examined, there were a few oysters upon it, but so small that a microscope was necessary to recognize them. On Aug. 2 it was again examined, and the tile of which a portion is figured was removed from the bundle. There were then from 26 to 348 young oysters on a tile; the total number upon the whole bundle was 1,506.

The third examination was made Aug. 23, when it was found the oysters had increased very much in size and numbers. On the tiles remaining, there were 1,334 oysters. A tile of which a portion is represented in fig. 2 was then removed. On Oct. 10 the bundle was again examined. The oysters had decreased fifty-five per cent in numbers; but two-thirds of them were now over three-quarters of an inch, and two specimens over two inches long, though the shells were still extremely

FIG. 3. — UPPER SIDE OF TILE EXPOSED JULY 9–OCT. 10. (TWO-THIRDS NATURAL SIZE.)

delicate. Part of one of these tiles is represented by fig. 3.

It was thus determined, that in 1879 the attachment of the young oysters began about the middle of July, and continued about a month, as after Aug. 20 there were no signs of fresh attachments; that fully fifty per cent died from natural causes within six weeks, no traces of predacious mollusks being noticed on the dead shells, though the evidence on this point is imperfect; that, the attachments being far more profuse on the concave under side of the tiles, the spat just previously must be on or near the bottom, and must rise to attach themselves; lastly, that the rate of growth is much more rapid than had previously been supposed, and may reach two inches in length in three months. Numerous other points of interest may be gleaned from the report, for which we have not space. Enough has been said, however, to show the value of Lieut. Winslow's work, the intelligence and assiduity with which it was carried on, and the wide field which awaits further investigation.

THE PEBBLES OF SCHLESWIG-HOLSTEIN.

Die sedimentär-geschiebe des provinz Schleswig-Holstein. Von Dr. C. GOTTSCHE. Als manuscript gedruckt. Yokohama, *Lévy & Salabelle*, 1883. 6+66 p., 2 maps. 8°.

THIS treatise by Dr. Gottsche, who is at present in Yedo, was an accepted thesis for admission to the position of private teacher at the Kiel university in 1880, printed privately in German at Yokohama in 1883, and seems to be a very painstaking and pretty thorough description of the pebbles, whether of rocks, minerals, or fossils (seventy-six kinds in all), found in four quaternary sedimentary beds at Kiel, with especial reference to the identification of their source, and is accompanied by two maps, — one showing with straight lines thirty directions in which such pebbles of the lowest bed appear to have been transported, and the other giving with similar lines the dissemination of three particular kinds of rock in the same Baltic region. Many of the lines are only a couple of hundred miles long, but some are six hundred or more. The author himself points out that the pebbles have not by any means necessarily been carried along those straight lines; and the place of origin may not necessarily have been exactly at the points where identical rocks are only found at present. Nevertheless the lines show that the transfer has in general been from the north-east, north, or north-west, and never from the westward or southward of Kiel. Of course,

there need have been no more than two directions of movement, south-westerly and south-easterly; for the pebbles carried a part of their course in one direction may have been carried the rest of the way in the other, and so produced any resultant direction between the two; or materials carried by floating ice may have come in a far more crooked course (and the places of origin are all on the shores of the Baltic, or on streams flowing into it). The lower sedimentary bed, with only a couple of exceptions, contains, so far as now known, every kind of pebble found in the upper ones, so that no inferences can yet be drawn as to changes with time in the direction of transport. The main result would seem then to be, that the Kiel sediments have all come from more northern parts of the Baltic basin, and might have been carried chiefly by floating ice, without a climate so very different from the present one.

The author is highly to be commended for his liberality in printing his pamphlet of sixty-six large octavo pages at his own expense, and that, too, in a country where good European printing is particularly troublesome. The two maps might, perhaps, have been advantageously combined in one, if one of the two sets of lines had been of a different character (say, dotted or broken) or of another color; for the very object of cartographic representation is to show at one view as much as can possibly be distinguished clearly of any given subject, — to assemble for convenient comparison on one sheet as many as may be of the scattered facts of nature bearing upon any given point.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Spectra of comets observed in 1881. — P. Tacchini discusses the varying appearances presented by the spectra of the comets *b* and *c* 1881, and accompanies his remarks with an extensive series of nearly forty lithographed drawings illustrating the changes which occurred. These changes, for the most part, consist merely in variations of the brightness and diffusion of the observed bands, and not in any alterations of position. He gives also a single figure of the spectrum of Encke's comet, observed the same year, and a set of twenty drawings of the comets (*b* and *c*) themselves. The paper, with its accompanying plates, constitutes an important collection of observed data; and some slight discrepancies between these representations and those of other observers raise interesting questions. — (*Mem. soc. spettr. ital.*) C. A. Y. [263

Uranus. — Within the last few months, considerable attention has been paid to this planet, and a number of series of observations upon it have been published. Safarik (*Astr. nachr.*, 2505), Meyer (*Astr. nachr.*, 2524), and Schiaparelli (*Astr. nachr.*, 2526), all present the results of their measures made for the purpose of determining its diameter and ellipticity. The observations of Schiaparelli are the most numerous and complete. He finds for the equatorial diameter of the planet 3″.911, and, for the polar, 3″.555 (both reduced to the mean distance 19.1826). This gives the ellipticity of the planet $\frac{1}{11}$, nearly the same as that of Saturn. He also reports the existence, upon the planet's disk, of spots and changes of color, too faint, however, to admit of delineation by means of a telescope of only eight inches aperture. In fact, to have seen them at all with such an instrument is a most remarkable evidence of the wonderful clearness of the Italian sky. The writer of this notice also made a series of observations upon the same object, in May and June, with the twenty-three inch equatorial of the Princeton observatory. Markings upon the planet's disk were unmistakably visible as belts resembling those of Jupiter and Saturn. The equatorial diameter determined by the writer's measures is 4″.280, and the polar, 3″.974, giving an ellipticity of $\frac{1}{14}$. Mädler, in 1843, obtained 4″.304 and 3″.869 for the two diameters, and an ellipticity of $\frac{1}{10}$. There can no longer be any doubt that the planet has a rapid rotation nearly in the plane of the satellite-orbits. — C. A. Y. [264

MATHEMATICS.

Perimeter of the ellipse. — Mr. Thomas Muir, referring to a recent article by M. Mansion, infers that the following formula, which he has known for some time, for calculating approximately the perimeter of an ellipse, has not yet been published. Denoting as usual by *a* and *b* the semi-axes of the ellipse, the expression for the perimeter is

$$2\pi\sqrt[\frac{3}{2}]{\frac{a^{\frac{3}{2}}+b^{\frac{3}{2}}}{2}};$$

or, *the perimeter of an ellipse is approximately equal to the perimeter of a circle whose radius is the semi-cubic mean between the semi-axes of the ellipse.* — (*Mess. math.*, xii. no. 10.) T. C. [265

Calculus of variations. — The general problem of the calculus of variations is to find the variation of an *n*-tuple integral of a function of *n* independent variables, and of depending also upon a number of arbitrary functions of these variables, together with the differential coefficients of the functions. M. Picart in his paper, which he entitles *Theorie nouvelle du calcul des variations*, confines his attention to a triple integral containing only one arbitrary