shells of ordinary construction, elaborated by Prof. Abel nearly three years ago, by which the breaking up of cast iron shells into a large number of fragments and their dispersion with considerable violence is accomplished by filling the shell with water instead of with an explosive agent.

In a memoir communicated by Mr. Abel to the Royal Society in 1873,* it was pointed out that detonation was transmitted from a mass of dry compressed gun-cotton to distinct masses of the material saturated with water and separated from each other and from the detonating (or "initiative") charge by small spaces filled with water, the whole being enclosed in a case of stout wrought iron; and Mr. Abel stated that the suddenness and completeness with which detonation was transmitted through small water-spaces had suggested to him the possibility of applying water as a vehicle for the breaking up of cast iron shells into numerous and comparatively uniform fragments, through the agency of force suddenly developed in the perfectly closed shell, completely filled with water, by the detonation of a small quantity of gun-cotton or other similarly violent explosive substance, immersed in the water. Mr. Abel considered that if such a result were obtained, a shell or hollow projectile of the most simple construction could be made readily to fulfil the functions of the comparatively complicated *shrapnel* and *segment* shells which have been specially designed to furnish a large number of dangerous missiles when burst during their flight.

A few experiments with ordinary cast iron shells, spherical and cylindro-conoidal, afforded conclusive demonstration of the power possessed by water, in virtue of its slight compressibility, to bring to bear uniformly in all directions upon the walls of the shell, the force developed by an explosion which is made to occur suddenly in the completely confined water-space, and showed, moreover, that the disruptive effect was proportionate not merely to the amount of explosive agent used, but also to the suddenness of the concussion imparted to the completely confined water by the explosion. In illustration of the disruptive effect of water, the following results may be quoted from a number given by Mr. Abel in his memoir. A 16-pounder (cylindro-conoidal) shell, filled with 16 ounces of gunpowder, was broken by the explosion of this charge into 29 fragments. The detonation of a quarter of an ounce of gun-cotton confined in a shell of precisely the same construction and weight, the chamber being filled up with water and tightly closed, burst the shell into 121 fragments, which were violently dispersed. A corresponding charge of gun-cotton, confined in a third similar shell, the chamber being filled with air, did not burst the shell when detonated; the resulting gases found vent through a minute perforation in the plug or screw-stopper of the shell. One ounce of gun-cotton confined in a similar shell, filled up with water, broke it up into 300 fragments, but in addition there were 2 lb. 1 oz. of the shell almost pulverised by the force of the explosion brought to bear upon the metal through the agency of the confined water.

The manner in which Mr. Abel has applied this system of bursting shells is very simple. The fuse which is used in field-artillery service for bursting shrapnel-shells or the common shell (when the latter is filled with gunpowder and used as a mine or an incendiary projectile), has fitted to it a small metal cylinder closed at one end, into which is tightly packed from a quarter to one-half ounce of dry compressed gun-cotton. The open end of the cylinder is closed with a screw plug containing a small chamber filled with fulminate of mercury, the upper side of which is in close contact with the fuse when the cylinder has been attached to the latter. To employ common shells as *water-shells* it is now only necessary to fill them completely with water, and then to insert and screw down firmly the fuse with its little detonating cylinder attached, when the detonating charge is fired by the action of the fuse, the shell is instantaneously burst into a large number of fragments by the concussion transmitted by the water.

Mr. Abel's prediction that this plan of bursting shells would be found most effective, is amply borne out by the magnificent practice made by the field-guns at Okehampton. Of the two batteries of Royal Artillery which have carried on the experiments during the past week, one has done more mischief with the "water-shells" than with the delicately constructed shrapnel, with the nature of which the gunners are intimately acquainted; while with the other battery of heavier field-guns the practice made was but little inferior. A little better acquaintance on the part of artillerymen with the new system of using shells will, it is anticipated, still further increase the deadly effect of these terrible weapons. Moreover, the water-shell has hitherto only been used in conjunction with a percussion fuse, while it is with the time-fuse that the shrapnel-shell is found the most effective. With the percussion-fuse the two shells are about on an equality, while the water-shell has the advantage of greater simplicity.

* Contributions to the History of Explosive Agents, Second Memoir, by F. A. Abel, F.R.S.—Phil. Trans. 1874, p. 373.

NOTES FROM THE "CHALLENGER"

THE following extracts from a letter dated Yeddo, June 9, 1875, addressed to me by Prof. Wyville Thomson, will, I think, interest the readers of NATURE:—

"In a note lately published in the proceedings of the Royal Society on the nature of our soundings in the Southern Sea, I stated that up to that time we had never seen any trace of the pseudopodia of Globigerina. I have now to tell a different tale, for we have seen them very many times, and their condition and the entire appearance and behaviour of the sarcode are, in a high degree, characteristic and peculiar. When the living Globigerina is examined under very favourable circumstances; that is to say, when it can at once be transferred from the tow-net and placed under a tolerably high power in fresh, still sea-water, the sarcodic contents of the chambers may be seen to exude gradually through the pores of the shell and spread out until they form a gelatinous fringe or border round the shell, filling up the spaces among the roots of the spines and rising up a little way along their length. This external coating of sarcode is rendered very visible by the oil-globules, which are oval and of considerable size, and filled with intensely coloured secondary globules; they are drawn along by the sarcode, and may be observed, with a little care, following its spreading or contracting movements. At the same time, an infinitely delicate sheath of sarcode containing minute transparent granules, but no oil-globules, rises on each of the spines to its extremity, and may be seen creeping up one side and down the other of the spine, with the peculiar flowing movement with which we are so familiar in the pseudopodia of Gromia, and of the Radiolarians. If the cell in which the Globigerina is floating receive a sudden shock, or if a drop of some irritating liquid be added to the water, the whole mass of protoplasm retreats into the shell with great rapidity, drawing the oil-globules along with it, and the outline of the surface of the shell and of the hair-like spines is left as sharp as before the exodus of the sarcode. We are getting sketches carefully prepared of the details of this process, and either Mr. Murray or I will shortly describe it more in full. . . .

"Our soundings in the Atlantic certainly gave us the impression that the siliceous bodies, including the spicules of Sponges, the spicules and tests of Radiolarians, and the Pustules of Diatoms which occur in appreciable proportions in Globigerina ooze diminish in number, and that

the more delicate of them disappear, in the transition from the calcareous ooze to the 'red clay;' and it is only by this light of later observations that we are now aware that this is by no means necessarily the case. On the 23rd of March, 1875, in the Pacific, in lat. 11° 24′ N., long. 143° 16′ E., between the Carolines and the Ladrones, we sounded in 4,574 fathoms. The bottom was what might naturally have been marked on the chart 'red clay;' it was a fine deposit, reddish brown in colour, and it contained scarcely a trace of lime. It was different, however, from the ordinary 'red clay,'—more gritty—and the lower part of the contents of the sounding tube seemed to have been compacted into a somewhat coherent cake, as if already a stage towards hardening into stone. When placed under the microscope, it was found to contain so large a proportion of the tests of Radiolarians, that Murray proposes for it the name 'Radiolarian ooze.' This observation led to the reconsideration of the deposits from the deepest soundings, and Murray thinks that he has every reason to believe (and in this I entirely agree with him) that, shortly after the 'red clay' has assumed its most characteristic form, by the removal of the calcareous matter of the shells of the Foraminifera, at a depth of say 3,000 fathoms, the deposit begins gradually to alter again by the increasing proportion of the tests of Radiolarians, until, at such extreme depths as that of the sounding of the 23rd of March, it has once more assumed the character of an almost purely organic formation, the shells of which it is mainly composed being however in this case siliceous, while in the former they were calcareous. The 'Radiolarian ooze,' although consisting chiefly of the tests of Radiolarians, contains, even in its present condition, a very considerable proportion of red clay. I believe that the explanation of this change, which was suggested by Murray, and was indeed almost a necessary sequence to his investigations, is the true one. We have every reason to believe, from a series of observations, as yet very incomplete, which have been made with the tow-net at different depths, that Radiolarians exist at all depths in the water of the ocean, while Foraminifera are confined to a comparatively superficial belt. At the surface and a little below it, the tow-net yields certain species; when sunk to greater depths, additional species are constantly found, and, in the deposits at the bottom, new forms occur, which are met with neither at the surface nor at intermediate depths. It would seem also that the species increase in number, and that the individuals are of larger size as the depth becomes greater; but many more observations are required before this can be stated with certainty. Now, if the belt of Foraminifera which, by their decomposition, according to our view, yield the 'red clay,' be restricted and constant in thickness, and if the Radiolaria live from the surface to the bottom, it is clear that, if the depth be enormously increased, the accumulation of the Radiolarian tests must gain upon that of the 'red clay,' and finally swamp and mask it."

Prof. Wyville Thomson further informs me that the best efforts of the *Challenger's* staff have failed to discover *Bathybius* in a fresh state, and that it is seriously suspected that the thing to which I gave that name is little more than sulphate of lime, precipitated in a flocculent state from the sea-water by the strong alcohol in which the specimens of the deep-sea soundings which I examined were preserved.

"The strange thing is, that this inorganic precipitated is scarcely to be distinguished from precipitated albumen, and it resembles, perhaps even more closely, the proligerous pellicle on the surface of a putrescent infusion (except in the absence of all moving particles), colouring irregularly but very fully with carmine, running into patches with defined edges, and in every way comporting itself like an organic thing."

Prof. Thomson speaks very guardedly, and does not consider the fate of *Bathybius* to be as yet absolutely decided. But since I am mainly responsible for the mistake, if it be one, of introducing this singular substance into the list of living things, I think I shall err on the right side in attaching even greater weight than he does to the view which he suggests.

T. H. HUXLEY

THE INTERNATIONAL CONGRESS AND EXHIBITION OF GEOGRAPHY

AT the distribution of prizes the Ordnance Survey obtained a letter of distinction, although it was not an exhibitor. It is the only instance in which such an honour was awarded. M. Quatrefages, in the name of the governing body of the society, awarded two exceptional prizes, one to MM. Payer and Weyprecht for the discovery of Francis-Joseph Land, and the other to M. Delaporte for the foundation of the Cambodian Museum at Compiègne. Admiral la Roncière, le Nourry closed the meeting by a very impressive address reviewing the characteristics of the Congress.

The success of the Exhibition is so great that it will be kept open up to the 19th of September. The number of visitors is greater than ever now that the Congress is over, and many fresh attractions have been added to several sections. M. Buys Ballot, the director of the Utrecht Meteorological Institution, has sent a board used by him for better indicating the direction of winds and distribution of pressure. Small holes are perforated in a map at the places occupied by the several stations. In these holes are placed small needles whose height indicates the barometrical height, and whose head is an arrow showing the actual direction of the wind.

In the French annexe has been exhibited a drawing of a machine for manufacturing relief maps out of a block of plaster. The knife is movable by a kind of pantograph, and can be conducted alongside the several *lines of level* (lignes de niveau) of a map which is seen by reflection in a plate of glass placed in a suitable position.

Peter the Great having been appointed a member of the Academy of Paris in 1717, ordered a map of the Caspian Sea to be drawn, which he sent to his fellow-members of the Academy as a proof of his zeal for the progress of science, and to justify the honour which had been conferred upon him. This map was lodged in the archives of the Academy, engraved and published in the volume of 1721, with a report written by Delisle the astronomer. It happens that the same map is exhibited at the Russian annexe, and the circumstances connected with it having become generally known, it has given rise to the report that the Grand Duke Constantine will be elected a member of the Academy, like his ancestor and the Emperor of Brazil. It is something more than an idle rumour.

A banquet was given by the Section of Commercial Geography, and some resolutions were adopted *inter poculas*. The most notable is in reference to the establishment of a *fonda* in the centre of the Sahara for the use of all civilised nations. But although adopted unanimously, the motion is not likely to be carried into execution very speedily.

SCIENCE IN GERMANY

(*From German Correspondents.*)

IT was the phenomenon of the motion of glaciers which caused most of the scientific men, that studied its details, to make experiments on the behaviour of snow and ice under pressure. The brothers Von Schlagintweit and Prof. Tyndall were the first who made such experiments with regard to glacial phenomena. Later on Helmholtz described a series of investigations, which proved amongst other things that snow is changed into ice by high pressure, that ice broken into little pieces can again be pressed into a homogeneous ice cylinder, that