PLAINTIFF'S EXHIBIT WRG-1455

GRACE

Construction Products Division

TO: H. C. Duecker

DATE: July 13, 1983

FROM: J. C. Yang

SUBJECT: Tremolite Analysis in Grace Vermiculite Ore Concentrates and Zonolite Products

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In 1977, we analyzed the tremolite content of all sizes of Libby and South Carolina ore concentrates, expanded vermiculites, and all Zonolite products containing vermiculite at E. S. Wood's request. Two memos were issued on April 19 and May 16, 1977 respectively describing the analytical procedure and the results of these analyses. Summarized tremolite analyses are attached with this memo.

Since then, various Zonolite products were analyzed from time to time. The results are tabulated by product in Tables 1, 2 and 3.

The tremolite content of Libby head feeds and ore concentrates were monitored monthly since October 1977. The yearly plots of this data are shown in Figures 1 through 5, and a running plot of each size is given in Figure 6. Only a few sets of ore concentrates were analyzed prior to October 1977. The results and analysis, other than monthly composites, are shown in Table 4. Yearly averages of the tremolite content of each size of Libby ore concentrates are tabulated in Table 5.

These data cover all the analyses of tremolite fibers in Libby ore concentrate and Zonolite products to date. The analyses of Libby head feeds and ore concentrates were reported under individual RFTS' with designated numbers in the block of 675XX to 68499. These reports are kept in the library.

Julie C. Yang

JCY/ph

Attachments

Table 1

Tremolite Fiber Content of Zonolite Products Using Expanded L-1 & L-2

Date	Reference	Material	Location	(%) Tremolite Content
(a)				
3/14/78	RFTS 69515 S	Attic Fill	W. Chicago	0.02
6/7/78	RFTS 69530	L-1	Hanna Furnace, Buffalo	0.013
8/19/80	RFTS 69622	CMC Coated L-1	Aldrich	.005
4/24/81	RFTS 69755	+14M, L-1	Weedsport	.56 ± 0.13*
6/25/81	RFTS 65538	SS L-1, + 14M Attic Ins.		
		CMC Coated		0.44
		Uncoated		0.79
5/4/83	Memo to J. Wolter	L-1	Easthampton	.003
(b)				
2/27/79	RFTS 69545	Ind. L-2	Pyro Engineering, Ca.	.008
5/5/80	RFTS 67583	+14M Ind. L-2	W. Chicago	.002
	RFTS 67589	+14M Ind. L-2	Ventron, Alpha	.021
2/3/82	RFTS 69755	+14M, L-2	Weedsport	.10 ± 0.02*
5/4/83	Memo to J. Wolter	L-2	Easthampton	.002

* average value of 6 determinations

Table 2

Tremolite Fiber Content of Zonolite Products Using Expanded L-3 & L-4

Date	Reference	Material	Location	(%) Tremolite Content
(a)				
7/22/77	RFTS 50110	L-3	W. Chicago (0-18)	.076
3/1/78	RFTS 69512	L-3	W. Chicago	.0036
5/16/83	RFTS 67016	L-3	A. H. Hoffman	.002
8/7/78	RFTS 69534	Screened, + 14M L-3	J. D. Brush Co.	.010
5/4/83	Memo to J. Wolter	L-3	Easthampton	.001
(b)				
7/22/77	RFTS 50110	L-4	W. Chicago	.062
1/31/78	RFTS 67012	L-4	Agway, NY	.032
1/31/78	RFTS 67013	L-4	Voluntary Purchasing Group, Texas	.008
4/28/78	RFTS 67015	L-4 Unscreened Unscreened	QC	.16 .003
5/16/78	RFTS 67016	L-4	Rockland Chemicals	.007
5/16/78	RFTS 67016	L-4	Sea Coat Lab Screened Unders	1.5
5/78	RFTS 67020	L-4	Dallas D-18 (dry) D-18 (wet)	.0099 .0025
1/19/79	RFTS 67026	L-4 Agricultural Grade	Wilder (D-18)	.039
2/27/79	RFTS 69544	L-4, Roof Deck	Gem Tel Bldg., CA	.61
3/6/79	RFTS 69543	L-4	Sinclair Paint Bldg.,CA	0.15
5/8/83	Memo to J. Wolter	L-4	Easthampton	.002

Table 3

Tremolite Fiber Content in Monokote

Date	Reference	Source	Analyst	Tremolite Content
6/25/76	RFTS 49189 & A. D. Little	Santa Ana, CA Newark, CA	J. C. Yang* E. T. Peters	$<$1.7 ppm $<$4.1 ppm
3/4/80	A. D. Little	Prudential Bldg. Morristown, N.J.	E. T. Peters	$<$1 ppm
6/27/83	A. D. Little	Easthampton	E. T. Peters Confirmed Possible	 1-3 ppm 7-30 ppm
7/11/83	A. D. Little	Trenton, Lot 2F1 Mt. Sinai "wipe-out" technique	E. T. Peters Found Estimated detection limit	 none 10 ppm

* J. C. Yang has concentrated the tremolite containg fine portion by dissolving the plaster of Paris binder burning off the cellulosic fiber and organic matters and floatings off the vermiculite and submitted to ADL for electron microscopic analysis.

Table 4

Tremolite Fiber Content of Libby Ore Concentrates Other Than Monthly Composites (1976-Present

Date	2/23/76	1/7/77	3/9/77	6/20/77	10/77	11/77	12/77	3/1/78		7/31/80	6/25/81	2/9/82	2/1/8
Reference (RFTS NO)	Memo to HCD	49974	------	67569	67631	67631-5	67634-67645	69515		69608	65538	67936	Memo J.Yar
Size	% Tremolite											% Tremolite	
L-1	1.92		1.2	2.12	2.6	2.0	2.18	----				1.24	1.0
									SS, + 14M		0.79		
									SS, + 14M CMC Coated		0.44		
L-2	4.97	+6M1.8 - 2.5 -6M 0.36-0.75	2.5	2.96	3.5	2.91	2.34	----				1.45	1.2
									SS, + 14M	0.76			
									SS, + 14M CMC Coated	0.13			
L-3	0.65		0.7	0.28	0.7	0.94	0.60	0.34				0.44	0.5
L-4	0.76		1.7	0.38	0.9	0.74	0.56	----				0.41	0.0
L-5	3.71		3.0	3.52	----	----	----	----				0.54	0.1

Table 5

Yearly Average of Tremolite Analysis of Libby Ore Concentrate

Size/Year	1978	1979	1980	1981	1982
L-1	1.47	1.08	1.26	1.35	1.19
L-2	1.71	1.71	1.96	1.84	1.63
L-3	.46	.57	.82	.52	.38
L-4	.28	.48	.66	.30	.26
L-5	1.10	1.55	2.03	.54	.36

Figure 1

TREMOLITE ANALYSIS OF ORE CONC.

1982

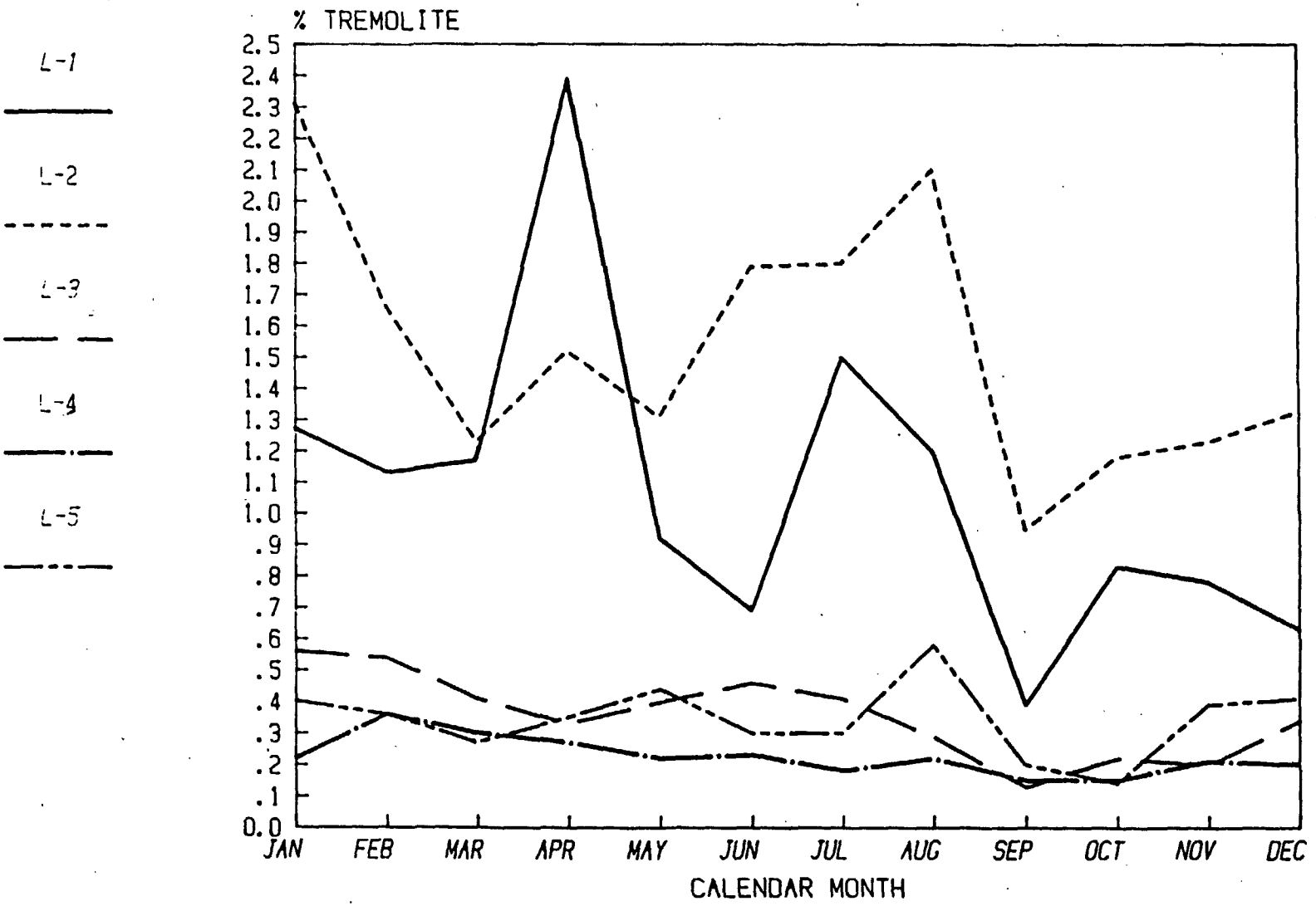

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Figure 2

TREMOLITE ANALYSIS OF ORE CONC.

1981

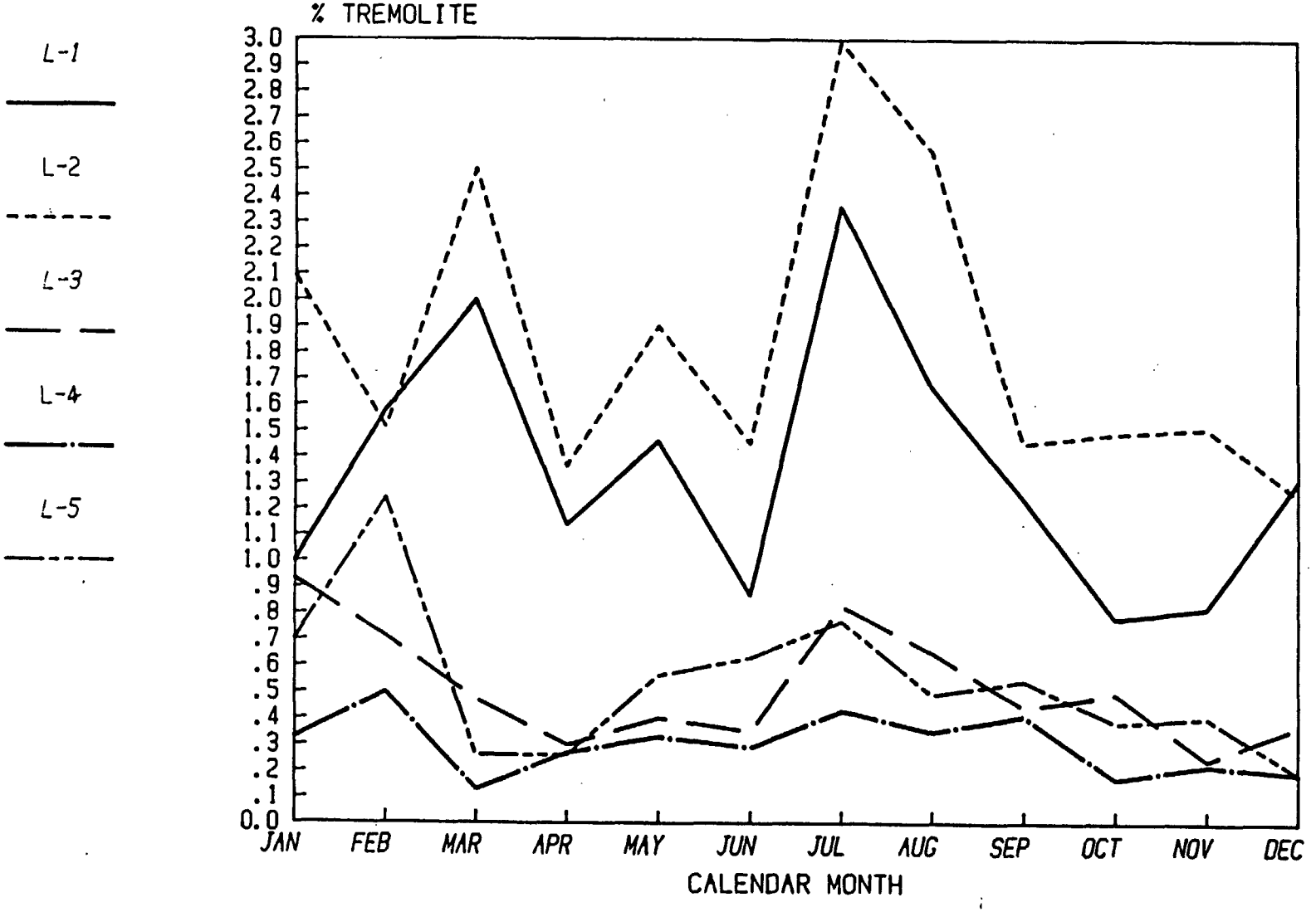

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Figure 3

TREMOLITE ANALYSIS OF ORE CONC.

1980

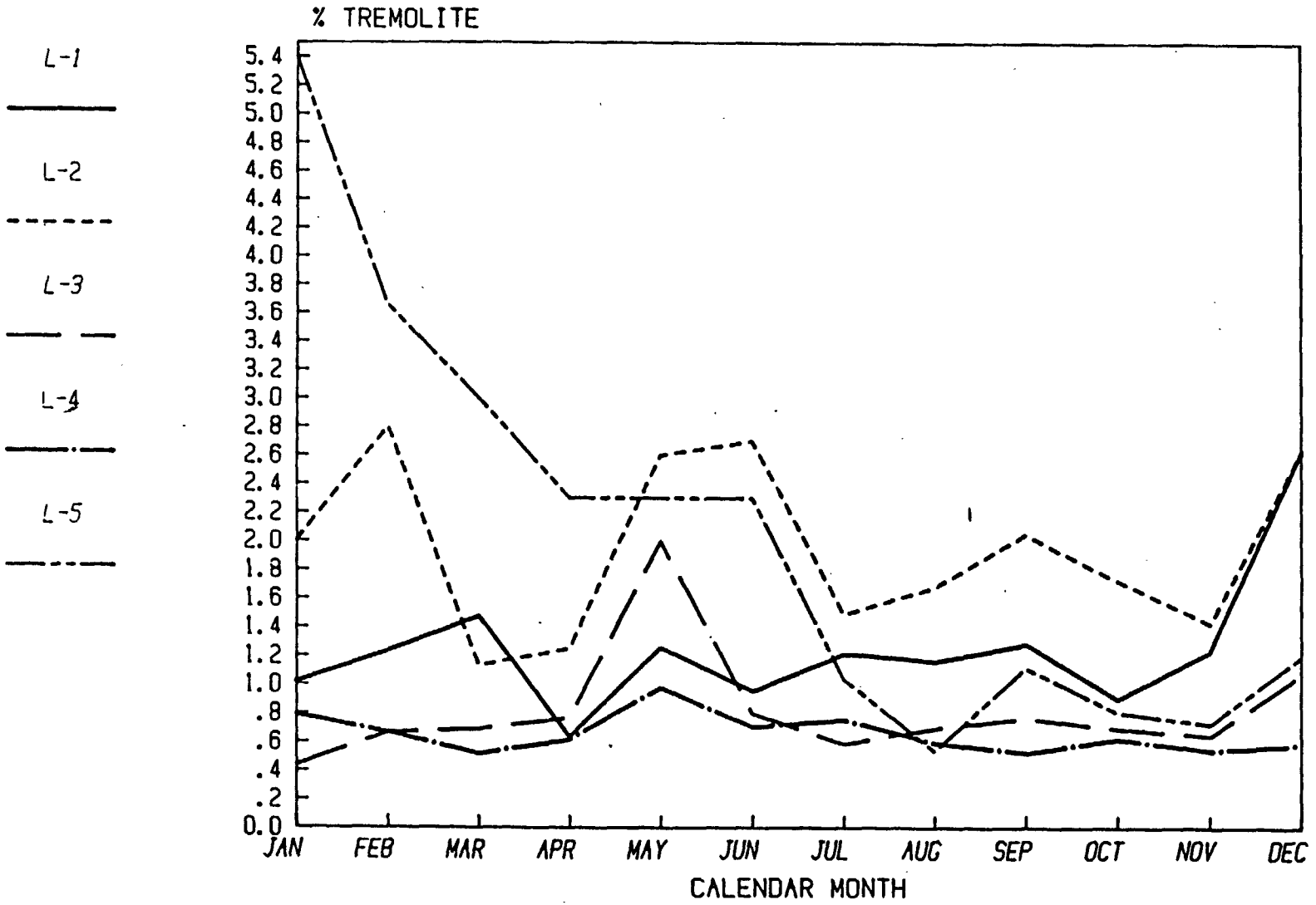

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Figure 4

TREMOLITE ANALYSIS OF ORE CONC.

1979

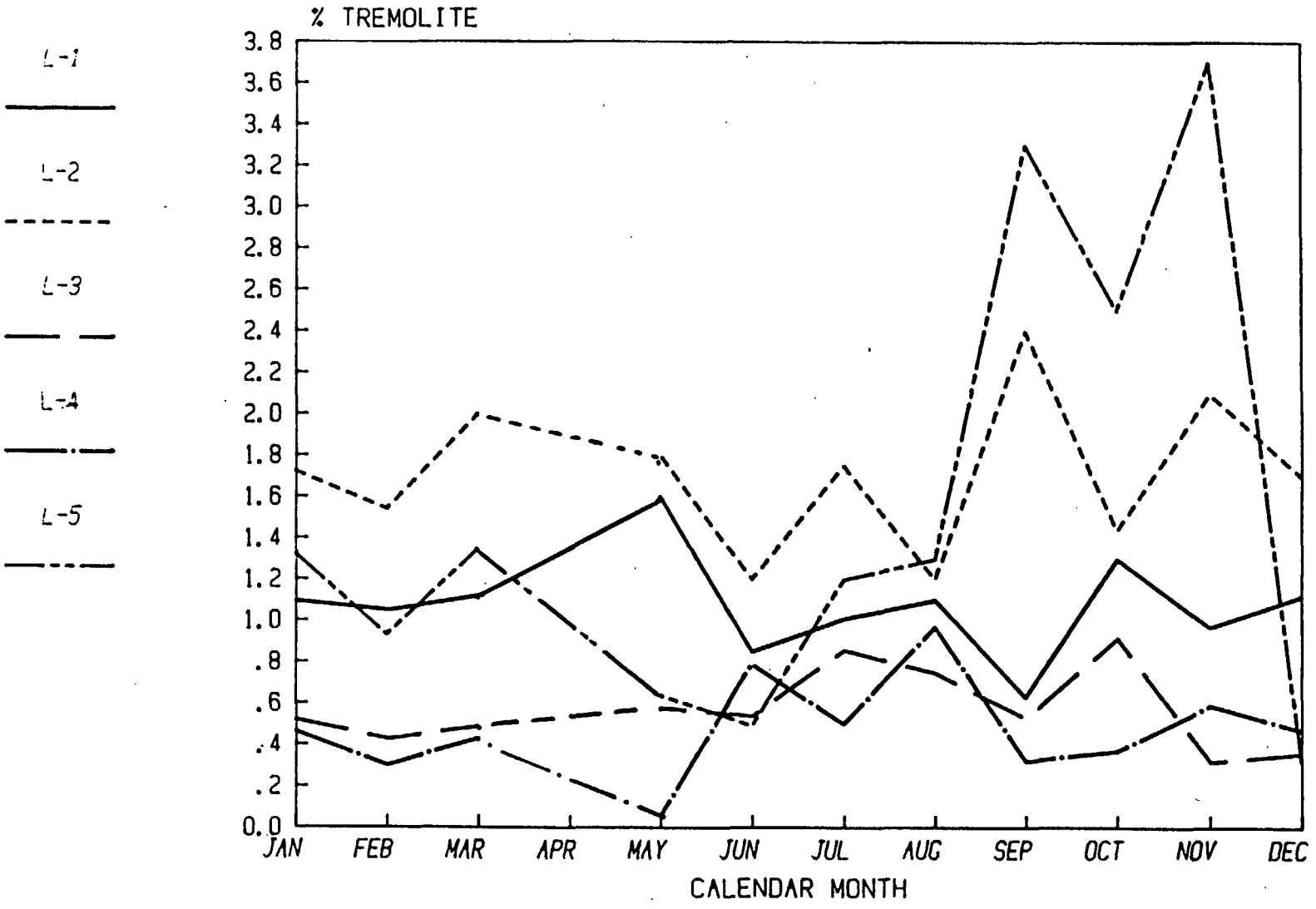

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Figure 5

TREMOLITE ANALYSIS OF ORE CONC.

1978

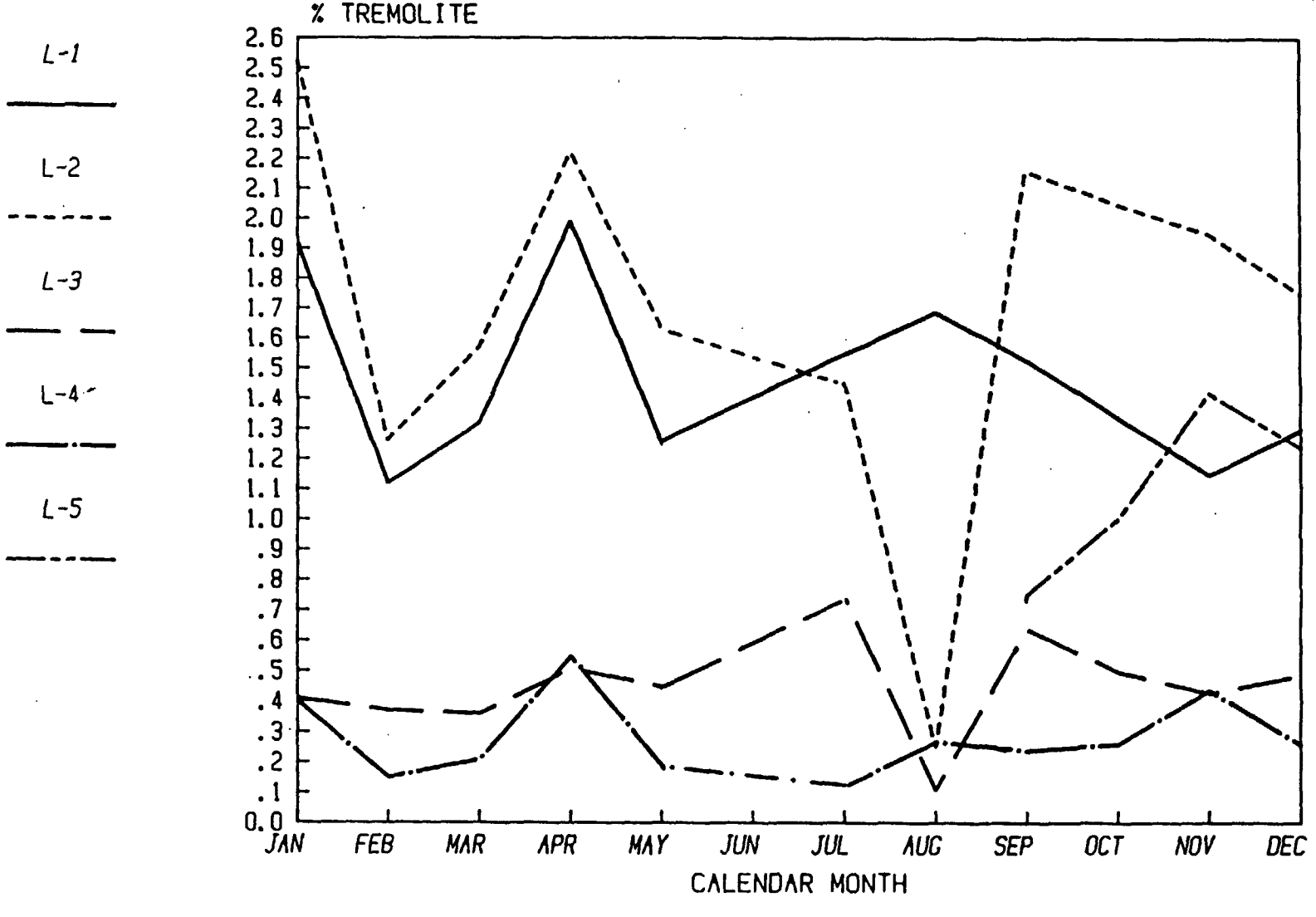

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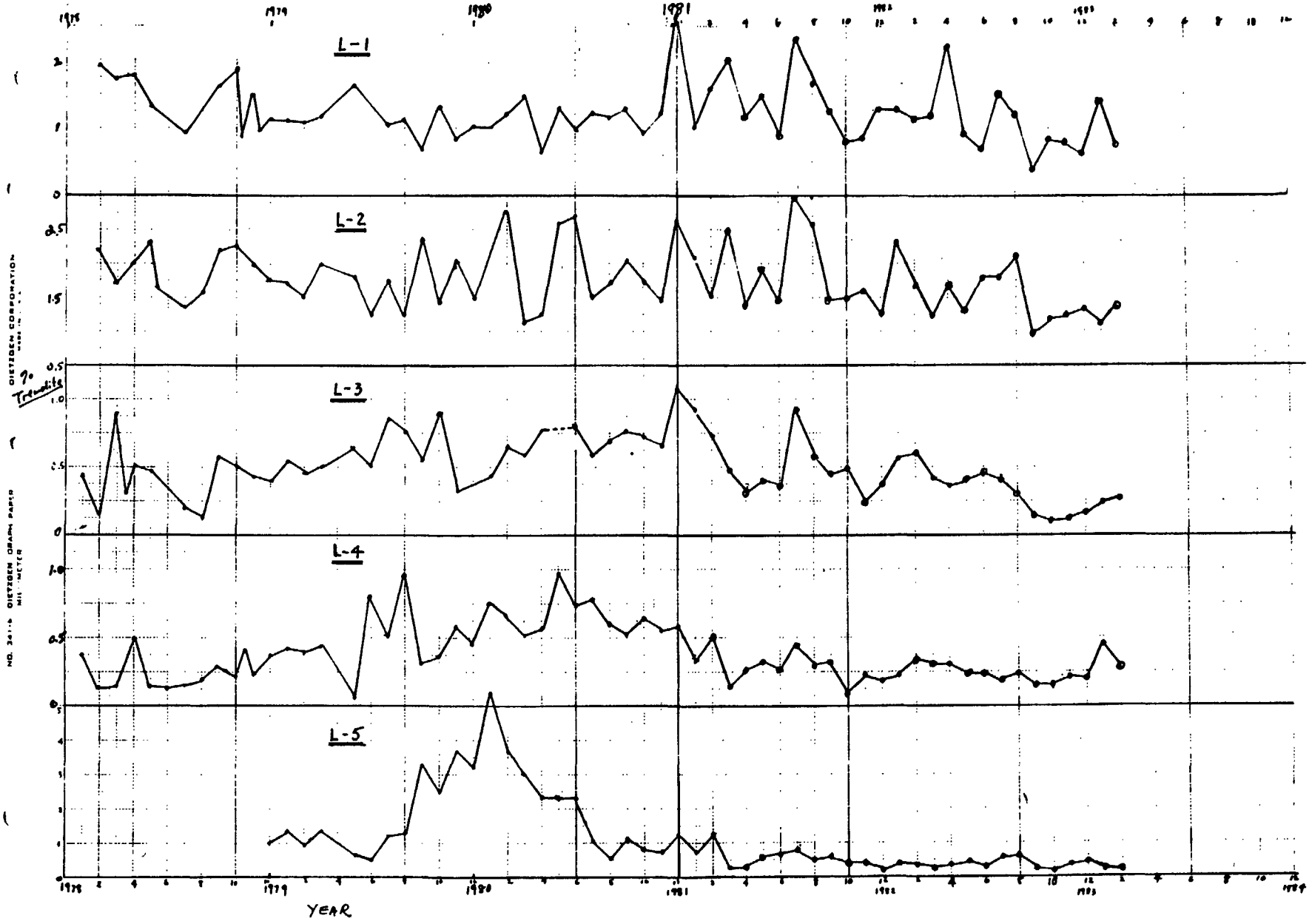
Figure 6 Tremolite Content in Vermiculite Ore Concentration



JCYANG
7/7/83

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Libby

ID No.	Product Description	% Tremolite	
10	MK-4 (L-3) West Chicago	< 0.10	
6	Masonry Fill (L4D-18) West Chicago	0.01	
19	Terra-Lite, W. Chicago	0.035	
25	Attic Fill (L-2) W.Chicago	.013	
28	Redi-Earth (L) Santa Ana	(as rec'd) .031	(dried) .051
14	Redi-Earth (L) W. Chicago	<0.02	
15	Metro-Mix 200 (L) W. Chicago	(as rec'd)0.034	(dried)<.043
12	Zonolite 3300 (L-3) W. Chicago	<0.007	
3	Concrete Aggregate (L4D-18) W. Chicago	0.344	
16	Scott Turf Builder (L) Dark	~0.009	
22	Scott Turf Builder (L) Light	<0.009	

B. Tremolite Content in Zonolite Job-site Samples

ID No.	Product Description	Location	% Tremolite	
8	ZK Roof Deck (K 4/5 B)	Montgomery, Ala.	2.828	
9	Masonry Fill (K-3)	Columbus, Ohio	0.050	
28	Redi-Earth (L-4)	Forest Service, Santa Ana	0.031	(.051)*
51	Monokote-5 (L-3)	San Diego	<0.106	
54	Masonry Fill (K-4)	W.Palm Beach, Fla.	2.86	
55	ZIC (K-4)	Edison H.S., Miami, Fla.	0.476	
58	Masonry Fill (L-3)	Mashburn & Coe Bldg., Oklahoma	0.250	
57	Monokote-4 (L-3)	Hyatt Regency, Dallas	0 240	

*oven-dried basis

To: E.S.Wood
From: J.C.Yang
Date: May 16, 1977

Tremolite & Vermiculite Content in Libby & Kearney Ore Deposits and Expanded Vermiculite

TABLE 1

Tremolite Content of Ore Concentrate

ID No.	Description	Date	% Vm.	% Tremolite		% Total Tremolite*
-31	L-1	3/10/77	91.7	(+50M) (-50M)	1.2 .005	1.2
-32	L-2	3/10/77	91.2	(+50M) (-50M)	2.5 .018	2.5
-33	L-3	3/10/77	78.1	(+50M) (-50M)	.653 .013	0.7
-34	L-4	3/1/77	70.1	(+70M) (-70 +100M) (-100M)	1.495 .232 .009	1.7
-35	L-5	3/1/77	63.9	(+70M) (-70 +100M)	.119 1.016 1.913	3.0
-36	K-3	3/1/77	72.0	(+50M) (-50M)	1.60 .158	1.8
-37	K-4	3/1/77	75.1	(+70M) (-70 +100M) (-100M)	8.903 .554 .492	10.0
-38	K-5	3/1/77	76.6	(+70M) (-70 +100M) (-100M)	0.874 2.070 13.034	15.9
-46	Head Feed, Libby	3/9/77	7.0**	(+6M) (-6 +20M) (-20 +70M) (-70M)	1.302 .684 1.235 .609	3.8

*Includes all amphibole minerals.

**The material floated after expanded with 30% H_2O_2.

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To: E.S.Wood
From: J.C.Yang
Date: May 16, 1977

Tremolite & Vermiculite Content in Libby & Kearney Ore Deposits and Expanded Vermiculite

TABLE 2

Tremolite Content of Expanded Vermiculite

ID No.	Description	Date Collected	% Vermiculite	% Tremolite
99952-39	L-1	3/18/77	97.7	0.074
99952-40	L-2	3/18/77	97.1	0.028
99952-48	L-3	3/9/77	97.7	0.049
99952-41	K-3	3/3/77	91.0	1.6*
99952-42	K-4	3/3/77	79.4	7.9*
99952-43	K-5	3/3/77	48.7	interference

*Includes all amphibole minerals.