of the whole book. It contains a full account of thermochemical notation, a selection of the more important data, and an elementary discussion of the law of maximum work. Chemical equilibrium and dissociation are also dealt with, the treatment being non-mathematical, and bearing evidence of the influence of van 't Hoff. The book as a whole forms an admirable introduction to general chemistry; the student who has mastered its contents will have nothing to unlearn, and will be able to proceed at once to the larger text-books of Ostwald and van 't Hoff.

Elementary Hydrostatics. By Charles Morgan, M.A., R.N. Pp. 106. (London: Rivingtons, 1899.)

THIS small text-book contains practically a condensed account of all the leading points in hydrostatics which are usually included in an elementary course, accompanied by an unusually large number of exercises. It makes no attempt at exhaustive treatment, and is rather intended for those studying the subject with tutorial aid. We are sorry to see that the author has gone on the old lines in the dual interpretation of "pressure" as thrust, and also as thrust per unit area, and we should have liked to have seen the notion of "whole pressure" kept in the background, and greater emphasis laid on the use of the formula for the same in obtaining the resultant thrust on a *plane* area. The familiar figure of the air-condenser with the valves resting in their usual impossible upside-down position is here once more reproduced. We like the author's simple treatment of centres of pressure as being instructive and useful to beginners, despite the objections that mathematicians may raise against its validity. For the points which we have criticised, the fault probably lies not so much with the author as with the examinations for which it is his purpose to prepare candidates, and we think that the book will be of great value to all students whose limited time prevents their reading a large treatise. G. H. B.

The Valley of Light.—Studies with Pen and Pencil in the Vaudois Valleys of Piedmont. By W. Basil Worsfold. (London: Macmillan and Co., Ltd., 1899.)

AN author adds to his difficulties by writing a book in the form of letters, especially when he desires to combine instruction with entertainment. Mr. Worsfold has not been more successful than others in overcoming these, and we are not surprised that, as he admits, his fair correspondent found his epistles "not very entertaining." In fact he does not add much to our knowledge of this district. Like his predecessors, he is almost silent on its geology and botany, and devotes himself to the history of the past persecutions and present fortunes of the Waldenses. The former subject is an interesting but hardly a novel one; for it is treated pretty fully in Beattie's "Waldenses" and Gilly's "Narrative." The Waldenses, in fact, have already been the cause of not a few books, if we include those in other tongues than our own, and Mr. Worsfold's does little more than add to their number. We doubt, indeed, whether the best authorities would agree with him in tracing the Waldenses back to early Christian settlements in these valleys, or in the date (twelfth century) which he assigns to the Nobla Leçon. Nothing of special importance seems to have happened in the Waldensian valleys during the last half-century. Their worthy inhabitants have prospered fairly and maintained their high character, but this, though satisfactory, affords but few opportunities to an author. In short, Mr. Worsfold's book has no scientific value, for even the illustrations are poor; and it displays little historical research or originality.

LETTERS TO THE EDITOR.

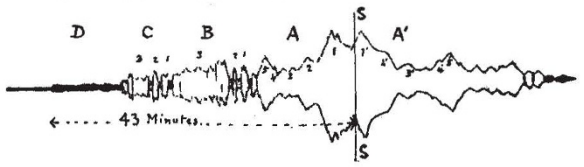
[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Earthquake Precursors.

IN NATURE, February 16 (p. 368), under the title of "Earthquake Echoes," I described the more or less rhythmical series of fading resultants which are seen to succeed many large earthquakes. These earthquake followers, the first of which may sometimes represent the *Uri Kaishi*, or return shaking of the Japanese, are repeated in groups with a decreasing amplitude, an increasing period, and with a smoother and smoother contour. The last of the series may be so small that it is usually difficult to say with certainty when a large earthquake has ceased to exist. As pointed out by Mr. R. D. Oldham, it seems quite possible that certain of the terminal vibrations may have travelled round the world in a direction opposite to that taken by the larger members of the series. The movements to which I now refer are the procession of vibrational groups which run before the main disturbance, with the smaller of which, under the name of preliminary tremors, we are already more or less familiar. These precursors have in several respects characteristics which are exactly the opposite to those of the earthquake followers. They have a definite commencement, and with large earthquakes group after group usually increases suddenly in amplitude and period.

Another feature of the precursors is that, whilst group after group may grow larger, they become more and more larger featured in their contours. The very first of the preliminary tremors have no *frétillements*, or have lost whatever they may have had, whilst those which follow carry serrations which are well marked. This observation, together with that of the growth in amplitude, suggests the idea that the main features of each group of precursors starting from a common origin have reached an observing station by different routes; the first have come along Knott's path of least time, whilst the latter, culminating in the shock, may have travelled along paths continually approximating to that of a free surface-wave.

Now and again, we see in groups of preliminary tremors a likeness in contour and arrangement of what is to follow; but likenesses of this description are perhaps best seen when we compare the shock and its immediate forerunners with the *Uri Kaishi*, or first echo and its successors. Thus, in the accompanying photographic reproduction of the disturbance of



June 29, 1898, if we take S S as a line of symmetry, which lines are not uncommon in seismograms, the shock 1 in the group A is preceded by groups of waves 2, 3, 4 and 5, which are not unlike the echoes 1′, 2′, 3′, 4′ and 5′; whilst in the precursors B and C, 1, 2, 3 are not unlike 1, 2, 3. In group D all likenesses are lost. Our knowledge of the very first preliminary tremors like D is less than that of those which follow. Near to an origin they may have a duration of from one or two up to ten or twenty seconds, and their period has been recorded at from 1/5 to 1/20 of a second. When they are preceded by a sound-wave, we have evidence of a very much higher frequency. If these vibrations have travelled long distances and through our earth, most records indicate a period of three or four seconds. Records from Rome have shown periods of less than half a second, but even these are probably much too large. My own records indicate only a slight switching at the end of a light elastic boom or a very rapid to-and-fro motion of the boom relatively to its steady-point. Until a steady-point seismograph with extremely light multiplying indices like that of Vicentini, or some other special form of apparatus, has been employed as a recorder, our knowledge of this end of the seismic spectrum is not likely to increase.

The last points connected with the earthquake precursors are