

"scarcely recognizable" appearance of the crab *Hyas* when covered with algæ, &c. Indeed, no one who has seen one of these crabs brought up with the dredge, or has found a well-covered *Stenorhynchus* on our own shores, can seriously doubt the usefulness of the habit in rendering the animal inconspicuous. In *Stenorhynchus* and *Inachus* the process of "dressing" with weeds and zoophytes has been described by Bateson (Journ. Mar. Biol. Association, vol. i. 1889, p. 213), and it is seen from his description that, as also in the cases of *Dorippe*, *Pagurus*, *Dromia vulgaris*, &c., the foreign substances or animals become attached to the body not by accident but by the act of the crabs themselves.

Now Mr. Walker, in regarding all these cases as instances of adaptation for concealment, has overlooked the fact that in two of our British species of hermit crab (*Pagurus bernhardus* and *P. prideauxii*) it is the habit of the animals to prefer, and often to fight for, shells which are rendered conspicuous by the attachment to them of species of Anemone, in the one case *Adamsia rondelii* (*Sagartia parasitica*), in the other *Adamsia palliata*. Another British species (*Pagurus cuanensis*) is almost invariably found inhabiting a shell enveloped in the sponge *Suberites domuncula*, which is frequently of a conspicuous orange-red colour. Only in the smallest species of *Pagurus* (e.g., *P. levis*) does the animal depend invariably upon an inconspicuous appearance for its safety.

The value to the crabs of a preference for shells to which Actinians are attached is found in the fact that these gaily-coloured animals are carefully shunned by fishes on account of their stinging powers; and although hermit crabs themselves are very palatable to fishes, their association with Actinians, while rendering them conspicuous as they move about, is at the same time an efficient protection from the persecution of their enemies.

This also explains the habits of the two Mauritanian crabs, which, according to Möbius, carry about a sea-anemone in each claw.

The sponge with which *Pagurus cuanensis* is associated is (like all other sponges with which I have experimented) exceedingly obnoxious to fishes on account of its bad smell and taste. I have never succeeded in inducing a fish of any species to swallow a fragment of the sponge; but on the contrary the smell is in most cases quite sufficient to drive the fish away. The association with the sponge is therefore here also an efficient protection, for I know of no fish capable of extracting the crab from its retreat. It is seen from this that the case of *Dromia vulgaris* should probably be removed from the category of adaptations for concealment, and, like the cases of *P. bernhardus*, &c., be included in a special group of warning adaptations.

There yet remains the interesting case, adduced by Dr. R. von Lendenfeld, of *Dromia excavata* associated with a Compound Ascidian of the genus *Atopogaster* (Herdman). This, I believe, will be found to belong to the same category of warning adaptations, for after repeated experiments with Compound and other *Tunicata* at the Plymouth Laboratory I can state that these animals are essentially inedible to fishes. The inedibility is in large part due, as in the case of sponges, to the characteristic odour which *Tunicata*, and more especially Compound *Tunicata*, give out, and in no family (excepting perhaps the *Botryllide*) is this better marked than in the *Polyclinide*, the group to which *Atopogaster* belongs. Bearing in mind also the fact that Composite Ascidians frequently vie with sponges and Actinians in the possession of varied and conspicuous colours, it is rendered practically certain that the case of *Dromia excavata* is another instance of this same type of adventitious warning contrivances.

Thus the edible (the edibility is not yet proved for foreign species) *Crus accea* which attach foreign substances to their bodies may be divided into two groups:—

(a) Those which are rendered inconspicuous in relation to their natural surroundings by the habit; e.g., *Stenorhynchus*, *Hyas*, *Dorippe*, *Pagurus levis*, and young forms of *Pagurus bernhardus*, &c.

(b) Those which associate themselves with animals, easily recognizable by, and possessing qualities offensive to, their chief enemies; e.g., *Dromia vulgaris* and *excavata*, *Pagurus bernhardus*, *prideauxii*, and *cuanensis*. WALTER GARSTANG.

Laboratory of the Marine Biological Association,
Plymouth, February 21.

P.S.—From facts which Mr. Weldon and Mr. Harmer have communicated to me, it would appear that *Dromia vulgaris* frequently attaches Compound Ascidians (*Leptoclinium maculosum*,

Botrylloides Gasconia) to its back instead of sponges, a variation of habit which is very interesting in connection with the apparently fixed habit of the Australian species.—W. G.

A Key to the Royal Society Catalogue.

"A CATALOGUER" appears to have misunderstood me in two points. In the index that I propose, the heads would not be numbered. Again, in forming an estimate of the size of the work, I made the supposition that the 8 papers of an author could be grouped, not under 8, but under 3 heads.

JAMES C. MCCONNEL.

A Meteor.

LAST night (Monday, the 3rd), as I was crossing the Old Deer Park to Richmond, I witnessed the flight of an exceptionally fine meteor, which shone out with great brilliancy notwithstanding the presence of a bright moon, which was almost at the full.

It appeared to start from the constellation of Leo, and travelled across the sky to the westward, vanishing some 10° or 15° above the horizon.

The night was very quiet at the time, and I heard no report. T. W. BAKER.

Kew Observatory, Richmond, Surrey, March 4.

THE DISCOVERY OF COAL NEAR DOVER.

THE question of the existence of coal under the newer rocks of Southern England, which has engaged the attention of some of our leading geologists since the year 1855, has found its final answer in the discovery announced last week in the daily press. The story of the discovery is a striking example of the progress of a scientific idea, passing through various phases, and growing more clearly defined through opposition and failure, until ultimately it has been proved to be true, and likely to lead to industrial changes of national importance.

The question was originally started 35 years ago by Mr. Godwin-Austen in a memorable paper brought before the Geological Society of London, in which it was argued, from the character and arrangement of the coal-fields and associated rocks of Somersetshire and South Wales on the west, and of the Belgian and North French coal-fields on the east, that similar coal-fields lie buried beneath the newer strata of the intervening regions. Mr. Godwin-Austen pointed out that the general direction of the exposed coal-fields was ruled by a series of great east and west folds, running parallel to the great line of disturbance—"the axis of Artois,"—from the south of Ireland, through South Wales and Northern Somerset on the west, eastwards through Belgium and Northern France, into the valley of the Rhine, near Disseldorf. Throughout this area the exposed coal-fields lie in long east and west troughs. This series of folded Carboniferous and older rocks formed also an east and west ridge along the line of the axis of Artois, which gradually sank beneath the waves of the Triassic, Liassic, Oolitic, and Cretaceous seas. Against this the strata of the three first of these rocks gradually thin off, while the coal-measures and other rocks of the ridge have repeatedly been struck in France and Belgium, and are now being worked immediately underneath the Cretaceous strata over a wide area.

The axis of Artois also, where it is concealed by the newer rocks in the south of England, is marked from Somerset eastwards by the anticlinal of the chalk of North Wiltshire, and the line of the North Downs, the general law seeming to be "that when any great folding and dislocation of the earth's crust has taken place, each subsequent disturbance follows the very same lines, and that simply because they are lines of least resistance."

Mr. Godwin-Austen, by combining all these observations, finally concluded that there were coal-fields beneath the Oolitic and Cretaceous rocks of the south of England,