In fig. 3, Professor Ewing has carefully combined the motion of the two components so as to give the actual path of a point of the earth's surface for a short interval. From p to q, following the arrowheads, it shows that motion (magnified six times) during an interval of three seconds.

This same characteristic wriggling motion is shown in fig. 4, which is the entire record, magnified three and a half times, upon a stationary plate, of an earthquake which occurred on April 23, 1883, and lasted four minutes and a half. It is quite likely that the earthquakes which recently shook up our middle and western states would have given a somewhat similar record.

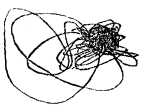

FIG. 4.

The principal characteristics of the average earthquake in the plain of Tokio are: 1°. The motion of the ground begins very gradually. 2°. An earthquake consists of many successive movements, and there is almost always no single large one which stands out prominently from the rest. 3°. The disturbance ends even more gradually than it begins. 4°. The range, the period, and the direction of movement, are exceedingly and irregularly variable during any one earthquake. 5°. The duration of disturbance of the ground is rarely less than one minute, and often several minutes. 6°. Even in somewhat destructive earthquakes, the greatest displacement of a point on the surface of the soil is only a few millimetres. 7°. The vertical motion is generally much less than the horizontal. 8°. A mass shaken back and forth in the most severe earthquakes of Tokio, would, if it did not slide, be urged by a horizontal force, which, at its maximum, would equal about one thirty-third of its weight. This, regularly repeated, is sufficient to crack brick walls, and sometimes throw down chimneys.

To the many readers who have had no experience of earthquakes, but are accustomed to think of them as a sudden violent thrust, accomplishing at a blow, as it were, all their disastrous work, the preceding descriptions will be a somewhat new revelation.

Professor Ewing plainly shows that as seismometers, the instruments in use by Palmieri and others are worthless; for not one of them can be depended upon to give a reliable measure of the direction, period, or amplitude of the vibrations of the ground, most of them being designed to record a single violent thrust in one direction, and nothing subsequent, and the greater part of them being some form of stable pendulum which is almost certain to be set swinging in an earthquake through amplitudes far greater than the earth itself, and thus to mask entirely the motion of the latter.

One novel 'time-taker,' the invention of Professor Milne, whose work in Japan is so well known, is worthy of note. A clock has its hour, minute, and seconds hands all on the centre of the face, and of different lengths, with their ends turned up into the same plane, and tipped with cork smeared with printer's ink. In front is a track upon which, when a seismoscope closes a circuit, a carriage travels up and presents a disk to the face, and then backs off again, carrying an impression of the instantaneous position of the three hands, and leaving the clock to go on undisturbed.

The closing chapter treats of the constructive details and requirements of a seismological observatory; and a series of experiments by Professors Milne and Gray are noticed, in which it was sought to determine, by a series of artificial earthquakes (dropping heavy weights in a foundery, and exploding buried cartridges of dynamite) in connection with time-recording seismometers, the velocity of transmission through the ground. These gave 438 feet per second for normal, and 357 feet per second for transverse, waves. This was through hardened mud. Mallet's earlier experiments gave for sand 825 feet, for jointed granite 1,306 feet, and for solid granite 1,665 feet, per second. The last, Professor Ewing remarks, is probably very much too low.

This element of earthquake motion, the velocity of transmission through the earth's crust, is very inexactly known; and the author notes the desirability of extending the observation of earthquakes over a considerable region of such a country as Japan by means of many stations connected by telegraph, to which simultaneous time-signals can be sent, and at which the same earthquake may be recorded on rotating plates, together with a record of the absolute time. These, if sufficiently widely distributed and numerous enough, would give us valuable data regarding the latitude, longitude, depth, and time of the origin of the disturbance, and the velocity of its transmission to the surface in all directions, supposing it rectilinear and uniform. Regarding the possibility of this, Professor Ewing, in the article referred to above (*Nature*, June 19, 1884), speaks as follows: "But all this depends upon our being able to recognize at the various stations, some one wave out of the complex records deposited at each; and, especially in view of the curvilinear nature of the motion, it would be hazardous to say, without trial, whether this can be done."

In conclusion it may be said, that the whole work is exceedingly interesting and valuable; and Professor Ewing is to be highly commended for thus bringing together the best results of modern methods in exact seismometry, and for showing the sources of error and the fallacies in older methods and theories. The work should receive as wide a distribution as possible by the University of Tokio. H. M. PAUL.

EXCURSION MAP OF THE VICINITY OF BALTIMORE.

THE need has long been felt, among those students of the Johns Hopkins university who are especially interested in the study of natural history, of a reliable map of the adjoining country, on a suitable scale, and so mounted as to be adapted for convenient pocket use. It is believed that a few words regarding the method by which the want of it has been recently

supplied in Baltimore, will have more than a merely local interest.

The students and instructors of the university whose work naturally inclines them to out-of-door explorations are associated in what is known as the Naturalists' field-club; and it was decided by the members of this club, that a map on a scale of a mile to the inch, covering an area twenty-five miles square, with the city-hall of Baltimore as its central point, would amply supply all present needs. The difficulties in the way of the construction of such a map were, however, considerable. The cartographic materials already existing were very fragmental, and varied much in their form, scale, and reliability, while the great cost of a new survey of so large an area was out of the question. Mr. Albert L. Webster, however, who had had four years' experience as topographer on the U. S. geological survey, submitted a plan to the trustees of the university, which met with their hearty approval.

All maps, of whatsoever kind, relating to the area in question, were collected and carefully compared, the most accurate of them being reduced to a uniform scale. A drawing on the scale of two inches to a mile was then commenced, upon which, however, only the most reliable material — the work of the U. S. coast-survey, which covered about one-third of the entire area — was incorporated. The remainder of this drawing was left blank, with the intention of placing upon it in future only such material as is up to the standard of the coast-survey work. For the remaining two-thirds of the area a tracing was made from the best existing sources, and the two together (drawing and tracing) reduced one-half, and photo-lithographed. The present published map, therefore, is on a scale of one mile to an inch, and represents the best existing information relating to the vicinity of Baltimore. It is, however, not in any way to be regarded as complete or final, but only as the first step toward the attainment of a really good representation of the region. It is doubtless faulty in many particulars, and is certainly very deficient in showing no topography. With a view to its improvement, any suggestions relating to either details or the general character of the map, as well as any information regarding accurately determined elevations within the area, are earnestly solicited from all persons who may make use of it. In this way it is hoped that the map may be a constant growth, improving year by year through the criticism and suggestions of those interested in it.

After the original drawing has once been made, the cost of embodying improvements and publishing successive editions is not large, and may easily be defrayed by the sale, at a moderate price, of the printed copies. The Baltimore maps, cut into sections and mounted on linen, folding into a pocket-case, are sold at a dollar each.

These details are given in the hope of eliciting suggestions, or of inciting similar clubs, in other cities where a good map is as much needed as in Baltimore, to start the development of something of the same kind.

THE NEW-YORK AGRICULTURAL STATION.

Second annual report of the board of control of the New-York agricultural experiment-station for the year 1883, with the reports of the director and officers. Albany, *Weed, Parsons, & Co., pr.*, 1884. 279 p. 8°.

IN the space at our command it is impossible to make any adequate review of the large amount of valuable work which we find in the New-York report. In general it may be said that it partakes of the characters of both the classes of experiments spoken of in our comments on p. 509. Some of it lies on the border-land between the two, yielding results of more or less immediate value to both science and practice. We include here such experiments as those upon methods of cutting seed-potatoes; the influence of depth, and distance apart, of planting, upon the crop; the effects of mulching, cultivation, root-pruning, and the like. Others are more distinctively scientific in their aim, such as the lysimeter observations, the notes on hybridization in maize, the experiments upon the influence of food upon milk and butter production, etc.

Perhaps the most noteworthy portion of the report is its proposed method of classification of artificial varieties of plants for purposes of identification. This method is based on the belief, confirmed by two years' observations, that those portions of the plant for whose sake it is especially cultivated are comparatively constant in form within the same variety, under the circumstances of cultivation, while the agriculturally unimportant parts may show considerable variations. For example: the roots of any particular variety of beet will show comparatively little variation, while the tops may present very considerable differences. Artificial selection has here impressed certain desired qualities upon the root, but paid little or no attention to the tops.

Proceeding upon this belief, it is proposed to base the classification in 'agricultural botany' upon the agriculturally important part of the plant. Thus all root-crops would be united into one class, irrespective of their ordinary botanical relationships, this class to be subdivided into smaller groups in accordance with the form of the root.

Such a method of classification for a particular purpose would appear to be legitimate. Its final justification is to be sought in its success, and of this it is too early to judge. When the observations shall have been extended over a term of years, and the constancy