

Trusting that these proposals will meet with the approval of your council,

I am, dear sir,
Yours faithfully and obediently,
(Signed) P. L. SCLATER,
Secretary.

January 21, 1893

(COPY.)

From the Geological Society, Burlington House, W.

DEAR SIR.—Your communication, dated January 21, 1893, was this day submitted to the council of the Geological Society, and I was asked by the council to inform you that they regretted that they were unable, in the present state of the Society's income, to recommend to the Fellows of the Geological Society an increase of expenditure such as would be necessitated by acceding to your request that a grant of one hundred pounds should be made to aid the publication of the *Zoological Record*.

Whilst regretting their inability to comply with your request, the council thank you for the conditional offer which accompanied it.

I am, dear sir,
Yours faithfully and obediently,
(Signed) JOHN E. MARR,
Secretary.

February 22, 1893.

The Proposed Continuous Polar Exploration.

YOUR excellent summary of the proposed continuous Polar exploration (November 2, p. 18) conveys a wrong impression in its closing sentence. The system may in the future assume large proportions; but the *beginning*, to be made next year, *will be very small*. It will consist merely in the establishment of the principal station at the south-east angle of Ellesmere Land, and 80 days' exploration along the west coast of that land. At most, an advanced depôt, erected some 100 miles farther west, may be so fitted out as to serve at once as a secondary station. It is not easy to see why this work should be postponed till Peary and Nansen have returned. Their fields are far from ours, and their results can shed no light on the area west of Ellesmere Land. As well might you say that the exploration of the Mediterranean should not be begun until that of the Baltic was completed.

As you say, the possibility of continuous Polar exploration is not demonstrated. There can be no doubt, however, of the value of a permanent station at the entrance of Jones Sound, nor of the practicability of its maintenance, so long as the whalers continue to visit that region. How far exploration may be carried with that station as a base, it is impossible to foretell, but at any rate the existence of a secure base will be an advantage possessed by no previous expedition in that direction, and, in the words of the "Encyclopædia Britannica," will "make disaster on a large scale, humanly speaking, impossible."

U.S. Geological Survey.

ROBERT STEIN.

On the Classification of the Tracheate Arthropoda.— A Correction.

IN No. 423 of the *Zoologische Anzeiger* (1893) I ventured to propose a new classification of the Tracheata, including under this heading those Arthropoda that are usually known as myriopods and insects. The principal changes suggested were the abolition of the name Myriopoda as indicating an unnatural assemblage of beings and the union of the *Chilopoda*, *Symphyla*, and *Hexapoda* in a division (Opisthogoneata), which was based upon the situation of the generative apertures at the hinder end of the body. But in referring the *Symphyla* to this category by adopting the assertions of Menge and Latzel respecting the position of the orifices in question, it appears that I fell into error; for Dr. Erich Haase has kindly written to me from Bangkok, with the information that by means of a series of transverse sections he was able, although with considerable difficulty, to confirm Grassi's statement to the effect that the generative apertures in *Scolopendrella* are situated upon the fourth body-segment. This genus is therefore progoneate, like the *Diplopoda* and *Pauropoda*; but whether it should be ranged with these two classes, or occupy an independent position between the Progoneata and Opisthogoneata, is a question for future discussion.

R. I. POCKOCK.

THE LOSS OF H.M.S. "VICTORIA."¹

II.

WE dealt last week with the circumstances relating to the loss of H.M.S. *Victoria*, and the causes of her sinking with such startling rapidity after she was rammed. The facts, so far as they are known, are fully and, in our opinion, fairly summarised by Mr. W. H. White, in No. 3 of the Admiralty Minutes, just issued; and Mr. White demonstrates clearly, from the results of calculations made in the Construction Department of the Admiralty, that the movements and behaviour of the ship after the accident, and the observed effects upon her line of flotation and her stability, are precisely what would be caused by the entry of water into the compartments at the fore end of the ship, which are known, or believed, to have been filled before she foundered. These calculations serve, therefore, the useful purpose of showing that the water known to have entered those forward compartments that were proved, by evidence given before the Court Martial, to be filled, was quite sufficient to account for the subsequent capsizing and sinking of the ship; and for the capsizing and sinking to happen exactly in the manner that was observed. This is so, as already stated, whether Mr. White be absolutely right or not with regard to the precise state of each separate compartment after the damage; as the evidence is sufficiently conclusive, upon the whole, respecting the various compartments, to reduce the probability of error to a very small amount, such as would not materially affect the practical results of the demonstration.

The Admiralty calculations thus remove all reasonable doubt as to whether the compartments known to have been filled were sufficient in themselves to account for the final disaster; and they make it unnecessary, in order to explain what happened, to speculate as to the probability of the collision having been more far-reaching in its effects upon the structure, or internal arrangements, of the ship than the evidence indicates. The evidence, as it stands, is shown to completely account for the facts; and to furnish a solid basis for investigation, or argument, as to the lessons that may now be learned from the loss of the *Victoria*.

The Lords Commissioners of the Admiralty, in the first of the three Minutes lately issued, dated October 28 last, on the finding of the Court Martial, stated that the question of closing the water-tight doors of the *Victoria*, and the construction and stability of the ship, would be dealt with separately. Their lordships accordingly issued the second Minute, dated October 30. This Minute states that, in consequence of the Court Martial finding "that it does not feel itself called upon, nor does it feel itself competent, to express an opinion as to the causes of the capsizing of the *Victoria*," their lordships instructed the Director of Naval Construction to make a thorough examination and analysis of those parts of the evidence which throw light on these points. The report prepared by Mr. White, in accordance with these instructions—No. 3 of the present Minutes—was dealt with in our article of last week; but we then left over for subsequent consideration the references made in the Minutes to the lessons taught by the various circumstances of the case.

These points being dealt with authoritatively in the second Admiralty Minute, dated October 30, we shall deal principally with that Minute in the following remarks. It commences by adopting the figures and the conclusions stated in Mr. White's report with regard to the nature of the blow received by the *Victoria*, the after movements and behaviour of the ship, the extent to which water found access into her, and the effect of such water upon her flotation and stability. We have nothing

¹ Continued from p. 103.

further to say upon the subjects dealt with in this portion of the Minute, which appears to accord with the evidence, and also with the known effects that would be produced by filling the compartments that were opened up directly to the sea, or into which water could pass freely through open doors, hatches, &c.

The Admiralty Minute next expresses the opinions of the Board upon the following points; and we will take these in the order named in the concluding paragraph of our former article: (1) The effect of longitudinal bulkheads upon the capsizing of the ship; (2) what would probably have happened if the doors and ports in the upper-deck battery had been closed; (3) what would probably have happened if all doors, hatches, &c. had been closed before the collision took place; (4) the efficiency of the water-tight doors to the bulkheads, and the means of closing them quickly; (5) the value of an armour belt at the ends for resisting damage; (6) the sufficiency of the stability possessed by the ship; and (7) the steps that should be taken "to prevent the recurrence, under similar circumstances, of the conditions which, after the collision, resulted in the loss of the ship."

1. *The effect of longitudinal bulkheads upon the capsizing of the ship.*—Mr. White points out that there was no continuous central longitudinal bulkhead in the *Victoria*. In the stokeholds and engine-room there were two such bulkheads on opposite sides of, and each several feet from, the centre line; but these were far abaft the damaged portion of the hull, and do not appear to have been reached by water that entered the ship up to the moment of sinking. There were a few longitudinal partitions in the fore part of the ship; but some of these were inoperative because of damage or open doors. The effect of filling the compartments formed by these longitudinal partitions has been calculated, and it is stated that this would only cause an inclination of about 5° in the intact condition of the ship. This result does not, however, bear directly upon the actual effect produced in such circumstances as are being considered, because the damage caused by collision not only admitted water into the ship, but it reduced, at the same time, her power to withstand the heeling effect of the excentric compartments that were thereby filled. The ship would only have heeled about 5° with these compartments filled, if the hull had been uninjured; but if the hull had been uninjured, the compartments would, of course, not have been filled. Mr. White goes on to say: "It appears on investigation that in the damaged condition and at the extreme position which the *Victoria* occupied before the lurch began, the flooding of the compartments enumerated, and the accumulation of water on the starboard side, account for the observed angle of heel, 18 to 20 degrees." This inclination—which is what was really due, in the circumstances, to water being held over to starboard by the longitudinal partition above referred to; as the accumulation of other water to starboard was merely the consequence of the heeling thus caused—must have allowed the sea to enter the ports and door of the upper deck battery sooner than it otherwise would have done, and thus have hastened the capsizing of the ship. The Admiralty Minute states that "the evidence clearly shows that the existence of longitudinal water-tight bulkheads in the *Victoria* was not the cause of her capsizing. There were only a few minor longitudinal partitions in the fore part of the ship. Many of these were inoperative because of damage or open doors."

This conclusion is doubtless correct so far as it relates to the continuous longitudinal central bulkhead to which the capsizing of the ship was prematurely, though confidently, attributed by certain hasty critics, because such a bulkhead did not exist in the forward part of the ship that was affected by the collision. It clearly does not apply, however, to the minor longitudinal partitions above

referred to, because these must have been contributory to the disaster according to the extent by which the water they held over towards one side caused the heel of the ship to increase as the bow became immersed, and the stability diminished. It is a question that could only be settled by further investigation, whether the reduction of stability and the heeling effect thus caused was greater or less in this particular case than would have occurred if the water had been free to pass from side to side of the ship within the fore-and-aft limits of the compartments it entered.

2. *What would probably have happened if the doors and ports in the upper-deck battery had been closed.*—Mr. White says: "It is not possible to state absolutely that the *Victoria*, with turret and battery closed, could have been kept afloat permanently under the actual circumstances of the collision"; and he points out that there are many compartments into which water might have found its way eventually, through doors and hatches that were probably open. He considers, however, that "her capsizing would have been improbable even if she had eventually foundered." The Admiralty endorse this opinion in their minute, which states: "The great weight of water thus gradually admitted into the forward part of the ship might eventually have caused the ship to founder by the head."

We see no reason to believe that the ship could possibly have been saved by the closing of these doors and ports. By the time the sea had reached them the fore end of the ship was so deeply submerged, and there were so many openings by which water could then find its way into compartments not already filled, that it is difficult to conceive how even the rate at which she was so rapidly sinking could be checked. When the sea had reached the height of the turret ports and the upper-deck battery ports and doors, the ship was inevitably doomed. She might possibly have sunk by the head without capsizing, although this appears improbable. With her stability reduced to the extent described in the Admiralty Minutes, when the bow was under water, and the heel to starboard was great, it would appear that the effect of the increasing quantities of water in the ship would certainly be to capsize her very soon. But whatever might have been the precise manner in which she would have gone down, there appears no doubt that the vessel would have gone to the bottom almost immediately after she did, even if the turret and upper-deck battery ports and doors had been closed.

3. *What would probably have happened if all doors, hatches, &c., had been closed before the collision took place.*—We agree upon this point with the opinion, based upon the calculations of the Construction Department, which is expressed in the Admiralty Minute as follows: "While the loss of buoyancy must in that case have been considerable, yet, making all due allowances for probable damage, the ship would have remained afloat and under control, and able to make port under her own steam. Her bow would have been depressed about to the water level, her heel to starboard would have been about one-half of that observed before the lurch began (*i.e.* 9 or 10 degrees), her battery ports would have been several feet above water, and she would have retained ample stability."

4. *The efficiency of the water-tight doors to the bulkheads, and of the means of closing them quickly.*—This question is one of the greatest importance in the present case, because, as we have seen, the *Victoria* might apparently have been navigated safely into port if all the water-tight doors, hatches, &c. had been closed soon enough to prevent water passing from compartments directly opened up by the collision into others from which they were separated by water-tight bulkheads or decks. The Admiralty expresses strong and unqualified opinions upon this point. Their lordships say "the detailed evi-

dence establishes the fact that water-tight doors, hatches, &c. in the *Victoria* were in good order. It contains nothing which suggests a doubt of the efficiency of the system of water-tight subdivision existing in the *Victoria*. At the parts affected by the collision the subdivision was minute, but doors were left open. According to the established practice of the Admiralty in all classes of ships, the number of water-tight doors is made as small as possible consistently with the essential conditions for working and fighting the ship. . . . In conclusion, their lordships are of opinion that . . . the arrangements of water-tight doors . . . did not by any fault of principle contribute to the loss of the ship; but that, on the contrary, had the water-tight doors, hatches, and ports¹ been closed, the ship would have been saved." Mr. White says, in his Minute: "No orders were given to close doors until one minute before collision. It is established by the evidence that the doors, &c. were in good order. The failure to close doors, therefore, was due entirely to the insufficiency of the time available, especially in compartments breached by the collision."

The statement that the water-tight doors, hatches, &c. were in good order at the time of the collision appears justified by the evidence; except, perhaps, with regard to the door at the after end of submerged torpedo room, which slides horizontally, and could only be moved six or eight inches when the attempt was made to close it after the collision. Their lordships go on to say that the detailed evidence contains nothing which suggests a doubt of the efficiency of the system of water-tight subdivision. We cannot discover, however, that this question was investigated by the Court Martial. Very complete evidence was obtained as to the exact state of each compartment, and of each opening into the compartments, at the time of the collision; but the general question of the efficiency of the system of water-tight subdivision, which involves that of the water-tight doors and hatches to the various compartments, was not gone into. It would appear, indeed, to have been expressly excluded from the investigations of the Court Martial, since it can only be judged in relation to the buoyancy and stability of the ship; and the Court confined itself, as already stated in the quotation given from the Admiralty Minute, to placing upon the Minutes all evidence obtainable with regard to the closing or otherwise of water-tight doors, &c., but did not feel itself called upon, nor feel competent, to express an opinion as to the causes of the capsizing. While it may therefore be true that the evidence contains nothing which suggests a doubt upon these points, it is, on the other hand, equally true that it contains nothing which proves the assertion that the system of water-tight subdivision was efficient.

One of the weak points in the water-tight subdivision appears to have been the doors and hatches to openings in the bulkheads and decks; and especially the impossibility of closing a sufficient number of them after the collision to keep the ship afloat. The doors upon the mess deck were all closed; but this deck was about 3 feet above the water-line, and there was time to attend to the doors upon it before the inrush of water drove the men away. On the protective deck below, however, and on the platform in the hold, there was not time to get at all the doors and hatches before the water reached them; while most of those that were got at and closed appear to have been only partially, and very imperfectly, secured. The plans of H.M.S. *Victoria*, appended to the Admiralty Minutes, show ten water-tight doors in the bulkheads on the protective deck, at the fore side of the armour belt. This deck is about 100 feet in length, and includes the whole of the area directly affected by the collision; and there is only one important bulkhead in this space which

does not contain a door, viz. that which divides the cable locker from the fresh-water tanks. On the platform in the hold, immediately under the protective deck, there are eight water-tight doors in the bulkheads, while there is in addition a water-tight door in the bulkhead at Frame Station 35, which forms the after boundary to the space. This was the door which could not be closed when the attempt was made to do it. There is no bulkhead upon this deck in the space referred to which does not contain a door. Besides these doors there are numerous openings, fitted with water-tight hatches, in the decks over the various compartments.

The Admiralty Minute states that the number of water-tight doors was made as small as possible, in accordance with the established practice of the Admiralty. It would be difficult, however, to fit more doors than are shown upon the plans of the two decks that are below the water-line in the *Victoria*—the protective deck and the deck below it in the hold.

Judging by the Admiralty plans, it was only a certain number of these water-tight doors that were fitted so as to slide horizontally; and some were merely hinged doors, which could only be closed by entering the compartment in which they were situated, and were secured by a number of clips round the edge of the door. Some of these were upon the most important transverse bulkheads, such as the two bulkheads which enclosed the submarine mining flat on the platform in hold. We have always considered that arrangements should be made for closing all doors in bulkheads that are essential to the efficient water-tight subdivision of the ship from a deck that is at a safe height above water, as well as in the compartments where the doors are; and we believe, also, that this is the Admiralty rule—as it obviously ought to be. If doors are fitted below the water-line so as only to be opened or closed in the compartments where they are, they should seldom require to be opened, and never to be left open, unless the bulkheads to which they are fitted are not considered essential to the efficiency of the water-tight subdivision. It does not appear by the evidence, or by the Admiralty Minutes, that a single one of the many doors in the fore part of the ship on and below the protective deck could be closed from a deck at a safe height above water; because the sliding doors could only be closed, we believe, from the main deck, which does not appear to have been more than 3 feet above water at the time of the accident, and was almost instantly immersed. In view of these circumstances we cannot agree with the opinion of the Admiralty that there is "nothing which suggests a doubt of the efficiency of the system of water-tight subdivision existing in the *Victoria*. It appears, upon the other hand, quite practicable to improve the efficiency of this system by dispensing with some of the doors, and by arranging with reference to the others that every one which requires to be left open for even an instant, without the certainty of some one being in constant attendance upon it till it is closed, should be capable of being worked from a deck at a safe height above water.

Mr. White says that the failure to close the water-tight doors in the forward part of the *Victoria* has caused suggestions to be made that automatic or self-closing doors should be adopted instead of existing arrangements. This suggestion was, he adds, carefully considered long ago, after certain experimental doors had been tried. He is satisfied that the existing arrangements are the best, and that their safety is only a question of good time being allowed for closing the doors. It must be remembered, however, that when doors can only be closed in the compartments where they are situated, and these are below the water-level, the inrush of water would often effectually prevent the closing of the doors in bulkheads that separate the compartment that is breached from those

¹ It has already been pointed out that the closing of the ports would apparently have had but little effect, and the Admiralty admit that the ship might still have foundered.

adjacent to it. Also, with such arrangements below as those of the *Victoria*, it is impossible to ensure that an unforeseen accident would always allow of sufficient time to close the water-tight doors in the manner required.

The efficiency of the water-tight hatches, and the chances of their being properly secured in an emergency when they are fastened by a number of clips round the edge, as at present, is also a question that appears to require consideration; while it is to be observed that the sliding horizontal door in the protective deck of the *Victoria*, which opened into a shoot through which coal was trimmed from the reserve bunkers at after end of protective deck, into the side bunkers in the stokehold, could not be closed from the shoot in which the men worked who were trimming the coal; but had to be worked from the submerged torpedo room, a compartment below the protective deck. This open door had an important effect upon the capsizing, for Mr. White states that "one of the chief causes of inclination to starboard is to be found in the fact that, owing to open doors, water was able to find its way from bunkers above the protective deck, down through the coal-shoot, and so to fill No. 7 bunker just before the forward starboard stokehold."

It appears to us that one of the chief lessons taught by the circumstances of this disaster, is the necessity of reducing the number of water-tight doors and hatches, and of arranging that all of them which are essential to the efficiency of the water-tight subdivision, and are ever likely to be left without attendance while open, should be capable of being closed, either by a thoroughly satisfactory self-acting arrangement, or by appliances for working them from a deck at a safe height above water.

The points still remaining to be considered will be reserved for our next article.

FRANCIS ELGAR.

REAPPEARANCE OF THE FRESHWATER MEDUSA (*LIMNOCODIUM SOWERBII*).

FOR three years nothing has been seen of the freshwater medusa in the Regent's Park, and naturalists had given up hope of carrying on any further investigation into its life-history. It seemed as though this beautiful little organism—brought we know not how or whence into the midst of London—had, like some mysterious comet, unexpectedly burst on the zoological world, and as unexpectedly disappeared.

I was, therefore, greatly astonished to hear in September, from my friend the Director of Kew, that the curator of the Sheffield Botanic Gardens (Mr. Harrow) had discovered it in quantity in the Victoria Regia tank under his care during the present summer, and I was soon after delighted by the safe arrival from Sheffield of a bottle containing living well-grown specimens of the familiar jelly-fish. Mr. Harrow informs me that he observed it in the tank at Sheffield for the first time in the beginning of June of this year (1893). Specimens were still observed as late as the middle of October—giving a duration of some fourteen weeks—an unusually long period. Mr. Harrow estimates the total number seen as at least 300.

The last seen in the Botanic Gardens, Regent's Park, London, were taken from the *new* Victoria Regia tank on July 30, 1890. The question as to how the jelly-fish got to Sheffield is easily answered. Water plants (*Nymphæaceæ* and *Pontederia*) were sent (as I am informed by Mr. Sowerby and by Mr. Harrow) from Regent's Park to Sheffield to re-stock the tank there on April 4, 1892, and on April 7, 1893. Hence there was the probability of some of whatever reproductive germs of *Limnocodium* existed in Regent's Park being transferred to Sheffield. The curious thing is that in 1892 and in 1891 no *Limnocodium* were seen in the original source—viz. the Regent's

Park tank—nor in 1893, excepting a few sent from Sheffield and placed in that tank by Mr. Sowerby.

This is the first instance recorded in which another Victoria Regia tank has been "infected" with *Limnocodium* from the original Regent's Park tank, excepting when the new tank in Regent's Park was in 1890 infected from the old one—by the transference to it of weeds and roots containing the germs of the jelly-fish.

The tank at Kew has never been properly infected, for it is, I regret to say, the anti-zoological custom at the Royal Gardens to thoroughly cleanse, wash, and furbish up the Victoria Regia tank every year so thoroughly that the winter germs of the jelly-fish are removed or destroyed. Hence *Limnocodium* has flourished at Kew when sent there from Regent's Park, but has never "carried over" from one season to another. It is, fortunately, the custom in other botanical gardens to leave a quantity of "sludge" (including some old leaves and stems) at the bottom of the tank, when the water is drawn off and the soil prepared for a new season, and hence *Limnocodium* has been preserved from destruction for so many years.

As to what is the precise nature of the process by which *Limnocodium* has been carried over from one season to another in the Regent's Park, we are still uncertain. The facts at first ascertained were these, viz. that the jelly-fish suddenly appear each year as early as April or as late as August, and remain for from five to twelve weeks, when they die down and absolutely disappear. During the first few weeks of their appearance the water is found to contain an immense number of minute young forms ($\frac{1}{30}$ of an inch in diameter), which I described and figured in the *Quart. Journ. Micros. Science*, vol. xxi. p. 194. Evidently these young were being produced in quantity in the tank, and gradually developed to the full size of half an inch diameter. The form and appearance of these young were such as to lead me to the conclusion (subsequently found to be erroneous) that they had been developed from eggs. At the same time the remarkable fact was established by the examination in successive years of many hundred specimens that the adult *Limnocodia* were every one, without exception, males. They produced abundant motile spermatozoa, but not a trace of an egg-cell was ever found in any one of them!

The hypothesis which I entertained in 1884 as an explanation of this curious state of things was—that the female was a non-motile, perhaps a fixed hydriform organism, and I accordingly searched for such a form in the mud and *débris* from the bottom of the tank. At last, in a large quantity of such material which I obtained when the tank was cleared out in the winter of 1884, my assistant, Dr. A. G. Bourne, found a very strange diminutive polyp adhering in numbers to the root-filaments of *Pontederia*. This polyp he carefully described in the same year in a communication to the Royal Society. There was very great probability that this little polyp, devoid of tentacles, and not more than $\frac{1}{8}$ th of an inch long, was the "trophosome" of the *Limnocodium* medusa. That this was a true inference was subsequently proved by Dr. G. H. Fowler, who in 1890 (*Quart. Journ. Micros. Science*, vol. xxx.), the last year in which the jelly-fish were seen in London, showed that the little spherical young found floating in the water of the tank are nipped off by a process of transverse fission from the free ends of the minute polyps described by Bourne.

Fowler (whose observations were made in my laboratory in 1888) found the polyps very abundantly upon floating water-plants widely scattered in the tank; they were also detected by Mr. Parsons, of the Quecket Club, in water which was the overflow of the tank, and accumulated in an outside reservoir.

The immediate question then became "How do the polyps originate?" The polyps account for the medusæ,