

ment which detracts very much from the credit of photo-micrography. Dr. Klein says:—"In connexion with this it must certainly appear remarkable that in the numerous and important publications on Bacteria by Koch and his pupils since 1877 to the present time we do not find a single illustration represented by micro-photography. All their published illustrations are drawings."

In addition to the works I have quoted (viz. Koch, "Mitth. aus d. K. Gesundheitsamt," Band 1, 1881, illustrated with an extensive series of photographs; Hauser, "Ueber Faulnissbakterien," 1885, illustrated with an elaborately reproduced series; Van Ermengem, "Recherches sur le Microbe du Cholera," 1885, illustrated very successfully with twenty photographs), there are, since my work was published, Riedel, "Die Cholera," 1887, illustrated with most beautifully reproduced plates from negatives of comma-bacilli taken by Plagge and by Koch; "Zeitschrift für Hygiene," Zweiter Band, May 1887, two publications, illustrated with a series of photographs by the assistants at Koch's laboratory; Löffler, "Vorlesungen über Bakterien," May 1887, illustrated with reproductions from Koch's negatives.

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THE LANDSLIP AT ZUG.

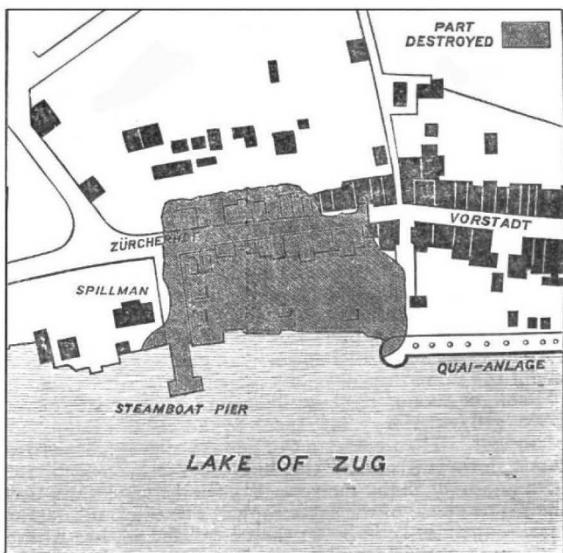
TO judge by the glimpses which I obtained of English newspapers during my late visit to the Alps, considerable misapprehension has prevailed in this country as to the nature of the disastrous landslip at Zug. For instance, one of the most important journals had a leading article on the subject, describing learnedly the fall of the Rossberg, the destruction of Flurs, and other like Alpine instances, with which the late calamity has no more connexion than the slipping of a piece of the Thames Embankment into the river would have with the fall of a peak of Snowdon. Hence, as I had the opportunity a short time since of visiting Zug, and in company with my fellow-traveller, the Rev. E. Hill, forming an opinion as to the cause of the accident, it may be worth while to give a few details. In drawing up this account I have used the abstract of a report by Prof. Heim, which takes the view which I had already adopted from examination of the locality, and has supplied me with a number of important details.

The newer part of the town of Zug stands on a plain which extends back from the lake to a considerable distance inland. Generally almost level, this at last shelves gently down, falling perhaps a dozen feet in the last hundred yards. The older part of the town occupies slightly rising ground between the water and hills which in England we should call mountains. Both parts, however, are not founded upon the rock, but upon a detrital deposit. Where are now the streets of Zug was once the lake: the streams from the adjoining hills have encroached upon its waters, and the town stands upon the delta which they have formed: the older upon the coarser more pebbly material, the newer upon the finer and sandy, where, in prehistoric times, the piles of lake-dwellings were driven.

A few years since the people of Zug thought to improve and beautify their town by building an esplanade in the place of the old irregular shore of the lake. It is faced by a wall of solid granite, which rests on a foundation of concrete, supported by piles. Outside this the water deepens rather rapidly: still no great depth is reached. Twenty metres from the edge of the quay it is 9 metres; at a distance of 100 metres it does not exceed 20, and even at a distance of 800 metres from the shore has only attained 45. The portion of the quay completed at the beginning of the present summer terminated for a time with a sort of bastion; north of that the piles had been driven for some distance, but no masonry had been laid. Rather more than 100 yards in this direction from the end of the new wall was a steam-boat pier, constructed as usual of wood.

Twice already in its history has Zug been the scene of disastrous landslips, once in the year 1435, and again in 1594; so that some few months back, when formidable cracks and indications of settlement began to appear in the new quay wall, considerable anxiety was aroused. Prof. Heim, among others, was consulted, and was not able, as a geologist, to offer much consolation, for he could only say that the foundation on which the whole place rested was, as will be seen, naturally defective. Still, as things had on the whole held together in the past, so, after this protest on the part of Nature, they might continue in the future. Certain remedial measures were suggested, and a careful watch was kept upon the new structures.

The catastrophe, however, occurred without further warning on July 5. Suddenly, about four o'clock in the afternoon, a large piece of land, occupied by houses and gardens, between the bastion and the steam-boat pier, seemed to break up, descend almost vertically, and become engulfed in the lake. It was a scene of wild and awful confusion, unhappily not unaccompanied by loss of life. A steam-boat had just come up to the pier: the waves broke the hawser and drove the vessel more than a hundred yards back into the lake. Here, however, all



escaped unhurt, but the occupant of a small boat was upset and drowned, and the landlord of an adjoining restaurant, who had gone from his garden with some guests to see what was happening (for the ground seems to have gone in a series of quickly successive slips, not in one single fall), when the earth cracked beneath his feet, sprang in the wrong direction and was engulfed in the muddy whirlpool. Three children also perished in one of the fallen houses.

Again about seven o'clock another and a larger slip took place; the destruction of property was greater, but this time without loss of life, for the people had taken the alarm and evacuated the houses. The dust from this ruin rose like a cloud, and was seen from the Rigi. Since then there has been no further slip; indeed, as we read, no further movement; for the cracks in neighbouring walls have been sealed up in many places, so that even a slight settlement could readily be detected.

The result of the landslip is as follows. A few months since there was a street in Zug running roughly parallel with

the shore, terminated by a road leading to the steam-boat pier, and at the end, on the land side, was a good-sized hotel, while between the shed and the lake were gardens with cottages and other buildings. Where once were houses and gardens there is now a kind of bay of the lake. It is as though a pit had been excavated parallel with the shore, which, about 120 metres wide at the water-side, extends inland from 60 to 80 metres, widening as it does so on the eastern side to about 150 metres. This "harbour" is bounded by a low cliff, which rises gradually from a little above the water's edge to a height of about four yards; the surface, however, instead of being occupied by vessels, is a scene of the wildest confusion: slabs of pavement here, a pile of bricks there, the broken framework of a roof with its displaced tiles, a group of beams, some trees yet living, in one place the wooded gable of a house, project from the surface of the water, which is covered thick with timber and floating debris. A sadder scene of ruin it would be difficult to imagine. On the land side, part of the pavement of the street yet crests the little cliff, displaced near its edge by a series of vertical faults, with a throw of a few inches. Below, large slabs, with the squared blocks still in contact, lie at various angles on a slope of rubbish which just rises above the water. Houses, cracked and shattered, with their fronts in some cases partially fallen, look down on the scene of ruin, and not a few more in the neighbourhood are so injured that they will have to be rebuilt. It is stated that thirty-eight buildings were destroyed in the actual landslip, of which twenty-five were inhabited houses.

The cause of the landslip is made obvious by examination of the sections which the broken ground affords. That beneath the broken street will serve as an example. Under the pavement for about a yard is a stony deposit, the upper part probably made ground, the lower resembling a coarse gravel. As is natural, it is difficult to decide where undisturbed ground begins: it is enough to call the whole a stony soil, many of the fragments being from the size of the fist to nearly as big as the head. Probably, however, the lowest foot has been little disturbed. Then comes about fifteen or eighteen inches of a well-stratified gravel—rather iron-stained, the pebbles not exceeding a couple of inches in diameter; under this is about the same thickness of a rather peaty silt—either an old soil, or part of the lake floor, on which aquatic plants have grown; for what seem to be dead rootlets are abundant. Then comes a thick mass of gray silt. It extends downwards below the level of the lake—probably to a depth of many metres. This it is which has been the prime cause of the catastrophe. The thick substratum of silt, at times little better than a quicksand, has always formed an unsafe foundation. Too heavy a load, either locally by building too large a house, or generally by building many smaller dwellings, any weakening of the cohesion of the mass, exceptional seasons,¹ may at any time suffice to pull the trigger of a weapon which, so to say, is always charged. It is doubtful whether this part of the town can ever be regarded as absolutely safe: at the same time there have been but three slips in four centuries and a half, and no doubt precautions will be taken to reduce the danger to a minimum. It is possible that the building of the esplanade has been the immediate cause. Prof. Heim, however, does not so regard it, though I cannot say that his arguments entirely satisfied me. However, this is certain, that of the completed building only a few feet were damaged; the frontage which slipped was that into which piles alone had been driven.

The most remarkable thing about the slip is that the displacement has been nearly vertical. There has been but little outward lateral movement of the ruined build-

ings. As Prof. Heim words it in the above-named report, "Ground which formerly was from 6 to 2 metres above the water is now from 2 to 6 metres below it." The silty substratum must have flowed outwards into the deeper water, or in some way been displaced laterally to allow of the surface thus sinking. In accordance with this it is stated that the piles driven for the new wall—which were fixed in the silt alone—were thrust outwards for distances of from 100 to 300 metres from the shore, and were pushed up above the level of the water. The catastrophe, then, cannot be numbered with the bergfalls, or even with the ordinary landslips, though perhaps an analogy may be established with some sea-side slipping of cliffs; but it is none the less lamentable, for, in addition to five deaths, many families have lost their all—goods, house, and even the site itself being destroyed; and great additional expenditure will be required before the neighbourhood can be regarded as safe.

T. G. BONNEY.

THE NORWEGIAN NORTH ATLANTIC EXPEDITION.

NO T surpassed by the records of the Austrian Novara Reise, nor by those of our own Challenger Expedition, is the account of the Norwegian Expedition to the North Atlantic, the latest part of which is a Report on the Alcyonida, by D. C. Danielssen. Like the other parts of this Report the present forms a quarto or rather small folio volume, and contains over 160 pages of text with 23 plates and a map giving the details of the geographical distribution.

The author was one of the staff on board the *Varingen*, and he now has the pleasure of describing the specimens collected, but he has not had the assistance of that excellent zoologist (Koren) whose able work on the Alcyonidae of Norway had been executed in partnership with Danielssen, and whose death all those interested in natural science have to deplore.

The Alcyonidae collected during the Norwegian Expedition are almost exclusively deep-sea forms; the depths varying from 38 to 1760 English fathoms. Among them there are no less than nine new genera, which all belong to the sub-family of the Alcyoniinae, with 33 new species, of which two belong to Clavularia, one to Sympodium, one to Nidalia, and the rest to the several new genera. There is also a new sub-family with a new genus and species described.

The author says quite truly, that, of all the large groups of the Alcyonaria, none have been treated more superficially by recent zoologists than that of the Alcyonidae. No doubt there are many reasons for this; the delicacy of their structure, combined with the difficulties of their preservation in a state for minute investigation, has to some extent made their study a difficult one; and even the repeated endeavours of Mr. Danielssen to observe them in a recent state were unsuccessful. In regard to classification, the author for the moment follows that of Milne Edwards; in this we think he is correct, and we thoroughly agree with his reasons; for until the present material in the museums of Europe and America has been properly worked out, and much fresh material has been collected, any attempt to give a definite classification of the group will be so much lost labour.

In the diagnosis of the genera and species, especially of the latter, the form of the spicules, as well as their arrangement and position on the polyps, have been found of great value, though minuter histological details have not been used as much as they possibly will be in the near future. One very important and interesting fact is mentioned, viz. the discovery in a species of a new genus *Vceringia* of a nervous system. On the uppermost part

¹ It is stated that the weather changed on the evening of July 5; storms and rain succeeding to a long period of dry weather. At the time the "ground water" beneath the town was rather above, the lake rather below, its usual level.