the anterior with very fine striæ crossed at the margins by equally fine radii. The fine pores between, but not on the coarse ridges, are wanted on the anterior surface. The scale seems to belong to some large Glyptodipterine, and merits description from its occurrence in the same shales with the tooth last described.

The large transversely oval scale, named *Dendroptychius*, belongs to the same group; its anterior half is finely tubercular by the intersection of concentric and radial striæ; the distant, rudely parallel, vermicular, frequently bifurcated ridges of the posterior do not radiate from a centre, but pass from the whole transverse diameter. The determination of this, like the preceding from the same locality, awaits further discoveries.

The Acanthodian remains are abundant and well preserved.

Scales of two species of *Gyrolepis* occur along with those of *Palæoniscus*. *Amblypterus* is represented by a few scales.

The Plagiostomous remains are numerous and varied; among them occur *Orodus*, *Helodus*, *Cladodus*, and *Ctenodus*. Among them, as among the numerous spines, are several forms which are yet under investigation.

Of the genus *Platysomus*, one species, *P. parvulus*, and a variety unnamed, are found; the scale ornament of the one is tubercular*, of the other striated. *P. striatus*, obtained in Derbyshire, is wanting in this coal-field.

The list both of genera and species will doubtless be augmented when the large mass of materials, collected by Mr. Molyneux and others, shall have been more fully investigated.

First Report on the Structure and Classification of the Fossil Crustacea. By HENRY WOODWARD, F.G.S.

A GRANT having been made in September last at Bath (1864) in aid of my researches into the structure and classification of the Fossil Crustacea, for which the Earl of Enniskillen, Professor Phillips, and Mr. C. Spence Bate were appointed a Committee, I beg to submit my first Report.

The first portion of my investigation relates to the Crustacea of the Devonian and Upper Silurian formations belonging to the order *Eurypterida*.

These are now elaborated, and will be published in a Monograph, with plates and woodcuts of all the species, by the Palæontographical Society during the ensuing year.

The following is an abridged list of the genera :—

   1. Eurypterus .... 9 species examined.
   2. Pterygotus 10   ,,   ,,
   3. Slimonia 3   ,,   ,,
   4. Stylonurus .... 6 ,,   ,,
   5. Hemiaspis .... 5 ?   1   ,,.

and includes three genera defined, viz. :—

Slimonia†, *Stylonurus*‡, and *Hemiaspis*§; and also six new species added

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* A new genus, *Amphicentrum*, has been founded by the writer upon certain fossils bearing certain strong anatomical resemblances to *Platysomus*, while the dentition indicates affinities with the Pycnodonts. The description of this genus, with a review of its relations, will shortly appear elsewhere.

† See Intellectual Observer, vol. iv. 1863, p. 229, " On the Seraphim and its Allies."

‡ See Geological Magazine, vol. i. 1864, p. 196, " New Palæozoic Crustacea."

§ See Quart. Journ. Geol. Soc. vol. xxi. pt. 4, Nov. 1865, " On *Hemiaspis*."

to the list, including the great *Stylonurus Scoticus**, nearly 4 feet in length.

Of the other species we now possess much more ample material than was at the disposal of Messrs. Huxley and Salter in 1859, when their Monograph appeared, and many important details in the structure and position of the parts and their mutual relations are now elaborated.

In addition to the Devonian localities of Herefordshire, Forfar, Arbroath, and Dundee, the Upper Silurian of Lanark, and the Lower Ludlow of Leintwardine, Shropshire, all of which have yielded new and characteristic forms (several of them described by me during the past year), I have lately obtained from the Wenlock Limestone and Shale, Dudley, good evidence that in this locality also species of *Pterygotus* occur.

Until June 1865, the oldest known Cirripede was the *Pollicipes Rhæticus* from the Rhætic beds of Somersetshire; but I have just described † a new Cirripede with intersecting rows of plates (similar to the Cretaceous genus *Loricula*), from the Wenlock Limestone and shale of Dudley, figures of which are added ‡.
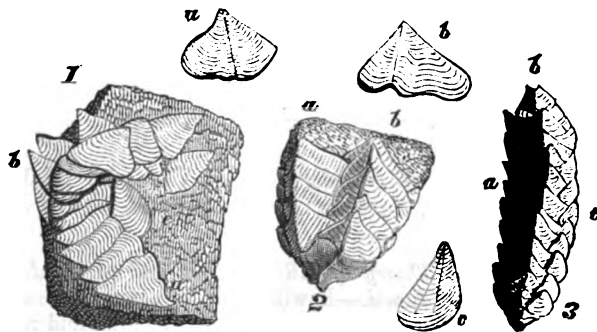
TURRILEPAS WRIGHTII, H. Woodw. (*Chiton Wrightii*, De Kon.).
  Fig. 1. Specimen from Mr. E. J. Hollier's collection.
  Fig. 2.   „   Mr. Charles Ketley's   „
  Fig. 3.   „   Mr. H. Johnson's   „
  Figs. *a, b, c* represent the three forms of plates of which the several rows are composed in figs. 1–3, which bear the corresponding letters. The opercular valves are not known.

Another Cirripede of the genus *Pyrgoma*, occurring recent on the south coast of England and Ireland, living in deep water attached to the edge of the cup of *Caryophyllia*, and fossil in the Coralline Crag of Suffolk, has now been detected by me in the Upper Chalk of Norwich. As this is a new species I have named it *Pyrgoma cretacea*. It is interesting to find it associated with the same genus of corals (*Caryophyllia*) both in the Chalk and in recent seas.

I have examined and determined six genera, and am preparing descriptions of about sixteen new species of Liassic Crustacea.

* See Quart. Journ. Geol. Soc. vol. xxi. pt. 4, Nov. 1865, "On *Hemiaspis*."
† See Quart. Journ. Geol. Soc. vol. xxi. pt. 4.
‡ Two detached valves of this fossil were discovered by Mr. John Gray of Hagley, and described as a *Chiton* by M. De Koninck, Bulletins de l'Acad. de Bruxelles, 1857, 2nd series, vol. iii. p. 199, pl. 1, f. 2.

1865.   z

Among the new genera are—

1. Palinurina .... 2 species
2. Aeger.................... 3 ,,
3. Glyphæa .... 2 ,,
4. Pseudoglyphæa .... 2 ,,
5. Scapheus .... 1 ,,

besides the genus *Eryon,* to which two or three new species have to be added.

I have likewise detected a minute species of *Squilla.* All these seven genera (save one) characterize also the Solenhofen limestone of Bavaria* (Upper White Jura).

I have now to notice a remarkable burrowing Crustacean of the family *Thalassinœ* (a genus of which (*Callianassa*) occurs in the uppermost bed of the Cretaceous series at Maestricht), as occurring in our Hempstead series (Upper Eocene) in the Isle of Wight, and another species in the Greensand formation of Colin Glen, Belfast.

The death of my brother and colleague Dr. Samuel P. Woodward (my best scientific adviser during the past eight years), has materially retarded my accustomed work ; I beg therefore to be allowed to speak of this as my first report only, and that I may be permitted next year to offer a more complete and detailed statement of my researches in this interesting group.

Report on the Theory of Numbers.—Part VI.   *By* H. J. Stephen Smith, *M.A., F.R.S., Savilian Professor of Geometry in the University of Oxford.*

124. *Application of the Theory of Elliptic Functions to Quadratic Forms. —The Theta Functions of Jacobi.*—It will be for the convenience of the reader to give in this place a brief statement of a few principles and results which belong to the theory of elliptic functions, and to which we shall have occasion to refer in the following articles.

The Theta functions of Jacobi are defined by the equation

$$\theta_{\mu,\nu}(x,\omega) = \sum_{m=-\infty}^{m=+\infty} (-1)^{m\nu} s^{i\pi\left[(2m+\mu)\frac{x}{a} + \frac{1}{4}(2m+\mu)^2\omega\right]},$$

or if $s^{i\pi\omega} = q$, by the equation

$$\theta_{\mu,\nu}(x,\omega) = \sum_{m=-\infty}^{m=\infty} (-1)^{m\nu} q^{\frac{1}{4}(2m+\mu)^2} s^{(2m+\mu)\frac{i\pi x}{a}}.$$

In these equations, μ and ν are given integral numbers; ω is an imaginary constant, having for the coefficient of i in its imaginary part a quantity different from zero and positive ; so that the analytical modulus of q is inferior to unity, and the series defining the Theta functions is convergent for all values of x real or imaginary ; lastly, a is a constant at present undetermined, but to which we shall hereafter assign a particular value depending on that of ω. When it is not necessary to specify the value of ω, we shall write $\theta_{\mu,\nu}(x)$, instead of $\theta_{\mu,\nu}(x,\omega)$. The following equations are immediate consequences of the definition of the Theta functions :

* See Oppel's Palaeontolog. Mittheilung. Munich, 1863.