If we introduce another network-forming oxide, for example, BeO , Al_2O_3 , in sodium silicate glass, the equation (4) remains valid, only the additive constant being modified to a small extent; for sodium silicate glasses containing alumina

$$v = 3.8R + 15.1$$

and for those containing BeO

$$v = 3.8R + 14.6$$

The equation for sodium silicate glasses containing boron trioxide is somewhat more complicated.

Three-component glasses containing network-modifiers such as CaO , MgO , etc., are contracted by ions of smaller size and higher charge and this can be accounted for in a simple way. If we denote the number of moles present in 100 gm. of glass of a network-modifying oxide by Mg^* , Ca^* , etc., then the contraction brought about by them is proportional to Mg^* , Ca^* , etc. For soda-lime glasses

$$v = 3.8R - 5\text{Ca}^* + 14.9$$

for soda-barium oxide glasses

$$v = 3.8R - 0.5\text{Ba}^* + 14.9$$

and so forth. If the glass contains also alumina, it must be considered when calculating R . The maximal error is 0.9 per cent.

The case of three-component glasses derived from potassium silicate is similar, only the coefficients of Ca^* , etc., being different. For potash-lime glasses an equation derived from (4)

$$v = 12R - 12\text{Ca}^* - 1.1$$

holds with a maximal error of 1.1 per cent. Similar equations have been found for potassium glasses containing other network-modifying oxides.

Calculations for four-component glasses are being made with good results and it is proposed to extend them for five- and multi-component silicate, borate and other glasses.

This makes it possible to calculate the densities of glasses from the composition with an accuracy much greater than the equations proposed earlier allow. Standard errors of the above equations are of course much smaller than maximal errors.

It is evident that the volume of the non-periodic tetrahedral network in glasses is extended when R increases, because R is the measure of the bridging of tetrahedra; the greater R , the fewer corners of tetrahedra are bridged, that is, connected with other tetrahedra. Therefore with increasing R the network expands. Our results show that this expansion is linear, therefore each 'molecule' of Na_2O expands the SiO_2 -network by the same amount, but the introduction of a K_2O causes a different amount of expansion. Network-modifying ions contract the network according to the size and charge; the factors are different for sodium glasses and potassium glasses:

Ion	Factor for sodium glasses	Factor for potassium glasses
Mg^{2+}	5	13
Ca^{2+}	5	12
Ba^{2+}	0.5	9
Zn^{2+}	2	—
Ti^{4+}	10	—
Zr^{4+}	10	—

A detailed account of this work is to appear in *Acta Physica*, Budapest.

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¹ Most of the literature is to be found in Morey, G. W., "The Properties of Glass", 2nd edit. (New York, 1954).

Large Sand Waves near the Edge of the Continental Shelf

TRAINS of large ridges, made mostly of sand and orientated normal to tidal streams, occur at many places in the shallow waters around Britain and in other parts of the world. The largest features of this form have recently been found by echo-sounding during cruises of R.R.S. *Discovery II* and R.V. *Sarsia* near the edge of the continental shelf, in depths of about 90 fathoms. It may be useful to describe the work carried out by the former ship on La Chapelle Bank in the neighbourhood of $47^\circ 41' \text{N.}$, $7^\circ 13' \text{W.}$

The patch of sand waves, about 12 miles long, ended abruptly at the edge of the continental shelf (Fig. 1) while the eastern limit was rather ill-defined. The patch extended laterally for 5 miles, but was probably rather more extensive than this for the ridges were large at the limits of the region sounded.

Fig. 1. Sand waves on La Chapelle Bank showing their abrupt termination at the edge of the continental shelf. Section is approximately normal to the crests. The slopes are distorted by the curvature and exaggeration of the depth scale

The crests have an average height of about 25 ft., 40 ft. being the maximum value observed. The mean separation of the crests was about 2,800 ft., although there was considerable variation. The survey consisted of seven lines arranged in a star-like pattern over the ridges. From the differences in the apparent separation of the crests, on sounding lines of different orientation, it was possible to derive the direction giving a true profile. The orientation of the crests was about 110° true, and so the ridges were parallel to the general line of the edge of the shelf.

A large sample taken from a ridge and from a trough, by conical dredge, showed that sand together with some shell gravel were the chief components (median diameter about 0.5 mm.).

These sand waves are of interest for a number of reasons. Their crests have a separation about three times greater than for similar ridges in shallower water. Their presence suggests that the tidal streams on La Chapelle Bank, even at 90 fathoms, are strong enough to transport sand and gravel along the floor. From a study of the slight asymmetry of the profiles of the ridges it was inferred that there must be a net westward transport of sediment. The abrupt western limit of the ridges at the edge of the shelf may mean that the material, once it reaches the top of the continental slope, is carried away (perhaps periodically) into deeper water.

We shall be pleased to hear of other places where such features occur, since we hope to make a more general study.

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