The hematite crystals in the Dunsapie pseudomorphs are oriented with respect to the saponite crystals so that $[100]_S \| [10\bar{1}0]_H$, and $(001)_S \perp [0001]_H$, which is as one would expect because of the similar orientational relationship between chlorite and hematite in the pseudomorphs after olivine in Markle basalt.[2]

Summarizing the above results, the three alteration products in the pseudomorphs after olivine in Dunsapie basalt may be arranged so that $[100]_S \| [010]_G$, $[0\bar{1}6]_G$, $[016]_G$, $[10\bar{1}0]_H$; and $(001)_S \perp [100]_G \| [0001]_H$. The structural unit dimensions corresponding to these directional relations are as follows: $2a_S \bumpeq b_G \bumpeq 2a_H$ and $c_S \bumpeq 3a_G \bumpeq c_H$.

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Some observations concerning viscosity and anionic groups in silicate melts.

THE study of the viscosity of silicate melts has steadily increased in importance in petrology and industry. The slope of the viscosity curve has industrial significance wherever process automation of melts is present. Most theoretical considerations of viscosity reveal a relationship of this quantity to the geometry and internal and external anionic forces of the unit of flow.

The purpose of this study was to discover whether any data existed that on re-analysis would yield supporting or conflicting data on the theory of anionic groups as described in a previous publication (de Wys, 1960). It was felt that if various anionic groups had an effect on viscosity characteristics this would most likely be obvious in the slope of the viscosity curves, which is an indication of the activation energy for viscous flow.

According to Eyring's 'hole' theory it would appear reasonable to assume that the fluidity of a liquid will be related to the number of holes. Since the number of holes in a solid is related to its temperature elevation, ΔT, above its most dense state it would appear reasonable, in view of modern solid–liquid transition theory, that the increase in the number of holes in a liquid above those present in its most ordered state might also be related to the $\triangle T$ above the melting point or liquidus.

Therefore in replotting iso-viscosity curves on a phase equilibrium diagram it was felt that this should be done at a constant $\triangle T$ above the liquidus, rather than at a constant T, a technique that, although generally practised and of industrial concern, tends to ignore the morphological realities of the phase diagram to which the iso-viscosity curves pertain.

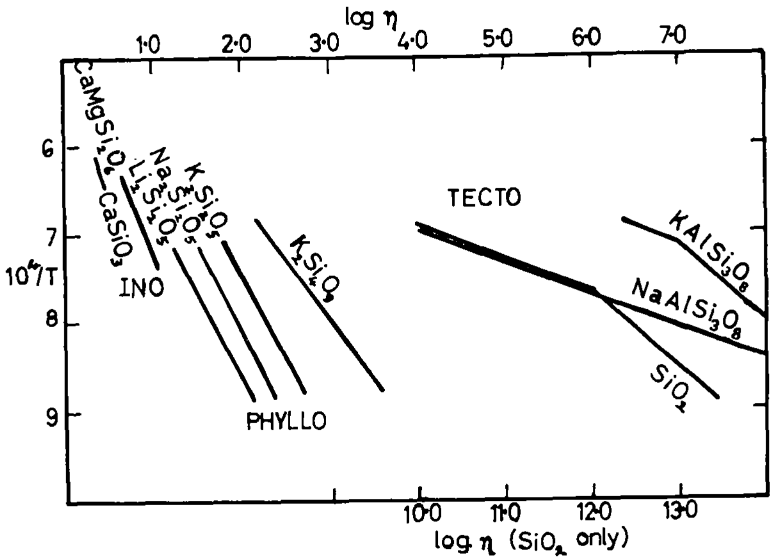

Fig. 1. Log viscosity plotted against $1/T$ (°C.), to show similarity of slopes of those liquids originating from compounds with similar crystal structures. Tecto slopes from data of N. L. Bowen; phyllo slopes from Shartsis, Spinner, and Capps; ino slopes determined by the author.

Fig. 1 shows plots of log viscosity of various congruent melting compounds against the inverse of absolute temperature. The similarity of the slopes of those liquids believed to have similar liquid structures is clear. It is of some interest to note that the $K_2Si_4O_9$ liquid, originating from a compound with a probable structure somewhat more complex than the phyllo but less than a tecto silicate, has a slope indicating an activation energy for viscous flow somewhat in between these two types.

It was of some interest to know whether the slope of the viscosity curve would change on crossing boundary curves in a ternary system since those curves separate regions in which certain anionic groups predominate. Fig. 2, which was derived by replotting the data from Machin and Yee (1948), indicates that the structural response of viscosity to a change in the predominance of a liquid structure is significant.

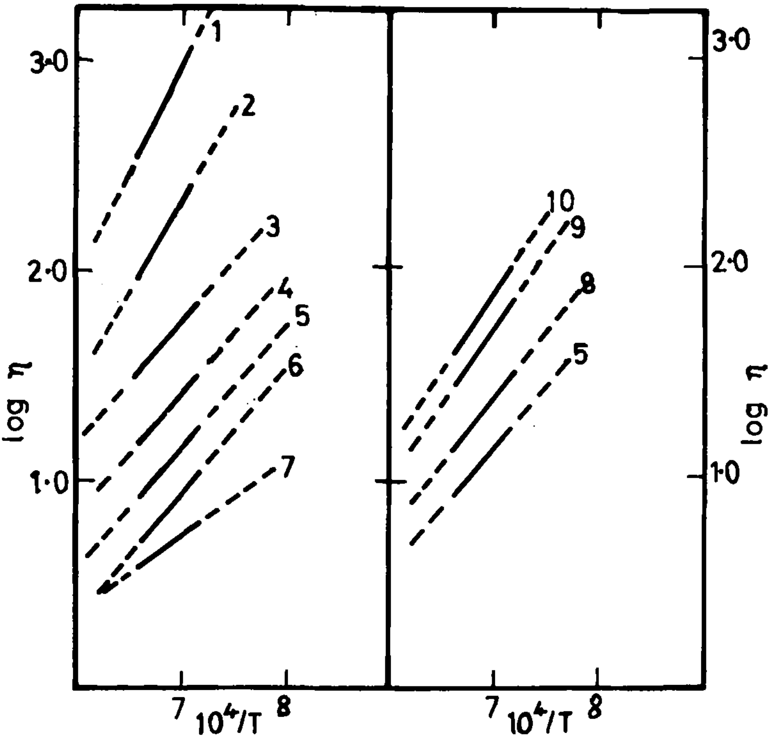

FIG. 2. Log viscosity plotted against $1/T$ (°C.) for a series of melts in the system $CaO-Al_2O_3-SiO_2$; for lines 1 to 7, Al_2O_3 is 10 mol. %, while CaO is 20, 25, 30, 35, 40, 45, and 50 wt. % respectively; for lines 5, 8, 9, and 10, SiO_2 is 50 wt. %, and CaO 40, 35, 30, and 25 wt. % respectively. The compositions for lines 1 and 2 fall within the SiO_2 field of the system; for lines 3, 4, 5, 6, and 8 within the $CaSiO_3$ field; for line 7 within the Ca_2SiO_4 field; and for lines 9 and 10 within the $CaAl_2Si_2O_8$ field.

The viscosity data presented by the above authors were also replotted at a constant $\triangle T$ above the liquidus surface, fig. 3. The iso-viscosity lines change directions when crossing into different primary fields where different liquid structures predominate.

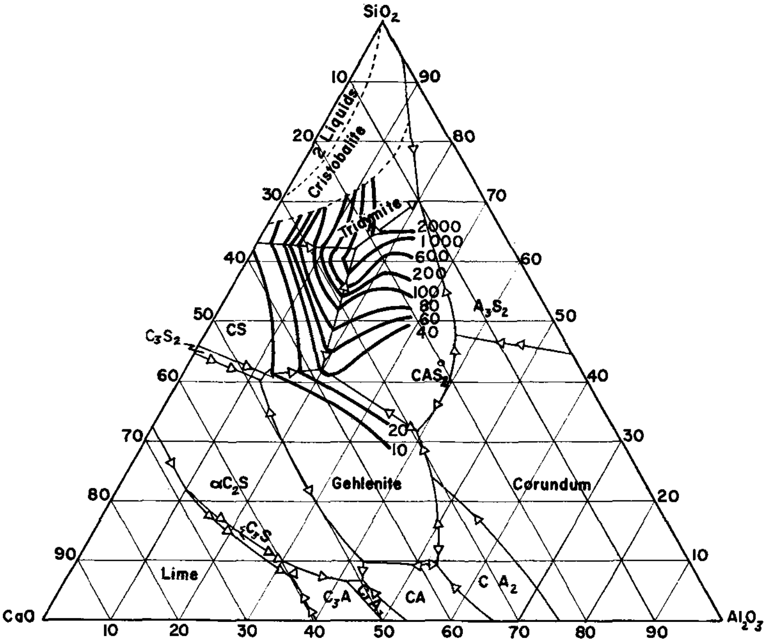

FIG. 3. Iso-viscosity curves in the system $CaO–Al_2O_3–SiO_2$, plotted for a temperature 50° C. above the liquidus.

Conclusion. It appears to the author that the above data tend to support the structure concept that various silicate anionic groups are present in silicate melts of different composition. It would seem by the viscosity response that the slope of the viscosity : temperature relation is strongly influenced by the dominant anionic group present in the mixture of anionic groups. From a practical point of view it would appear that by careful selection of anionic group mixtures the slope of the viscosity curve may be controlled.

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