point of picric acid (122°) than that of trinitrotoluene (82°) is another disadvantage, but this may be overcome by the use of certain eutectic mixtures. One such contains forty parts of picric acid with sixty parts of trinitrometacresol (*cresylite*). The mixture melts at 85°, and, after solidification, on reheating becomes plastic at 70°, which permits of compression to high density in the shell.

The various smokeless powders are dealt with, Vieille's work in the development of pure nitrocellulose powders receiving special mention. It is pointed out that, in addition to control of the rate of burning by variation in the form and size of the pieces, a greater proportion of the more slowly burning "soluble" nitrocellulose affords a means of control; thus for small arms the "soluble" may be 25 per cent., for large marine guns 50 per cent., the remainder being "insoluble" nitrocellulose.

Nobel's invention of the use of nitroglycerine as a non-volatile solvent is referred to as a great improvement, there being many disadvantages in the use of volatile solvents. A more recent non-volatile gelatiniser is dinitrotoluol, the Italian Avigliani powder being composed of "soluble" nitrocellulose fifty parts, "insoluble" N.C. twenty-five parts, dinitrotoluene twenty-five parts.

The use of stabilisers is next considered. It is shown that nitrocelluloses, like other nitric ethers, are liable to slow hydrolysis, with the formation of oxides and acids of nitrogen, these actions being promoted by moisture and rise of temperature, the rate being greatly increased by the catalytic action of the products. These actions lead to irregular ballistics, and even to spontaneous ignition. Stabilisers, of which diphenylamine is the most generally used (in ballistite, BN powder, etc.), absorb the liberated nitrogen compounds and prevent, or at least greatly retard, the decomposition.

In conclusion, particulars are given of the celebrated 75 mm. French gun. The projectile weighs 7·2 kilos., and has a muzzle velocity of 529 metres per second. The charge of powder B, in flake form, is 720 grams. It is shown that the gun, as a heat engine, gives an efficiency of 35·1 per cent. To an increase in this efficiency the author looks for further progress in the future.

THE MINUTE LIFE OF THE SEA.[1]

THE quantitative examination of the microplankton of the North European waters is the subject of the present important memoir, which is the outcome of a resolution of the International Council to take advantage of cruises in Denmark, England, Holland, Norway, and Sweden in the spring of 1912 for the collection of plankton samples taken by means of the water-bottle at depths ranging from 0 to 100 metres and more. In this way a series of accurately determined species is followed from sample to sample, and the distribution of these species is used to illustrate the laws of production and destruction of organic substance in the ocean. Prof. Gran has exhaustively examined the whole of the material collected with the exception of the greater part of the Scottish collections, for which Miss Ogilvie is responsible; a special chapter being devoted to this portion of the work. The samples were all preserved by adding Flemming's solution to the water directly it was collected. This method, although admittedly restricted, answers well for the preservation of all important Plankton species, as is shown by the fact that, when comparing the living material from Flødeveigen, Skager Rak, with the preserved, no species were found which were not present in the preserved material. For examination, Lohmann's centrifugal method is used, and the number of organisms (cells) per litre given in a series of tables with hydrographical data. Even delicate Peridiniales such as Gymnodinium, and Infusoria, especially Labœa, are well preserved, and are shown to form an important part in the economy of the sea.

Part i. gives a descriptive account of the plankton from each area taken separately. Of these the Danish results from the Skager Rak, taken both in February and in June, are of special interest. The colder surface water of the Skager Rak in February is found to contain an exceedingly rich Diatom plankton, which the author attributes not to the low temperature, but probably to the fact that the surface water is specially rich in some nutritive substance necessary to the development of the Diatoms. In June, this rich surface Diatom plankton has almost entirely disappeared, different species of Ceratium taking their place. The Danish water investigations also bring out striking results with regard to the relations existing between the assimilating algæ and oxygen tension in the different layers.

In Part ii. new light is thrown upon the distribution and biology of the separate species. *Nitzschia delicatissima*, Cleve, is found to be the commonest of all species in the plankton from the ocean round the Shetlands and the Faroes, having in places the large density of more than a million cells per litre. With regard especially to the Ceratium species, it is shown that passive sinking of the cells plays an important part in their vertical distribution, and this statement applies also to many of the other genera. The species of Labœa are true surface forms and are very abundant: "The whole of the ocean round Scotland and the Faroes contains, at the surface, on an average, one for each cubic centimetre of sea-water."

In the extensive discussion on general conditions of life and of plankton production, taking the many factors into account, the conclusion is arrived at that with the assimilating algæ the optimum production is near the surface, although the maximum at certain periods may be at a greater depth. Thus, in the case of the Ceratium species, although in the present investigations the greater number were found to occur at depths between 15–20 metres, it does not follow that this represents the depths of optimum production. In fact, other researches show it to be generally nearer the surface. The author suggests that by far the greater number of the assimilating plankton algæ have their maxima close to the surface, probably not as deep as 10 metres.

The last portion of the work on the horizontal quantitative variations of the plankton shows the influence of the coastal waters on distribution. The entirely different conditions of the area round Scotland and the Faroes compared with the Skager Rak and the north-eastern corner of the North Sea is thus explained by their supply on the one hand from Scotland and the Faroes, and on the other through the Baltic current from the Scandinavian coastal sea. Throughout the investigation runs the same idea binding the whole together and emphasising the importance of a permanent supply of nutritive substance from land. This nutritive substance taken up by the sea forms the means of subsistence of all plankton organisms which, originating from the coastal waters, spread out from thence into the more distant waters of the ocean. M. V. L.

[1] H. H. Gran: "The Plankton Production in the North European Water in the Spring of 1912." Conseil Permanent International pour l'explorations de la Mer. *Bulletin Planktonique* pour l'année 1912 (continuation du Bulletin Trimestriel des résultats acquis pendant les croisières périodiques et dans les périodes intermédiaires, Partie D). Publié par le Bureau du Conseil avec l'assistance de C. H. Ostenfeld, chargé du service planktonique.