0	68	4	57.0	57.5	3.9	1	20	-4	10.2	7.7	182.8	2	10	1	17.6	14.8	112.7
0	69	4	15.4	14.0	266.5	1	1	5	24.8	22.8	267.2	2	11	1	20.6	19.3	-35.0
0	70	4	74.6	77.0	8.1	1	1	-5	20.6	19.5	94.6	2	13	1	22.2	21.5	15.6
0	71	4	42.3	43.7	5.3	1	2	-5	22.3	21.9	111.9	2	14	1	27.4	26.2	8.2
0	72	4	29.4	29.3	-71.9	1	2	5	52.3	52.5	170.8	2	15	-1	20.8	26.4	237.8
0	73	5	19.7	20.2	183.1	1	3	5	35.8	35.7	-51.1	2	16	1	10.6	9.7	-49.9

0	5	5	8.6	6.8	-11.3	1	4	-5	27.3	26.9	54.6	2	17	1	3.6	5.4	132.9
0	10	5	12.2	12.3	76.8	1	4	5	31.4	31.6	178.3	2	19	1	18.8	20.9	215.9
0	0	6	38.0	39.1	182.2	1	5	5	37.2	36.1	-89.7	2	20	1	31.7	33.5	196.5
0	2	0	44.8	42.4	168.4	1	5	-5	40.3	38.4	92.4	2	20	-1	11.7	11.9	141.6
0	4	0	11.3	11.2	150.2	1	6	-5	15.7	15.7	182.5	2	21	-1	13.4	14.7	50.4

(4)

(5)

0	6	6	34.3	34.3	183.2	1	6	5	42.6	41.4	182.4	2	22	1	3.9	5.0	215.8
1	2	0	23.4	25.0	-1.1	1	7	5	19.2	17.7	268.6	2	22	-1	28.8	27.9	12.1
1	4	0	18.2	14.6	-20.2	1	8	-5	24.3	22.1	-12.9	2	23	1	4.3	7.7	216.6
1	5	0	29.1	26.7	-43.3	1	8	5	16.7	18.8	202.4	2	1	-2	19.7	20.6	99.8
1	6	0	72.8	78.3	1.7	1	9	5	15.6	15.2	239.8	2	1	2	117.6	116.3	93.8
1	9	0	19.7	23.5	41.6	1	9	-5	34.1	36.5	95.3	2	2	2	52.5	52.0	181.8
1	16	0	10.1	9.9	206.8	1	10	-5	18.8	18.3	174.8	2	2	-2	60.4	60.4	210.9
1	18	0	11.7	11.5	57.9	1	10	5	14.5	14.4	206.6	2	3	-2	41.7	39.5	19.8
1	22	0	9.0	10.4	120.1	1	11	5	7.6	8.4	-25.4	2	3	2	57.5	55.2	82.4
1	23	0	7.0	6.8	157.2	1	11	-5	16.8	17.2	100.8	2	4	2	5.2	4.1	-55.4
1	24	0	8.5	6.7	149.9	1	12	-5	23.2	22.8	42.9	2	4	-2	22.9	21.3	-71.1
1	1	-1	46.5	39.7	97.7	1	12	5	6.1	7.2	112.8	2	5	-2	51.9	49.9	93.2
1	2	-1	27.4	29.1	118.9	1	13	5	17.6	15.5	-67.6	2	5	2	25.5	26.9	137.7
1	2	1	60.3	64.4	191.6	1	13	-5	40.7	41.7	96.6	2	6	2	34.5	34.1	179.9
1	3	1	108.7	105.1	-84.3	1	14	-5	14.1	14.4	133.4	2	7	-2	62.8	62.0	92.2
1	5	1	22.7	25.4	256.0	1	14	5	40.0	40.1	181.3	2	7	2	31.8	32.0	58.5
1	5	-1	129.1	127.5	97.7	1	15	-5	44.5	46.1	96.4	2	8	2	13.3	13.6	-14.1
1	6	-1	33.2	32.0	253.4	1	16	-5	18.3	15.3	-31.6	2	10	2	47.1	46.7	181.0
1	8	-1	82.9	85.4	-29.0	1	17	-5	33.2	32.2	100.7	2	10	-2	81.7	83.7	181.7

## BERMANITE

SHEET NO. 1 PART 2

H	K	L	FO	FC	ALPH	H	K	L	FO	FC	ALPH	H	K	L	FO	FC	ALPH
2	11	-2	54.5	56.5	87.7	2	21	1	9.7	11.7	-60.2	3	21	-3	9.4	10.3	216.4
2	11	2	70.2	71.4	82.3	2	23	-1	4.6	9.3	136.2	3	1	4	12.0	13.4	74.2
2	12	2	8.6	8.5	187.2	2	0	2	48.6	46.7	180.3	3	2	-4	24.4	24.8	-56.9
2	13	2	40.6	41.4	104.6	2	0	-2	12.3	11.4	-4.7	3	2	4	8.6	7.5	-73.8
2	15	-2	10.1	10.6	43.9	2	6	-2	88.2	88.6	186.0	3	3	4	17.5	18.1	241.6
2	15	2	10.1	10.5	77.5	2	8	-2	43.2	43.7	158.0	3	3	-4	13.5	14.3	-83.3
2	16	2	3.5	3.2	66.8	2	9	-2	80.2	80.3	107.4	3	4	-4	14.4	14.0	230.9
2	17	2	26.9	27.7	101.8	2	9	2	38.0	37.0	128.4	3	4	4	15.2	13.9	196.1
2	18	2	21.9	20.7	194.8	2	12	-2	26.5	29.0	195.6	3	5	4	14.5	12.5	-43.6
2	19	2	25.4	25.6	88.4	2	13	-2	29.4	28.0	91.9	3	5	-4	19.1	19.0	-52.8
2	1	3	16.2	15.8	27.0	2	14	2	23.3	23.0	187.7	3	6	-4	22.8	21.9	24.4
2	2	3	25.4	24.7	26.6	2	14	-2	30.1	29.7	218.0	3	6	4	6.4	7.8	-56.6
2	2	-3	30.0	30.0	35.4	2	16	-2	3.7	5.3	-72.9	3	7	4	13.6	14.1	211.4
2	3	-3	11.2	10.2	-6.6	2	17	-2	20.2	21.6	138.0	3	7	-4	23.7	24.0	226.0
2	3	3	7.1	5.8	36.7	2	18	-2	42.5	44.7	177.2	3	8	-4	22.8	24.4	122.6
2	4	3	43.7	44.7	187.8	2	19	-2	44.4	46.8	97.7	3	8	4	13.9	13.2	148.3
2	4	-3	12.0	12.3	136.6	2	20	2	3.9	6.5	155.1	3	9	4	19.0	19.3	38.0
2	5	-3	18.1	19.5	67.2	2	20	-2	22.8	28.5	181.8	3	9	-4	5.3	4.2	9.5
2	5	3	30.1	29.6	-47.4	2	21	-2	34.9	38.6	107.2	3	10	-4	14.6	12.8	32.2
2	6	3	17.2	17.5	143.9	2	21	2	33.7	35.5	106.4	3	10	4	18.0	16.5	53.0
2	6	-3	17.8	18.6	-34.7	2	22	-2	48.4	50.2	187.4	3	11	4	17.4	18.5	109.0
2	7	-3	23.5	25.1	204.1	2	23	-2	32.9	34.8	81.6	3	11	-4	12.5	12.6	124.3
2	7	3	16.7	15.8	200.1	2	0	3	39.6	41.5	-0.7	3	12	-4	28.2	26.8	211.2
2	8	-3	32.1	32.8	223.1	2	0	-3	42.5	43.3	181.9	3	12	4	10.9	11.1	110.2
2	9	-3	14.4	14.1	238.7	2	1	-3	19.2	17.6	-17.1	3	13	-4	20.1	19.3	34.0
2	9	3	8.2	7.7	-3.5	2	6	3	37.6	38.3	184.1	3	14	-4	16.9	16.0	-36.9
2	10	3	34.6	36.5	3.9	2	20	-3	13.4	13.2	194.9	3	15	-4	3.8	5.2	197.5
2	10	-3	16.9	17.3	-55.4	2	0	4	34.2	30.3	2.8	3	16	-4	16.0	15.2	161.6
2	11	-3	20.1	18.7	218.6	2	0	-4	110.7	114.9	1.7	3	17	-4	3.8	4.4	92.3
2	11	3	13.5	11.8	152.1	2	1	-4	66.3	64.4	241.7	3	18	-4	19.5	19.5	75.8
2	12	3	15.7	18.0	26.3	2	18	-4	4.0	11.5	-15.3	3	19	-4	15.4	14.6	125.5
2	12	-3	34.2	35.6	180.5	2	19	-4	16.5	17.0	-52.3	3	1	-5	17.9	18.6	79.8
2	13	-3	15.5	15.1	1.6	2	0	5	36.8	36.3	181.4	3	2	-5	19.4	19.1	44.5
2	13	3	18.9	19.4	29.6	2	0	-5	13.9	11.4	184.5	3	3	-5	34.1	33.4	26.8
2	14	3	10.3	8.8	27.5	2	8	5	6.1	5.4	192.7	3	4	-5	53.0	52.0	13.1
2	14	-3	41.6	42.7	7.8	2	0	-6	44.0	43.1	181.9	3	5	-5	24.9	24.8	111.9
2	15	-3	27.1	26.0	103.9	2	0	-7	24.0	24.2	181.9	3	6	-5	15.6	13.2	-21.8
2	15	3	7.1	6.9	-64.0	3	2	0	27.9	26.8	11.3	3	7	-5	22.7	23.0	136.9
2	16	3	16.1	15.3	160.6	3	3	0	27.3	28.0	210.0	3	8	-5	47.8	47.1	-10.8
2	16	-3	9.0	8.9	251.5	3	4	0	27.7	27.2	158.0	3	9	-5	34.3	33.0	153.7
2	17	-3	9.9	12.0	99.1	3	5	0	24.5	23.8	-48.8	3	10	-5	24.0	23.2	-12.7
2	17	3	6.8	8.6	0.9	3	6	0	22.6	23.0	45.0	3	11	-5	19.6	23.4	93.2
2	18	3	10.2	9.4	25.4	3	8	0	15.9	14.8	212.4	3	13	-5	19.9	21.4	55.1
2	18	-3	15.5	14.7	-25.7	3	9	0	8.7	10.2	23.8	3	14	-5	35.9	38.8	17.5
2	19	-3	4.6	5.3	228.1	3	10	0	14.3	13.5	-61.8	3	15	-5	23.1	26.4	69.3
2	19	3	8.9	10.9	194.1	3	11	0	38.7	37.0	96.4	3	16	-5	37.9	38.3	10.6
2	21	-3	8.6	10.8	-22.5	3	12	0	33.5	34.1	250.9	3	1	-6	4.5	3.4	204.6
2	22	-3	14.1	15.6	123.8	3	13	0	14.6	17.3	1.9	3	4	-6	13.3	11.4	153.4
2	1	4	59.0	58.2	260.8	3	15	0	36.7	37.9	258.2	3	5	-6	11.1	10.5	-70.0
2	2	4	5.7	5.5	218.8	3	16	0	18.0	16.8	136.4	3	7	-6	3.9	2.2	-46.2
2	2	-4	37.4	37.1	63.8	3	17	0	18.9	19.8	-37.9	3	8	-6	17.5	16.0	224.8
2	3	-4	38.0	37.4	206.1	3	19	0	12.8	13.7	238.6	3	9	-6	10.1	8.1	9.5
2	3	4	29.9	27.8	-63.2	3	21	0	15.0	14.9	51.6	3	10	-6	16.8	14.7	12.3
2	4	4	23.1	23.0	35.5	3	1	1	25.9	27.4	202.1	3	11	-6	14.4	15.9	203.1
2	4	-4	58.6	61.2	31.3	3	1	-1	16.9	11.7	129.3	3	12	-6	23.5	22.3	121.2
2	5	-4	41.5	42.8	226.8	3	3	1	25.9	23.5	41.8	3	1	-7	21.8	22.5	241.5
2	5	4	22.8	22.1	240.0	3	3	-1	40.8	35.1	33.8	3	2	-7	35.4	34.8	200.3
2	6	4	13.0	13.6	117.5	3	5	1	19.6	16.6	259.7	3	0	0	37.9	36.9	181.6

2	6	-4	16.6	18.4	37.3	3	5	-1	34.9	20.2	126.1	3	1	0	55.6	54.8	55.5
2	7	-4	19.1	18.4	-48.1	3	7	1	38.4	39.2	14.6	3	7	0	10.7	9.3	224.3
2	7	4	27.5	26.6	-72.6	3	7	-1	25.1	18.8	83.8	3	14	0	18.2	15.5	-45.0
2	8	4	23.4	22.2	41.4	3	9	1	13.6	10.4	-1.6	3	18	0	21.1	20.6	60.2
2	8	-4	33.6	34.6	-11.3	3	10	-1	7.4	4.6	150.1	3	20	0	18.4	17.8	130.7

(7)

2	9	-4	29.2	30.3	-53.5	3	10	1	33.0	32.2	193.2	3	22	0	7.8	6.5	-45.0
2	9	4	46.2	45.9	263.2	3	11	1	14.2	16.9	-17.3	3	0	-1	50.2	48.4	4.1
2	10	4	11.8	10.6	54.8	3	11	-1	26.9	28.6	9.3	3	0	1	9.4	8.4	-10.5
2	10	-4	34.9	37.3	-15.9	3	12	-1	27.0	27.0	14.6	3	2	-1	54.9	51.1	7.0
2	11	-4	42.5	42.4	-74.6	3	12	1	11.8	8.8	158.0	3	2	1	73.8	73.7	175.4
2	11	4	53.0	53.6	-79.9	3	13	1	21.9	21.6	173.6	3	4	-1	122.8	120.6	3.1
2	12	4	19.3	17.5	-23.8	3	13	-	6.1	6.4	98.7	3	4	1	68.1	65.5	194.7
2	12	-4	54.2	55.5	10.4	3	14	-1	20.9	21.8	8.3	3	6	-1	74.7	71.9	3.8
2	13	-4	26.4	25.3	242.1	3	15	1	6.8	1.8	-75.5	3	6	1	81.6	82.0	175.9
2	13	4	34.3	33.9	-87.7	3	15	-1	21.2	19.8	26.1	3	8	-1	80.4	80.8	1.7
2	14	4	6.4	7.4	-84.9	3	16	-1	67.3	69.0	4.4	3	8	1	45.5	45.0	188.5
2	14	-4	11.5	11.5	49.0	3	16	1	41.2	41.9	181.3	3	9	-1	23.6	21.7	163.0
2	15	-4	15.1	13.6	251.9	3	17	1	10.9	10.6	195.6	3	14	1	64.6	67.7	189.7
2	15	4	12.5	11.9	-42.2	3	18	1	40.6	42.2	189.0	3	17	-1	24.9	26.8	162.5
2	16	4	11.1	10.8	20.9	3	20	-1	36.1	36.3	6.6	3	18	-1	25.1	27.9	-1.4
2	16	-4	34.2	34.3	14.0	3	20	1	10.3	12.0	197.1	3	19	1	13.0	11.2	-1.3
2	17	-4	16.5	15.9	-84.2	3	21	1	5.0	4.3	233.9	3	19	-1	7.6	10.6	134.0
2	20	-4	33.8	34.6	4.1	3	22	-1	11.2	13.4	12.6	3	21	-1	4.7	3.6	147.2
2	1	-5	12.1	10.9	150.9	3	1	2	39.7	40.3	-76.0	3	0	-2	40.1	39.5	181.3
2	2	5	5.7	5.0	-14.9	3	1	-2	29.4	30.1	-30.7	3	0	2	15.6	15.3	182.5
2	2	-5	3.5	4.3	127.1	3	2	-2	47.9	48.2	29.2	3	14	-2	18.5	15.8	38.7
2	2	-5	32.2	31.5	-56.5	3	2	2	15.7	14.3	44.3	3	17	2	11.4	8.4	36.6
2	3	-5	24.4	24.0	200.7	3	3	2	15.4	16.2	132.7	3	19	-2	7.4	8.5	182.6
2	3	5	3.7	4.1	185.9	3	3	-2	35.5	34.6	147.9	3	0	-3	3.2	3.4	-23.0
2	4	5	5.0	7.7	-23.5	3	4	-2	27.0	28.2	152.7	3	0	3	6.7	5.2	33.0
2	4	-5	33.3	34.6	227.6	3	4	2	20.6	17.8	108.0	3	2	-3	82.5	79.0	191.2
2	5	-5	17.1	14.9	257.9	3	5	2	39.7	39.9	73.2	3	4	3	65.9	64.8	-0.3
2	5	5	14.7	13.8	16.2	3	5	-2	13.8	15.0	26.4	3	13	3	4.1	7.3	228.5
2	6	5	19.4	18.8	7.9	3	6	-2	20.3	20.9	-48.3	3	14	-3	75.0	75.1	185.8
2	6	-5	8.7	10.0	48.5	3	6	2	17.6	16.7	13.7	3	18	-3	40.1	38.1	175.9
2	7	-5	5.7	4.9	-23.4	3	7	2	34.9	35.9	118.1	3	0	-4	25.3	24.3	182.7
2	7	5	3.9	3.4	184.6	3	7	-2	13.4	11.0	250.4	3	0	4	3.6	1.5	-21.8
2	8	-5	26.2	26.1	126.6	3	8	-2	26.8	28.5	-86.4	3	1	-4	20.1	18.2	42.4
2	9	-5	18.5	18.1	-15.1	3	8	2	14.5	12.5	221.7	3	0	-5	37.5	36.4	4.8
2	9	5	4.9	3.2	16.6	3	9	2	13.1	14.3	-3.3	3	12	-5	39.5	39.0	18.8
2	10	5	8.3	9.7	217.5	3	9	-2	11.4	11.7	-19.9	3	0	-6	3.5	4.2	189.9
2	10	-5	25.6	25.9	53.1	3	10	-2	24.6	24.8	-51.2	3	2	-6	19.8	18.1	78.6
2	11	-5	14.3	12.0	93.7	3	10	2	16.8	14.0	19.0	3	3	-6	18.1	17.8	138.5
2	12	-5	9.3	7.4	221.7	3	11	2	33.6	34.5	244.1	3	6	-6	16.6	17.6	-10.6
2	13	-5	8.5	8.3	153.9	3	11	-2	30.2	31.0	255.8	3	0	-7	14.0	14.0	184.3
2	14	-5	17.8	17.0	-36.1	3	12	-2	11.0	7.8	173.6	4	1	0	45.2	43.9	247.9
2	15	-5	11.3	12.9	217.1	3	12	2	16.5	17.0	176.4	4	2	0	30.3	28.3	149.8
2	16	-5	12.7	11.4	183.5	3	13	2	20.9	21.4	-53.4	4	12	0	24.1	18.5	164.0
2	17	-5	9.9	10.5	83.0	3	13	-2	11.5	11.8	73.3	4	3	0	38.1	39.3	-31.6
2	1	-6	30.0	28.5	73.9	3	14	2	19.1	18.7	44.1	4	13	0	36.1	36.9	-87.0
2	2	-6	53.9	55.3	189.9	3	15	2	11.7	12.6	153.7	4	4	0	20.4	17.8	69.5
2	3	-6	21.5	19.9	57.0	3	15	-2	33.3	33.9	113.7	4	14	0	14.1	12.4	144.7
2	4	-6	15.7	16.4	193.4	3	16	-2	22.8	23.9	212.0	4	5	0	34.7	34.9	251.9
2	5	-6	13.4	13.6	133.8	3	16	2	11.1	11.3	120.5	4	15	0	20.0	20.2	-29.6
2	6	-6	33.5	31.9	172.3	3	17	-2	12.0	11.7	48.2	4	16	0	5.8	3.5	25.6
2	7	-6	17.3	18.4	141.5	3	18	-2	16.2	14.2	-26.6	4	7	0	45.7	45.3	-75.1
2	8	-6	12.1	11.3	145.0	3	18	2	9.8	8.3	-26.0	4	17	0	23.5	23.3	253.5
2	9	-6	18.4	19.5	166.0	3	19	2	10.6	11.7	229.9	4	8	0	25.9	20.9	235.4
2	10	-6	39.0	37.0	181.3	3	20	-2	7.9	7.7	200.0	4	18	0	25.7	26.2	222.4
2	11	-6	20.9	19.9	69.5	3	21	-2	10.8	14.2	-83.7	4	9	0	64.0	65.5	261.1
2	12	-6	21.0	22.0	202.6	3	22	-2	17.5	18.5	61.9	4	10	1	7.7	8.3	170.7
2	13	-6	13.9	19.3	42.5	3	1	3	13.2	13.8	175.6	4	10	-1	31.5	30.5	-12.5
2	1	-7	17.2	15.9	-69.2	3	1	-3	31.7	29.1	-201.5	4	20	-1	11.4	8.8	173.5
2	2	-7	19.7	19.7	58.5	3	2	3	9.6	9.9	33.9	4	1	-1	20.9	19.3	-84.5
2	0	0	64.0	65.6	2.6	3	3	3	16.6	16.9	-24.0	4	1	1	26.5	27.7	26.4
2	7	0	63.7	63.8	-48.6	3	3	-3	40.0	35.4	265.5	4	11	-1	18.1	19.1	268.0
2	8	0	78.0	80.3	-1.8	3	4	-3	43.7	40.7	176.4	4	11	1	20.0	20.9	141.1
2	9	0	53.5	53.7	249.9	3	5	3	15.9	15.2	219.7	4	2	1	13.0	10.1	-42.4

2	11	0	81.3	84.2	-83.2	3	5	-3	15.8	17.7	208.3	4	?	-1	30.7	31.0	43.0
2	12	0	72.8	75.0	20.8	3	6	-3	59.7	59.2	192.7	4	12	1	15.5	14.8	186.1
2	13	0	38.4	40.3	245.4	3	6	3	46.4	45.3	6.3	4	12	-1	15.0	12.8	27.9
2	14	0	9.9	8.6	101.8	3	7	3	13.4	14.1	-29.5	4	3	-1	45.5	46.6	161.7
2	17	0	30.0	33.0	-75.1	3.	7	-3	29.3	30.0	-69.3	4	3	1	12.0	9.6	-36.3

(9)

(10)

2	18	0	17.2	16.8	-46.3	3	8	-3	33.4	34.3	176.8	4	13	-1	5.6	6.1	26.3
2	20	0	33.9	34.0	-1.3	3	8	3	57.1	55.2	6.5	4	13	1	29.1	28.4	-2.6
2	21	0	44.7	47.9	268.2	3	9	3	11.6	10.8	216.5	4	4	1	14.9	16.4	-75.9
2	22	0	17.1	18.9	31.3	3	9	-3	18.4	18.9	232.9	4	4	-1	34.6	33.8	193.3
2	0	1	56.0	61.4	181.4	3	10	-3	46.2	45.9	193.4	4	14	1	36.6	37.0	-14.0
2	0	-1	22.8	15.9	-3.4	3	10	3	16.6	16.6	-4.0	4	14	-1	3.7	2.3	183.7
2	8	-1	25.5	26.5	156.6	3	11	3	7.2	7.2	9.6	4	5	1	19.4	20.3	2.5
2	10	-1	47.3	49.9	6.6	3	11	-3	11.2	11.9	227.0	4	15	-1	13.5	13.6	174.8
2	11	-1	30.4	31.4	130.0	3	12	-3	18.4	21.2	220.0	4	15	1	18.0	17.9	260.6
2	12	1	27.7	28.6	172.2	3	12	3	27.4	26.7	23.3	4	6	1	9.7	8.3	25.5
2	12	-1	17.7	18.2	268.3	3	13	-3	36.2	37.5	222.9	4	6	-1	15.7	11.4	108.0
2	13	-1	20.7	21.8	237.1	3	14	3	41.3	43.4	4.5	4	16	1	15.8	18.6	-17.0
2	14	-1	16.5	17.6	197.5	3	15	3	7.8	9.0	-54.1	4	16	-1	23.8	23.2	175.9
2	15	1	40.9	8.6	94.1	3	15	-3	22.2	22.0	-39.1	4	7	-1	11.8	10.4	59.0
2	16	-1	39.1	41.0	188.5	3	16	-3	31.3	34.2	181.1	4	17	-1	15.1	14.8	12.3
2	17	-1	13.0	18.0	-60.6	3	16	3	49.6	49.6	7.2	4	17	1	14.6	13.0	-18.4
2	18	1	10.9	10.4	260.5	3	17	-3	22.7	23.8	-45.6	4	8	1	17.0	17.3	158.6
2	18	-1	11.9	12.0	60.4	3	19	-3	25.1	26.1	-14.2	4	18	1	11.9	10.7	18.7
2	19	-1	3.7	5.4	-17.1	3	20	-3	10.7	14.1	184.0	4	18	-1	4.9	4.7	180.6

H	K	L	FO	FC	ALPH	H	K	L	FO	FC	ALPH	H	K	L	FO	FC	ALPH
4	9	-1	43.4	43.4	2.0	4	9	3	6.8	3.9	-90.0	4	11	-2	67.2	66.4	76.9
4	9	1	11.2	9.5	90.0	4	19	-3	21.5	21.1	173.0	4	3	2	30.2	28.3	54.6
4	19	-1	3.9	5.2	183.1	4	1	-4	85.9	82.7	268.7	4	8	-2	29.0	27.1	39.1
4	10	2	23.6	25.0	12.7	4	11	-4	49.7	48.9	-70.1	4	0	3	6.2	4.1	-3.2
4	11	2	49.8	49.5	88.6	4	2	4	28.4	26.2	182.6	4	0	-3	35.5	35.0	181.5
4	2	2	10.6	10.1	-7.5	4	2	-4	16.8	12.3	126.5	4	11	-3	8.3	4.0	139.1
4	2	-2	51.9	49.7	-84.3	4	12	-4	25.1	22.9	72.3	4	8	-3	7.5	1.0	160.3
4	12	2	32.1	31.5	-5.3	4	3	-4	52.0	48.7	-75.9	4	0	4	34.1	36.8	182.2
4	12	-2	32.2	29.7	-14.0	4	3	4	25.0	23.4	-63.2	4	0	-4	6.2	5.5	172.9
4	3	-2	43.4	42.5	97.9	4	13	-4	41.1	42.8	265.3	4	10	-4	20.2	16.7	198.0
4	13	-2	41.3	42.5	118.9	4	4	-4	11.8	12.3	17.4	4	1	4	37.9	38.3	259.5
4	13	2	32.2	30.5	129.0	4	14	-4	18.4	17.2	108.1	4	9	-4	25.8	24.7	242.1
4	4	2	21.7	19.5	39.3	4	5	-4	31.6	29.9	249.0	4	0	-5	12.0	11.4	-3.3
4	4	-2	50.7	47.2	-68.5	4	15	-4	26.1	28.2	-70.1	4	0	-6	9.8	6.5	2.9
4	14	2	3.9	3.8	-67.4	4	6	-4	31.5	30.4	233.7	4	1	-6	25.5	23.7	119.2
4	14	-2	18.3	16.0	249.2	4	16	-4	10.5	12.3	-76.0	4	3	-6	25.7	24.0	74.5
4	5	-2	46.0	44.3	129.3	4	7	-4	28.1	26.4	-51.6	4	6	-6	22.0	22.0	131.2
4	5	2	21.1	19.8	111.7	4	17	-4	31.4	32.9	260.8	5	10	0	19.6	16.9	9.0
4	15	-2	20.1	20.6	80.2	4	8	-4	27.1	28.2	-37.5	5	1	0	3.7	5.4	127.0
4	15	2	15.1	14.3	71.5	4	18	-4	20.4	20.0	253.7	5	11	0	17.5	16.7	152.5
4	6	2	10.3	11.8	55.8	4	10	-5	13.6	12.4	11.1	5	12	0	6.9	6.4	244.7
4	6	-2	14.3	12.9	240.0	4	1	-5	9.1	7.1	185.6	5	3	0	18.8	19.3	193.6
4	16	2	12.9	10.8	2.0	4	11	-5	23.7	23.9	188.7	5	13	0	5.2	8.2	-42.3
4	16	-2	13.9	11.3	3.0	4	2	-5	11.2	9.1	-11.3	5	4	0	13.7	14.0	188.7
4	7	-2	40.0	39.6	63.3	4	12	-5	4.8	0.8	23.8	5	14	0	18.3	20.4	190.3
4	7	2	27.6	25.6	62.0	4	3	-5	30.5	29.5	193.3	5	5	0	18.9	17.9	13.3
4	17	-2	30.5	30.6	108.5	4	13	-5	22.5	22.9	190.9	5	15	0	13.5	14.6	251.0
4	8	2	28.3	25.7	45.6	4	4	-5	18.7	17.1	170.6	5	6	0	13.1	13.1	18.4
4	18	-2	3.9	2.1	116.3	4	14	-5	7.5	6.3	55.4	5	16	0	19.5	20.2	179.2
4	9	-2	39.2	39.7	117.5	4	5	-5	11.3	8.8	25.3	5	7	0	9.6	8.6	133.0
4	9	2	39.4	38.0	93.7	4	15	-5	15.5	15.2	175.2	5	8	0	13.9	12.0	96.0
4	19	-2	22.8	25.8	82.6	4	6	-5	11.0	9.8	-14.4	5	10	-1	14.5	15.0	0.2
4	10	3	17.6	16.8	32.4	4	7	-5	8.9	7.7	-68.0	5	10	1	13.7	11.6	199.3
4	10	-3	6.4	2.3	-2.2	4	8	-5	25.4	23.9	171.1	5	1	1	31.0	29.6	123.6
4	1	-3	32.7	32.6	11.9	4	3	-5	20.1	19.6	4.9	5	1	-1	18.7	17.2	251.5
4	1	3	18.8	19.2	-26.5	4	10	-6	13.2	11.4	192.6	5	11	1	10.4	6.5	35.2
4	11	3	23.4	23.6	222.0	4	11	-6	30.4	30.9	88.1	5	11	-1	21.3	20.6	-27.6
4	2	3	6.2	6.4	-56.0	4	2	-6	19.7	17.4	214.5	5	2	-1	25.6	23.3	-34.2
4	2	-3	19.7	17.6	-10.2	4	4	-6	11.0	7.7	50.6	5	2	1	33.7	29.5	169.7
4	12	3	8.4	7.2	75.2	4	5	-6	36.2	36.8	106.5	5	12	-1	23.9	24.3	-11.8
4	12	-3	23.9	22.5	197.1	4	7	-6	37.1	38.5	89.8	5	12	1	7.0	9.1	146.0
4	3	-3	6.6	3.7	-24.2	4	8	-6	20.1	20.6	83.5	5	3	1	45.5	45.1	88.3
4	3	3	11.5	9.5	146.3	4	9	-6	34.6	33.7	105.1	5	3	-1	50.2	49.3	-43.4
4	13	-3	23.4	22.4	18.4	4	0	0	14.4	5.5	184.6	5	13	1	24.9	24.4	128.9
4	4	3	19.6	19.2	176.2	4	10	0	34.9	33.4	183.4	5	4	-1	47.8	46.1	-20.2
4	4	-3	4.9	5.0	-56.3	4	11	0	59.7	60.2	-75.3	5	4	1	30.4	30.3	152.1
4	14	-3	8.5	5.8	-48.4	4	6	0	29.6	28.5	187.3	5	14	-1	30.0	30.5	-11.8
4	5	-3	18.5	18.1	-0.1	4	19	0	37.5	40.0	-73.6	5	14	1	27.5	24.3	157.6
4	5	3	15.2	15.3	36.5	4	0	1	26.1	25.6	181.7	5	5	1	45.0	44.7	115.9
4	15	-3	6.9	3.5	214.3	4	0	-1	33.1	27.6	-1.1	5	15	-1	36.0	35.8	-76.6
4	6	3	5.1	8.3	224.1	4	5	-1	13.2	13.6	-31.2	5	6	-1	25.0	25.7	8.1
4	6	-3	31.6	30.7	4.6	4	7	1	19.9	21.1	168.0	5	6	1	34.6	33.4	200.7
4	16	-3	7.2	7.8	209.0	4	8	-1	27.4	26.1	212.3	5	16	-1	33.4	33.6	21.0
4	7	-3	32.2	33.3	184.0	4	0	2	49.5	50.4	2.2	5	7	1	33.9	32.9	59.2
4	7	3	5.7	6.7	204.4	4	0	-2	42.4	31.4	2.5	5	7	-1	33.0	30.4	-57.4
4	17	-3	10.2	10.9	154.4	4	10	-2	21.7	22.7	99.9	5	17	-1	28.6	27.1	243.5
4	8	3	8.8	6.8	122.3	4	20	-2	14.8	13.2	56.7	5	8	-1	36.5	35.3	13.1
4	18	-3	4.8	4.0	167.8	4	1	-2	88.3	85.3	102.6	5	8	1	14.7	12.8	213.1
4	9	-3	4.4	6.5	167.6	4	1	2	56.5	56.0	116.3	5	9	-1	30.8	29.5	244.1

## BERMANITE

SHEET NO. 2 PART 2

H	K	L	FO	FC	ALPH	H	K	L	FO	FC	ALPH	H	K	L	FO	FC	ALPH
5	10	-2	12.1	10.2	-61.3	5	3	-5	33.8	33.2	-31.0	6	9	-1	9.8	13.5	19.7
5	10	2	11.1	13.2	156.4	5	4	-5	45.0	42.3	-1.6	6	10	-2	28.2	26.6	6.2
5	1	2	15.8	15.4	-45.6	5	5	-5	21.4	19.4	249.1	6	1	-2	38.2	36.8	149.4
5	1	-2	25.5	24.7	-10.9	5	6	-5	30.0	29.6	17.5	6	11	-2	12.9	12.9	99.7
5	11	-2	23.7	22.4	204.8	5	7	-5	21.8	20.3	234.4	6	12	-2	35.7	34.9	0.2
5	2	-2	28.8	27.3	67.1	5	9	-5	38.2	35.6	208.4	6	3	-2	17.9	18.4	78.6
5	2	2	3.9	2.6	151.5	5	1	-6	17.8	16.3	2.3	6	13	-2	30.8	27.8	160.2
5	12	-2	16.7	15.2	176.9	5	2	-6	21.2	20.6	54.7	6	4	-2	33.6	30.0	0.5
5	3	2	14.1	14.6	193.3	5	3	-6	5.2	3.7	236.2	6	5	-2	12.8	11.3	127.1
5	3	-2	16.5	14.0	19.3	5	4	-6	14.8	14.4	113.6	6	6	-2	25.4	23.3	16.7
5	13	-2	21.4	21.1	-11.4	5	5	-6	10.4	9.1	-44.6	6	7	-2	25.1	25.7	24.5
5	4	-2	23.0	21.4	72.9	5	6	-6	10.8	10.0	263.5	6	8	-2	21.8	20.1	34.3
5	4	2	8.2	10.4	-9.3	5	7	-6	16.3	15.8	220.6	6	9	-2	14.4	14.7	50.7
5	14	-2	15.0	14.3	49.7	5	0	0	5.2	5.1	-3.0	6	10	-3	6.1	5.6	-24.3
5	5	2	8.4	9.2	55.7	5	2	0	11.2	10.4	232.6	6	1	-3	15.6	15.6	7.1
5	5	-2	25.0	24.7	21.9	5	9	0	35.6	36.2	25.0	6	11	-3	11.2	7.6	153.4
5	15	-2	4.1	2.9	213.4	5	0	-1	24.5	23.4	5.2	6	2	-3	18.1	17.0	-63.5
5	6	-2	16.3	15.1	3.8	5	0	1	15.3	16.6	183.7	6	12	-3	23.0	22.5	-85.6
5	6	2	15.4	12.5	-12.1	5	13	-1	29.8	28.8	-72.1	6	3	-3	8.0	7.7	240.5
5	16	-2	7.2	5.6	110.8	5	5	-1	36.8	34.1	256.9	6	4	-3	13.9	12.8	-89.8
5	7	2	16.6	16.6	178.4	5	9	1	20.5	18.5	127.0	6	5	-3	12.0	11.7	38.7
5	7	-2	31.0	30.6	172.6	5	0	-2	13.3	14.7	181.6	6	6	-3	11.9	10.3	70.2
5	17	-2	4.3	5.5	-28.7	5	0	2	30.3	30.5	180.7	6	7	-3	15.6	15.5	158.5
5	8	-2	23.9	24.9	270.0	5	0	-3	17.7	15.4	185.6	6	8	-3	10.2	9.7	99.8
5	8	2	4.8	4.0	59.5	5	12	-3	24.3	26.8	163.0	6	9	-3	4.1	6.2	3.9
5	9	2	14.3	14.6	-14.9	5	13	-3	38.6	39.5	136.5	6	10	-4	30.1	28.4	180.2
5	9	-2	8.0	5.3	228.3	5	7	-3	41.3	40.1	39.6	6	1	-4	17.5	14.5	241.4
5	10	-3	40.6	39.6	205.1	5	0	-4	5.6	1.3	207.9	6	11	-4	25.6	23.9	-33.1
5	1	-3	27.5	27.1	160.1	5	9	-4	17.1	13.3	-21.0	6	2	-4	23.6	20.6	177.0
5	11	-3	21.8	18.6	55.1	5	0	-5	34.2	33.1	4.8	6	4	-4	20.1	20.9	194.2
5	2	-3	45.0	41.9	150.0	5	10	-5	19.6	20.1	25.5	6	5	-4	30.3	27.4	224.7
5	3	-3	34.6	34.6	105.3	5	8	-5	48.1	43.3	24.7	6	6	-4	40.8	38.6	194.3
5	4	-3	28.4	24.6	163.7	5	0	-6	14.2	12.7	181.6	6	8	-4	29.7	30.7	209.5
5	14	-3	42.9	44.2	177.3	6	10	0	40.2	38.6	191.1	6	9	-4	28.9	26.3	235.1
5	5	-3	20.6	19.3	149.3	6	1	0	11.0	8.7	-73.8	6	1	-5	10.3	7.2	-26.0
5	15	-3	25.9	26.7	95.3	6	2	0	40.6	36.2	178.6	6	2	-5	22.2	21.2	81.6
5	6	-3	36.9	34.6	185.3	6	4	0	22.1	21.1	179.3	6	3	-5	22.0	21.1	171.6
5	10	-3	22.8	24.7	182.2	6	5	0	5.8	5.6	-68.4	6	5	-5	17.9	15.1	-57.1
5	17	-3	13.2	13.0	112.3	6	6	0	28.9	27.4	167.9	6	6	-5	5.7	6.0	-18.5
5	8	-3	35.3	33.4	226.0	6	7	0	10.3	7.2	-45.0	6	7	-5	8.3	7.3	-66.7
5	9	-3	27.2	24.9	60.3	6	8	0	24.4	23.9	181.4	6	0	0	50.8	50.9	182.7
5	10	-4	6.8	3.8	22.8	6	9	0	18.0	18.9	209.8	6	3	0	35.1	35.2	-13.1
5	1	-4	16.3	15.7	52.3	6	10	-1	5.1	3.5	83.6	6	0	1	4.2	2.8	2.9
5	11	-4	17.9	14.9	149.9	6	1	-1	17.1	16.4	-43.5	6	0	-1	3.8	4.5	183.9
5	2	-4	23.1	21.3	-63.4	6	1	1	24.7	25.1	59.6	6	0	-2	69.8	66.4	2.2
5	12	-4	25.8	25.6	-85.0	6	11	-1	18.7	18.5	234.2	6	2	-2	42.3	38.2	-2.2
5	3	-4	30.1	27.2	192.9	6	2	1	20.0	19.9	-85.8	6	0	-3	3.7	0.8	-6.5
5	13	-4	11.7	9.6	156.2	6	2	-1	6.0	5.5	78.7	6	0	-4	14.6	14.8	186.9
5	4	-4	18.1	17.9	216.7	6	12	-1	12.3	13.0	101.7	6	3	-4	24.7	22.7	-39.8
5	14	-4	16.3	17.7	-85.4	6	3	-1	15.3	14.8	151.3	6	7	-4	20.7	21.1	242.7
5	5	-4	11.9	11.7	-1.3	6	3	1	11.4	12.2	208.9	6	0	-5	9.2	7.5	183.4
5	15	-4	13.5	11.3	186.6	6	4	1	9.3	7.5	-85.8	6	4	-5	6.6	4.5	126.4
5	6	-4	9.3	7.4	52.6	6	4	-1	14.3	11.2	126.3	7	1	-2	21.7	20.7	9.3
5	7	-4	7.6	6.7	264.8	6	5	-1	19.0	18.1	52.9	7	2	-2	10.0	7.2	198.7
5	8	-4	17.1	15.7	146.6	6	5	1	17.5	16.7	-51.0	7	3	-2	6.6	9.5	-34.7
5	1	-5	15.0	13.9	-64.2	6	6	1	5.6	5.2	26.4	7	1	-3	32.3	30.6	111.2
5	11	-5	15.5	12.7	-32.6	6	6	-1	16.3	17.6	247.5	7	2	-3	14.0	11.8	82.4
5	2	-5	29.3	28.1	-18.7	6	7	-1	11.5	10.1	115.8	7	0	-2	20.8	19.2	180.2

5 12 -5 25.8 23.6 -6.0 6 8 -1 10.9 9.3 249.7 7 0 -3 4.2 4.0 179.9

(13)