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The crystal structures and the phase transformation of Zn-Li silicates: reply

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The composition of the Zn–Li silicates reported by us (Yu *et al.*, 1978) has been questioned by West (1979) who suggests a composition closer to $Li_{1.6}Zn_{1.2}SiO_4$. The arguments raised by West require some clarification.

(1) West identified our β, α, and α' as γ_{II}, γ_0, and C respectively. West's three phases differ in composition while our β, α, and α' all have essentially the same composition. In addition, our α' is not a single phase but a twinned state of the α form at the atomic scale (Table 1).

(2) West claimed that the powder pattern of our α phase corresponds fairly well to γ_0 (West and Glasser, 1970) except that the latter has more lines. The two patterns are compared in Table 2 and Figure 1, and it is self-evident that they do not match "fairly well" as claimed. West also mentioned that the larger number of lines observed for γ_0 is probably because a high resolution focusing camera was used in West and Glasser's work to record the powder pattern. As a matter of fact, we also used the focusing camera (Guinier camera) in obtaining our X-ray pattern.

(3) West's atomic coordinates of Li_3PO_4 are identical to those of our Zn–Li silicates except that the former has an extra Li atom. If this extra Li atom in Zemann's Li_3PO_4 (Zemann, 1960) is ignored, it appears that these two structures are similar.

(4) The measured and the calculated density for our Zn–Li silicates are, respectively, 3.53 and 3.51 g/cm³. If West's composition were adopted, the calculated density would be 3.61 g/cm³, which is slightly too high when compared with the experimental value.

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Table 1. Comparison of chemical compositions reported for Zn–Li silicates

Yu et al.	West		
β	γ_{II}	$(Li_{1.6}Zn_{1.2}SiO_4)$	x = 0.2
α	γ_0	(Li_2ZnSiO_4)	x = 0
α'	C	$(Li_{1.52}Zn_{1.24}SiO_4)$	x = 0.24

Table 2. Comparison of the powder patterns for α and γ_0 Zn–Li silicate

α				γ_0		
Yu et al.				West & Glasser		
d_o(A)	d_c(A)	I	hkl	d_o(A)	I	hkl
5.45	5.43	10	110	5.50	60	110
				5.40	10	020
4.23	4.52	10	011	4.60	10	011
4.07	4.05	50	120	4.09	80	120
				3.99	40	101
3.97	3.92	20	101	3.97	60	
				3.71	20	111,021
				3.69	100	
				3.19	20	200,121
				3.17	10	
3.09	3.07	40	130	3.12	40	130,210
				2.93	10	031
				2.92	20	
				2.74	60	220
2.711	2.715	30	220	2.71	80	
				2.68	80	040
2.658	2.629	30	040	2.65	40	131
2.632	2.611	30	131	2.64	10	
				2.60	10	211
				2.58	40	
				2.54	80	002
2.521	2.506	100	002	2.52	60	
2.452	2.437	30	012			
1.6282	1.6118	20	103			
1.5429	1.5338	40	260			
1.5179	1.5175	25	420			
1.3720	1.3721	25	342			

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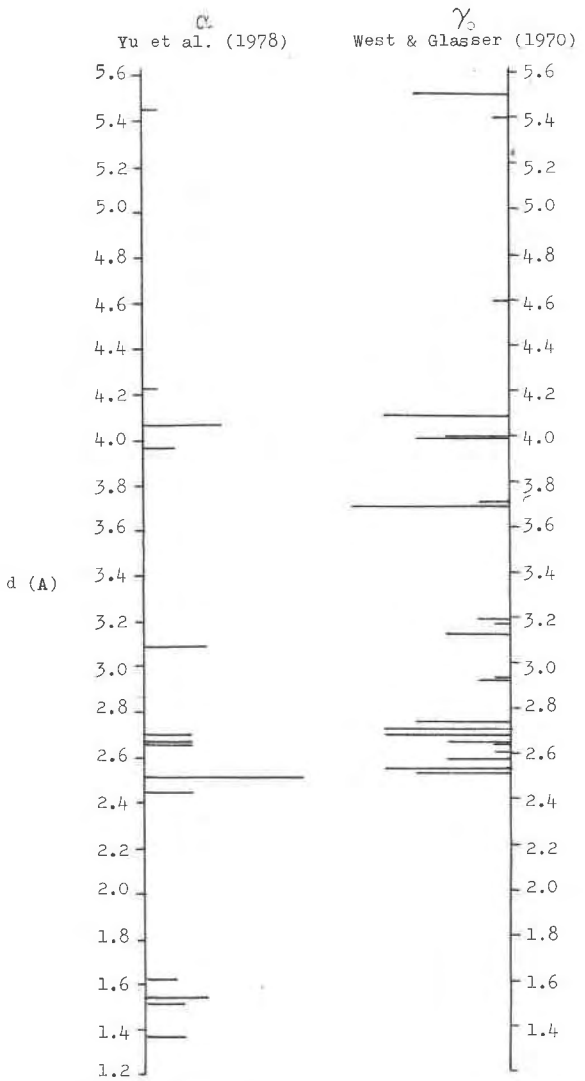

Fig. 1. Graphical comparison of two X-ray powder patterns of α and γ_0 Zn–Li silicate.

In view of the above discussion we conclude that our Zn–Li silicate appears to be a distinct phase from those reported by West. However, we appreciate West's interest and comments, and his calling to our attention to some of his valuable work on Zn–Li silicates which we did overlook in our literature review.

References

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