that these sounds are closely connected with ordinary earthquake-sounds, and Prof. Hobbs finds that the Calabrian villages from which brontidi are reported are also those which have suffered most from disastrous earthquakes, and that they are ranged along the more prominent seismotectonic lines of the district.

In great detail Prof. Hobbs studies, not only the places damaged by the important earthquakes of 1638, 1659, 1783, 1894, and 1905, but also those at which numerous slight shocks were observed, for the latter, owing to their small disturbed areas, seem to be the most useful indices of the course of seismotectonic lines. The positions of more than 300 such lines in Calabria and north-eastern Sicily are estimated and drawn upon a series of maps, as well as the bearings of joint-planes, the trend of the volcanotectonic lines, and the distribution of brontidi.

It will be seen from this brief abstract that Prof. Hobbs's memoirs possess considerable interest. They are the result of extensive reading, and contain many useful references. But his wide generalisations seem to me to be based on insecure principles and insufficient data. Isoseismal lines, it is well known, are elongated in the direction of the originating faults, but the positions of a few places at which shocks are felt cannot determine a line of fracture. For instance, one of the British seismotectonic lines is located by the positions of four places, two of which are more than 200 miles apart. The seismotectonic lines revealed by the New England earthquake of 1870 are based on the positions of about a score of places distributed over an area reaching from Quebec to New-haven, and on about a dozen apparent directions of the shock. When observed in houses, such directions are almost invariably perpendicular to the principal walls, but Prof. Hobbs assumes that they indicate that the shocks were transmitted along parallel seismotectonic lines. In Calabria, on the other hand, the damaged villages are so numerous that it would be strange if many of them were not collinear. Several of the seismotectonic lines plotted by Prof. Hobbs no doubt correspond with lines of fracture, but the existence of a very large number of his lines must, I think, be regarded as doubtful. Industrious as he has been in the collection of materials, he has tried within little more than a year to achieve results which the long-continued labours of many men might fail to establish.

C. DAVISON.

HYDRATES IN AQUEOUS SOLUTION.

A RECORD of researches which have been carried out by Prof. H. C. Jones with his students and confrères has recently been published by the Carnegie Institution.[1] The investigations which have been undertaken were to elucidate an observation made by Jones and Ota when studying the freezing-points of solutions of double salts in order to ascertain whether in solution they remained as constituent molecules or were broken down. They found that concentrated solutions gave abnormally low freezing points, the molecular lowering of freezing point passing through a well-defined minimum as the concentration changed. Now according to the ionic theory as then expressed, the molecular lowering should decrease continuously as the concentration of the solution increased.

A very large number of solutions of salts, acids, and bases, and neutral organic substances have now been studied, and as a result it has been found that this excessive depression as the concentration increases is a general property of solutions. In order to explain this digression from the generally accepted rendering of the ionic theory, Jones postulates that "in solution a part of the solvent is combined with the dissolved substance and no longer plays the *rôle* of solvent, at least so far as the freezing point method is concerned."

By a determination of the freezing point, conductivity, and specific gravity of the solutions, it has been found possible to calculate approximately the total amount of water held in combination by the dissolved substance, and consequently the approximate amount combined with one molecule of the compound or of the ions resulting from it.

[1] "Hydrates in Aqueous Solution." By Harry C. Jones. Pp. viii+264. (Washington: Carnegie Institution, 1907.)

The theory proposed here differs from that suggested by Mendeléeff, who considered that such substances as sulphuric acid and calcium chloride form a few definite compounds with the water in which they are dissolved. But the present theory supposes that combination between the dissolved substance and water to be a general phenomenon. The compound forms, say, for example, calcium chloride, a complete series of hydrates extending from a few molecules of water to at least thirty, all the intermediate stages being represented.

The memoir commences with an introduction, in which the earlier work is reviewed and the freezing-point and conductivity apparatus used by the author are described. Then follows part i., dealing with the evidence for the existence of hydrates in aqueous solution and the approximate composition of the hydrates formed by a large number of electrolytes. The work here described was carried out by Getman and Bassett. Attention is directed to the effect of temperature on water of crystallisation, as bearing on the theory of hydrates in solution. It is shown that salts which on crystallisation contain water of crystallisation are able to combine when in solution at ordinary temperatures with a much larger quantity of water than they are able to bring with them out of solution on crystallisation. The results obtained are illustrated in many cases graphically by curves and in other cases by tables.

Part ii. is chiefly the work of Uhler, and deals with spectroscopic investigations. The spectrographic photographs which are given have been magnificently reproduced, and form quite a feature of the book. The colour changes produced, for example, by the addition of different salts to cobalt salts have been investigated quantitatively. That is to say, the absorption spectra of the substances, separately and when mixed in known quantities, have been observed with a direct-reading spectroscope, and thus the wave-lengths and absorption bands obtained. The special spectrograph which has been used to obtain the photographic record of the absorption bands is also described. The final section deals with non-aqueous solutions, the solution of substances in methyl and ethyl alcohol having been studied. The results seem to indicate that some substances at least, such as lithium chloride, bromide, and nitrate, combine to some extent with the solvent. However, this portion of the work is yet in its initial stage, and much yet remains to be done. We understand that the author is extending the work in this direction.

Altogether, the memoir is an extremely valuable contribution to the study of the subject, more especially in connection with concentrated solutions. It has often been urged, and with a considerable amount of truth, that the ionic theory is simply a specialised hypothesis, which is true only of dilute solutions. Prof. Jones has gone far to remove this reproach by broadening the basis of the theory and enlarging its scope. The publishers, the Carnegie Institution, must also be congratulated upon the splendid way in which the letterpress and diagrams have been got up.

F. M. P.

PRODUCTION AND DECAY OF MEDIÆVAL STAINED GLASS.[1]

THE earliest direct evidence as to the methods of mediæval glass-painting is contained in the treatise of Theophilus ("Diversarum Artium Schedula"), which dates back in all probability to the latter half of the twelfth century; here one finds detailed instructions for the making of the glass as well as for its formation into the flat sheets or "tables" in which it is required by the glass-painter.

This treatise makes it clear that at that time such window glass was for the most part made by what is generally known as the "muff" process. The process referred to is one of the three known methods of making window glass, namely:—

(1) Cast or plate glass, made by pouring molten glass on to a flat stone or metal slab.

(2) Muff or cylinder glass, in which the glass is worked

[1] Abstract of a paper read before the Society of Arts on March 13 by Mr. Noel Heaton.