reezing temperature after entering the ground approaches by stages of quick or slow rates, in different parts, towards the supposed nearly even depth at last, if we might only presuppose that, because of the endless material obstruction to its motion in any horizontal direction, no channels for the earth's lateral expansion in freezing should subsist; but that in all places and in all conditions where the freezing happens, the only line of escape of the earth's increase of volume should be vertically upwards towards a direction where no insuperable forces are, at least, opposed to it.

Were this assumption of upward reliefs only of all of the expansions a really true and valid one, every vertical fibre of the wet earth's mass would behave in freezing quite independently of every other one, and would take up its fully expanded length at last, no matter at what times and in what order congealing overtook its individual portions. A stone, in this supposition, just embedded in the ground, would have its lower half lifted at last in its socket, and the upper half of the socket lifted off the stone (whether its thermal conductivity is great or small), to the height, in either case, of a water-column's change of length by freezing, whose initial height is but half the vertically measured thickness of the round embedded stone—that is to say, about one-eleventh of an inch for a stone 2 inches in diameter, instead of nearly half an inch, which was about the depth of the settlement, in some of the large-sized flint stones, which was actually observed.

To return to the reality, however, from this artificial supposition, the actual course of the expansions, and the effects produced by the freezing dilatations must, no doubt, be very different. Supposing that the flint-stones, by their good thermal conductivities, soon become covered with a thickening coat of frozen earth, flow of the soft, unfrozen earth between them will really spring up and be maintained by direct outward expansions from the stones of the icy coats surrounding them. On account of the firm rigidity of the exposed earth-surface, to which the stones themselves must soon become fast fixed, the resultant flow of soft earth from between the stones, instead of finding an upward path the easiest, will rather choose a vertically downward one for its escape from its confinement, and lift the stones and icy covering together, rather than seek by an upward course to break through the latter. Yet this last effect may also perhaps occur to some extent, raising the frozen earth-caps in some measure off the stones' upper sides, and stretching them, it may be, a little upwards, so as to leave between them and the stones clear empty spaces. That this last effect must be only a secondary and inconspicuous one, however, seems to be pretty obvious from this passingly essayed, and as it now appears all too uselessly pursued and desultory *aperçu* of the frost's real mode and process of expansive action.

Regarding the peculiar structures, in fact, altogether from another point of view, and rejecting the imperfect explanation which any one of these presumed congelation processes might at first have been supposed to furnish, of the curiously sunken-looking assemblages of the wayside pebbles, an exactly opposite interpretation of their semi-interred condition seems, perhaps, indeed, to afford a more satisfactory and likely explanation of it, than the expansive effects of frost in the moist earth were ascertained and shown to have any capabilities and physical resources for. The warmth of the sun, or of wind and rain in some thawing daytime temperature of the generally frosty week, may in short be supposed (which the weather-table of the week, on the 26th and 27th ult. confirms) quite plainly and certainly enough, in consequence of the flints' good thermal conductivities, to have melted and shrunk again to its natural dimensions the hard frozen earth under them, without lowering the level equally of the badly conducting frozen earth surrounding them. Alternate days of thaw and nights of frost would, by progressive stages which can be easily traced out and understood, tend quite naturally to exaggerate this difference. Thus in another way, but complementary to and at returning times just fitly supplemented by that first supposed, the problem which the winter scene presented is, still more simply and clearly than before, seen to be solved quite truly and correctly by the relatively high thermal conductivity of the rounded flints as compared with that of the hard frozen earth in which they are enveloped.

This gradual subsidence, therefore, of flint stones during alternate frosts and thaws, into frozen earth, by consolidation and lateral expansion, followed by liquefaction and vertical contraction of the water in the earth beneath them, is, it would seem that we may reckon it accordingly, a phenomenon on land

just analogous and similar to the familiar thermal process which small stones scattered on a smooth frozen glacier-field display in summer-time, by intercepting the heat of the sun's rays, and by sinking to the bottom of the deep water-holes which they thus scoop and delve out for themselves, wherever they happen to have found a lodgment in the naked ice.

A. S. HERSCHEL.

Observatory House, Slough, December 9.

Foreign Substances attached to Crabs.

AT the last meeting of the Linnean Society I exhibited a number of crabs and certain shells of the genus *Phorus* having various foreign substances attached to them, about which it is desirable that more should be known. Some of the crabs manage to fasten bits of sea-weed to the hairs on the carapace and legs; *Polyzoa*, *Balani*, *Serpulæ*, &c., in their earlier stages fasten themselves on others; a crab of the Indian Seas—*Camposcia retusa*—is sometimes completely covered on every part with sand, small shells, and bits of sea-weed—*Corallina* chiefly. These could only be attached by some adhesive matter, but whence derived? *Dromia vulgaris* is occasionally found with a sponge extending over the carapace and almost completely hiding the animal. The species of this genus have the two hinder pairs of legs much reduced, flattened, and lying close to the back, and this is assumed to be an adaptation for the purpose of retaining the sponge. Out of a number of specimens dredged in the Bay of Naples, I recollect only getting one with a sponge on it, and that very soon shrivelled up, leaving a leathery-looking substance attached to the base of the carapace, not held by the legs apparently.¹ Two crabs—*Ethusa mascaroni* and *Dorippe lanata*—having similarly reduced hind-legs, but directed upwards, seem much better adapted for retaining a foreign substance, which, however, they are not known to do. In a Mauritanian crab—*Dynomene hispida*—the hind pair only are reduced, but to such an extent as to be merely rudimentary and incapable of any use. *Paramithrax barbatus*—a New Zealand crab—has, like some others, hooked hairs, but in the specimen exhibited they appear to be free of any foreign substances, although many small fragments of an uncertain nature appear between them.

In *Phorus* a strong cement only could hold on those large and heavy substances—shells, stones, &c.—completely covering the shell, as in *P. agglutinans*. I have not seen any account of their *modus operandi*, but, as the animals have a long proboscis, it is possible that that may be the organ employed, but it is difficult to believe that it would be able to lift any large substance, or that it could reach the top of the shell. Another difficulty is that they must cast off, from time to time as they grow, the smaller substances, to replace them by larger ones. There is one *Phorus*, however—*P. calyculatus*—in which small shells imbed themselves at short intervals along the whorls, leaving the greater part of the shell uncovered; these little cup-shaped depressions are marked inside, as far as the mouth of the shell will permit them to be seen, by corresponding protuberances. This would seem to indicate a certain softening of the shell at one time or other.

I do not see where protection comes in, in any of these cases.

December 14.

FRANCIS P. PASCOE.

A Marine Millipede.

IN the hopes of arousing the interest and the energies of British entomological collectors, "D. W. T.," in a short notice on p. 104 of the present volume of *NATURE*, draws attention to the recent discovery in Jersey, by Mr. Sinel, of that remarkable marine centipede *Geophilus* (*Schendyla*) *submarinus* (not *submaritimus* by the way), of Grube.

Those who observed this notice, and are interested in the fauna of Great Britain, may be glad to hear in addition that more than twenty years ago a number of specimens of this then undescribed species were taken by Mr. Laughlin at Polperro on the south coast of Cornwall. These specimens, which were presented to the British Museum in 1868, were found associated with *Linotenia maritima* (Leach)—also a marine centipede—

¹ Bell, in his "British Crustacea" (p. 371), states having received "numerous young specimens from Sicily, every one of which had the carapace entirely covered with a sponge, which had grown over it, concealing even the two hinder pairs of legs, which were closely placed against the back, and rendered immovable." No mention is made of a sponge on those that came from the Channel.