

to their next investigator, for whose benefit also the most elaborate system of general and special indexes is provided. The history of actinological progress is critically exposed, and even the humblest species-maker scrupulously receives his tiny share of immortality, while the veriest trifles of etymology, popular nomenclature, or culinary use, are not forgotten.

Far more important, however, is the clear schematic account of actinian anatomy, with a recast morphological nomenclature, and thereupon follows the plan of the monograph, where our author briefly outlines the general view of biology and of the relations of its sub-sciences which dominate the work. This agrees largely with that usually adopted in this country (cf. Prof. Huxley's article, "Biology," in the "Encyclopædia Britannica"), but differs from it in some important respects, notably in the separation of taxonomy into *Specigrafia* and *Sistemática*. Next follows a keen re-discussion of the conception of *species*, and the limits of *genus* and *variety*. The last he proposes admitting as a rule, and then by giving variety an analytic and genus a synthetic aim, and making both changeable as systematists find expedient, he hopes to keep the conception of species near a more constant average. After some useful remarks on nomenclature, the systematic detail is entered upon, and the known species (520 or more), with their endless varieties, described with exquisite minuteness. Numerous diagrams aid the work of identification, and the volume concludes with thirteen magnificent plates, which reflect the greatest credit alike upon the author's pencil and the care of his lithographers, Messrs. Werner and Winter. The classification differs so much from existing ones as almost to be new. Two new families, *Edwardsiinae* and *Stichodactylinae*, are created; the *Ilyanthidae* are almost abolished, the *Minyadinae* wholly so.

If space permitted, one or two trifling criticisms might be offered, if only to accent the general praise; yet it is better to welcome the book unreservedly as a new sign of the scientific *renaissance* of Italy, and its author as henceforth one of its leaders, who has learned philosophic breadth from the "Origin of Species" without losing the detailed accuracy of the "Monograph of the Cirripedia."

A word finally as to the splendid series of monographs to which this belongs, and which, together with the *Challenger* volumes, mark an epoch in biology. Is it not lamentable that such works—which, if not yet indeed, in time-honoured phrase, "books which no gentleman's library should be without," are certainly needed in every public library, and which even no local natural history society can afford to be without—should be limited to an impression of, after all, only a few hundred copies by the apathy or ignorance of the scientific public? P. G.

THE EARTHQUAKE IN SPAIN

AN earthquake of wide extent and unusual violence took place on Christmas night in the southern provinces of Spain and in the neighbourhood of Madrid. The accompanying map may give some idea of its extent. As many of the towns and villages of Granada, Malaga, and Andalusia are unconnected with the capital by telegraph, the full extent of the damage is not yet known, but enough information has been received to mark the present as among the most destructive earthquakes of recent years. No precise observations as to time or direction have yet reached this country; and the officials at the Madrid Meteorological Observatory are reported to have made no observations at all, for there were no funds to purchase instruments for such a purpose. Madrid itself was within the disturbed area, but it was probably on its extreme north edge, for the effects of the shocks there were slight, and were confined to the rattling of windows, the ringing of bells, and the like. But in the three southern provinces the destruction was great and wide-

spread, involving in many cases considerable loss of life. There were several shocks, overthrowing whole villages and burying the inhabitants in the ruins. In Arenas del Rey 40 persons were killed, in Albuqueros 150, in Olivar 10, and in Cajar 12, and similar numbers in many of the towns and villages of the three provinces. The number of killed on the whole is put down in Madrid, from the reports of the local officials, at more than 1000. Even in large cities such as Granada, Malaga, Jaen, and Seville great damage was done, and much excitement prevailed. The inhabitants encamped in the open air through fear of fresh shocks. At Granada the front of the Cathedral was seriously injured, but the Alhambra was untouched. There is much discrepancy in the reports as to the duration of the earthquake: some village authorities have reported ten distinct shocks, while in other cases it is stated that there were seismic disturbances intermittently on the 26th, 27th, and 28th, the three days succeeding the great earthquake. This is especially reported from Jaen, where there should be ample means of corroborating the statement. At Cadiz a panic occurred in the theatre; in Malaga the Cervantes Theatre was much injured. It is noticeable that a sharp fall of the barometer was noticed all over the south of



Spain in the afternoon before the earthquake, and that there have since been frequent fluctuations. There is some doubt whether the number of persons who have lost their lives will not far exceed a thousand, inasmuch as the reports, as they grow more detailed, instead of diminishing, largely increase the original estimates. At Periana, in Malaga, a landslip on a mountain in the neighbourhood destroyed a church and 750 houses, from the ruins of which the dead and injured were being taken: similarly at Loja half the houses were overwhelmed. The town of Alhama in Andalusia is reported to have been completely destroyed, with 300 persons. A report is published with regard to Albuñuelas, stating that 900 persons are believed to have been killed under the houses thrown down by the earthquake. This would be about one-half the population of the town. At Antequera the shocks have left three churches in a dangerous condition, and the inhabitants are camping in the fields; the Cathedral at Seville, especially the Giralda tower, is much damaged; at Granada the richer classes are living in their carriages, which are stationed on the public promenade; the others camp out in the squares and open spaces; at Cordova the inhabitants are flying from the town. The loss in the town of Malaga is put down at 100,000*l.*, 227 buildings being injured. It would appear that five distinct shocks took place in this town on Christmas night, and three on the following morning. Five shocks on Friday and

Saturday are reported from Antequera, and nine from Archidona. That the disturbance has not yet ceased is shown by the report from Torrox that the shocks were renewed there on the morning of the 29th, shaking the foundation of the Town Hall, and causing cracks in the walls of other houses; while other violent shocks are reported from Malaga and Granada on the evening of the 30th, one at 7 and the other at 10 o'clock. In connection with these after-shocks, a report from Tarvis, in Carinthia, states that an earthquake was felt there on Sunday, which by the oscillation it caused cracked the walls of many houses. The Spanish earthquake was not felt in the north and north-western provinces. No precise information as to the times of the shocks at the various places has been received. At Xerez and Cadiz, according to one account, the first smart shocks occurred shortly before 9 o'clock, and other slighter shocks about midnight and 4 o'clock the next morning. At Ciudad Real no damage appears to have been done, beyond the alarm to the inhabitants, who passed the night in the open, fearing a recurrence of the shocks. At Velez Malaga and Malaga proper several shocks injured the theatre and the churches, the falling masonry killing several persons. The clocks are stated to have stopped in various parts of Andalusia at from ten to seven minutes before nine, which may therefore be taken as the time of the first shock.

We have received the following correspondence on the subject of the earthquake:—

YESTERDAY, 25th, at 8h. 53m. p.m., slight earthquake in Madrid: two distinct shocks in 3 to 5 seconds; house bells set ringing and lamps and other suspended objects swinging; the oscillations were almost due east and west, which gives north and south as the direction (rough) of seismic disturbance. This was evidently stronger in some parts of the town than others, as out here it produced no effect outside, whereas according to this morning's paper much alarm was produced in some streets by people rushing out of their houses. But earthquakes are very uncommon in Madrid, and this accounts sufficiently for the scare. There really was no particular cause for alarm. Official telegrams report shocks felt at about the same time in Cadiz, Malaga, Granada, and Cordova.

F. GILLMAN

Quintana, 26, Madrid, December 26, 1884

I HAVE reason to believe that this commotion extended to England. On the night of December 25 I left my family quietly seated round the fire at 10 o'clock. Being in bed myself at about 10.20, I perceptibly felt a shock of earthquake such as I have often experienced in the vicinity of Naples, and I said to my wife, who came up shortly afterwards, "I have felt a distant shock of earthquake, if there is nothing moving downstairs," which from the distance of the offices there certainly was not. The motion, we learn, was from south to north, and the usual rate of movement corresponds well with the time of the occurrence—say 6 minutes to 9 at Madrid.

The Rookery, Ramsbury, Wilts ALFRED BATSON

THE HABITS OF THE LIMPET

THE following observations upon the habits of the common limpet (*Patella vulgata*) were made during last July at the Scottish Marine Station, Granton, Edinburgh. I am much indebted to Mr. John Murray, the manager of the Station, for kindly placing its resources at my disposal, and also to Mr. J. T. Cunningham, B.A., the director, for much kind advice and assistance.

The *Ark* is moored in the centre of a flooded quarry, upon whose faces large numbers of limpets are to be found. As parts of these faces are almost or quite vertical, it was easy to take a boat round and make observations during all states of the tide. The few that were

made bear on the feeding and locality-sense of the form in question.

By far the larger number of limpets "roost" upon rocks whose only covering consists of minute green algæ and nullipores, together with numerous acorn barnacles. These last are seen to be of very unequal degrees of "cleanness," some being covered with vegetable growth, others quite white and bare. Those immediately surrounding a limpet or group of limpets are invariably free from algæ. As might have been anticipated, *Patella* is the cause of this freedom. At low tide anyone on the look-out can hear a quick, regular, rasping sound in all directions, and see numerous limpets slowly crawling about. Scrutiny of any particular individual shows that the rasping noise is caused by strokes of the radula, which speedily scrapes away the incrusting algæ. Whilst "on the feed" a limpet moves steadily on, pretty much in a straight line, and continually sweeps its elongated snout from side to side, feeling out probably suitable patches whereon to graze. When such a one is discovered, it is gradually licked quite clean. If the patch happens to be the surface of a moderate-sized barnacle, the circular lip is completely spread over it, almost tempting one to believe that the crustacean is about to be "sawn out." Such, however, is not the case, "house-cleaning" being the sole end in view. Indeed, limpets are often serviceable to one another by thus clearing away esculents growing upon their shells. To secure a dinner, a good deal of licking is requisite, and perhaps this habit may help to account for the inordinate length of the tongue-ribbon. Certainly it must be used up at a very great rate.

But this is not the only, though I believe the chief, way in which the limpet feeds. Those individuals which live near large sea-weeds, such as *Fucus*, feed extensively upon them, as their gnawed condition testifies. I can speak confidently in this matter, having caught more than one limpet in the act. The operation was as follows:—The edge of a thick flat part of the thallus was seized by the lip (as a traveller might commence on a colossal sandwich), and being, I suppose, held firmly by the upper jaw, a semicircular "bite" was gradually excavated by successive scrapes of the radula, the edges of the bite being bevelled on the under side. So far as my observations extended, limpets do not feed when covered by water, but always settle down firmly before the rising tide reaches them. The intervals between which any particular limpet feeds seem to be very irregular; but, as a rule, the largest limpets are apparently least fond of long fasts.

In regard to the second point, the locality-sense, great doubt seems to exist in the minds of naturalists as to whether limpets go back to the same place to roost. I believe the question was answered in the affirmative long since by a Mr. King, but, as far as is known to me, he did not publish any details of his observations, and this is my excuse for giving an outline of mine. Following a suggestion of Mr. Murray, I marked a number of limpets with white paint, and made corresponding marks near their "scars" with a view to "keeping my eye on them." As Dr. S. P. Woodward remarks, it seems probable from an *a priori* point of view, that limpets have a settled home, for they occupy scars, often sunk to a considerable depth, which *exactly* correspond to the outline of the shell. My observations, made on numerous specimens of various sizes, completely confirm Mr. King's opinion, and the method of marking rendered cases of "mistaken identity" quite out of the question. The greatest distance from its scar at which I noticed a marked limpet to be, was about three feet; yet this distance, though extremely rough, and covered with barnacles, was re-traversed without difficulty. The excursions from the roosting-places were made in any direction where food offered; so there were nothing like beaten tracks formed. But a limpet always returns home before the rising tide reaches it, and invariably