

will be made to show the principal waterways of the United States. The waste places on the margin of the map, resulting from irregular coast lines, will be used for plant exhibits of various kinds, showing plants grown around the world. Men in the employ of the Bureau of Plant Industry are now scouring the world in search of grasses and plants to be shown to visitors at the Exposition. One patch of ground is to be devoted to cereals, another to poisonous plants, another to fiber, and still another to seed production, grasses, plant breeding, etc. A school of gardening will also be a portion of this exhibit. School children living in St. Louis will attend to a model school garden to be furnished by the government. Prizes are to be awarded to the most apt pupil at this school. School gardens are now becoming more and more popular. The map is located on a sloping hill, and adjoins the agricultural and horticultural exhibits and buildings. It may be seen from any portion of the main exposition grounds, and will be one of the instructive and beauty spots of the Fair.

BORINGS ON A CORAL REEF.

One of the most complete and important contributions to the study of coral reefs and their mode of formation that has so far appeared, even if we bear in mind Prof. Alexander Agassiz's recent work "The Coral Reefs of the Tropical Pacific" (Memoirs, Museum of Comparative Zoology, Harvard College, 1903), may be seen in a monograph just issued by the Royal Society of London, entitled "The Atoll of Funafuti: Borings Into a Coral Reef and the Results."

The project for the investigation of a coral reef with the object of elucidating its structure, originated at the Nottingham meeting of the British Association, held in 1893. At that gathering Prof. W. J. Sollas was successful in promoting a committee, charged to consider whether an exploring expedition was feasible; in the end it was decided to go forward with such an undertaking, and eventually the Royal Society took over the necessary arrangements.

After many meetings and consultations, it was decided to select Funafuti, an island in the Pacific Ocean, as the site for inquiry, the primary aim being the bringing up of a core of rock in order that the composition of the reef might be determined from zoological and chemical standpoints. Actual operations at this ring-shaped spot of land were begun as long ago as 1896, and they continued until 1898.

The well-known hypothesis of Darwin respecting the development of coral reefs in their several forms, although at one time regarded as a truth in geology, is no longer tenable in its entirety, a result largely due to the later observations of Agassiz and Murray. Darwin, himself, however, earnestly desired a fuller examination, *in situ*, than had been at all practicable in his own day, and in fact went so far as to express his conviction (in a letter to Agassiz in 1881) that nothing of a really satisfactory nature could be brought forward as contributory evidence until a boring was made in one or other of the Pacific and Indian atolls, and a core obtained down to a depth of at least 500 or 600 feet. That hoped-for consummation has, however, been over-achieved, since the boring at Funafuti was carried down to a limit of 1,114 feet.

Three expeditions were made before this could be accomplished. The first attempt was made in 1896 with Prof. Sollas as leader, but it ended in failure owing to a breakdown of the diamond-drill borer, consequent upon an inrush of reef "sand." A second, which set out in 1897, having Prof. Edgeworth David, of Sydney, as conductor, and aided by the loyal cooperation of various authorities in Australia, so profited by past experience that a depth of 698 feet was attained; while a third, under the guidance of Mr. A. E. Finckh, also of Sydney, carried the main bore down to 1,114 feet.

The general story of the expeditions is given in the monograph by the leaders who took part in them, and the narratives, whether detailing the various steps in making borings, or treating of the difficulties and even dangers that were encountered, provide a fascinating chapter of plucky and long-sustained effort. Besides the primary purpose of the survey, a good deal of correlated scientific work was done, in which Capt. Field, R.N., of H.M.S. "Penguin," who conveyed the first party, took a prominent part. He made a complete topographical survey of the atoll, and charted an extensive series of soundings in the waters of the lagoon and the outer sea, as well as carrying out a magnetic survey of Funafuti, not alone in the interests of terrestrial magnetism, but as specially bearing upon the geological investigation that was in hand. Then again, the opportunity was embraced of making collections representative of the general fauna, flora, and anthropology of Funafuti and adjacent islands in the Ellice group.

The cores from the early borings, and that from the later and main bore, were all of them shipped to Prof. J. W. Judd, F.R.S., of the Royal College of Science, London, for detailed examination by him and by other experts, thus fulfilling Darwin's old wish, and it may

be readily imagined that this transport virtually marked the commencement of the inquiry. Although many papers and memoirs in various departments of science have laid Funafuti under contribution during the years that have passed since the expeditions, it was only to be expected that a long interval would elapse before the materials that were obtained could form the subject of a satisfactory official report. The magnitude of the task is abundantly indicated by the present monograph.

Dr. G. J. Hinde supplies an elaborated descriptive account of the organisms which have contributed to the building up of the atoll, compiled from an examination of hundreds of microscopic core slittings and other desiderata. The evidence derived from this piece of work goes to show that, whether in the form of solid rock-cores or as incoherent granular particles, the material appears to be entirely of organic character, traceable to the calcareous skeletons of marine invertebrate animals and calcareous algae; of the latter, Halimeda and Lithothamnion occur in abundance. And Prof. Judd's comment is that "from top to bottom the same organisms occur, sometimes plants, sometimes foraminifera, and sometimes corals predominating; but in the whole depth bored the same genera and species of these various groups of organisms take their part in the building up of the mass," a striking and significant summary. The only portion of a vertebrate noticed in the borings was a fragment of bone or spine, met with in the center of a core of compact dolomite, from a depth of 1,060 feet, which appears to belong to a fish. Mr. Finckh deals with the biology of the living reef-forming organisms at the atoll, and the mode of formation of rock brought about by their presence. He assigns their relative importance thus: (1) Lithothamnion, (2) Halimeda, (3) the Foraminifera, (4) the Corals. This, and another important section on the geology of Funafuti, by Prof. Edgeworth David and Mr. G. Sweet, are of especial value.

The conclusions reached in this opportune monograph are presented in no controversial fashion; the idea has been to put forward facts and leave the interpretation to others. But unfolding as they do the conditions surrounding the present-day life of an atoll and the structure of the deeper parts of its body, they will be read with profound interest by all who study the problems indicated by the formation of coral reefs.

THE UNITED STATES IN 1903.

The Statistical Abstract of the United States for the year 1903, issued by the Department of Commerce and Labor through its Bureau of Statistics, has just made its appearance. It is a solid mass of 650 pages of figures, with scarcely a line of "reading matter" other than the tables of figures and their necessary headlines. Yet a study of its tabular statements develops many interesting facts about the United States, its progress, development, and relation to the other countries of the world. It is interesting, for example, to observe, as shown on page 564, that the exports of domestic products from the United States now exceed those of any other country of the world. They amounted to \$1,392,231,000, against \$1,379,283,000 from the United Kingdom, \$1,113,313,000 from Germany, \$820,671,000 from France, and \$732,975,000 from Netherlands. In imports the United States stands third, the world's largest importer being the United Kingdom, \$2,571,416,000; Germany second, \$1,340,178,000; the United States third, \$1,025,719,000; Netherlands fourth, \$867,308,000, and France fifth, \$848,046,000. The above figures of imports and exports are, in the case of the United States, for the year ending June 30, 1903; the others, the calendar year 1902.

Regarding the details of the foreign commerce of the United States, the Abstract shows that 72 per cent of the exports were sent to Europe, 15 per cent to North America, and the remainder distributed in much smaller percentages to South America, Asia, Oceania, and Africa. The total value of the exports from the United States to Europe in 1903 was \$1,029,256,000; to North America, \$215,483,000; to South America, \$41,138,000; to Asia, \$58,359,000; to Oceania, \$37,468,000; and to Africa, \$38,437,000. Considering the exports by countries, the largest total is to the United Kingdom, \$524,263,000; the next largest to Germany, \$193,842,000; and to Canada, \$123,267,000.

Comparing conditions in 1903 with those of 1873, the exports have grown from \$522,000,000 to \$1,420,000,000, including domestic products and foreign merchandise re-exported. Agricultural products of course still form the largest group of exports, amounting to \$873,000,000 in 1903, or 63 per cent of the total, while manufactures amount to \$407,000,000, or 29 per cent of the total. Manufactures are, however, gaining rapidly upon agricultural products in the share which they form of the total exports. In 1880 agricultural products formed 83 per cent and manufactures but 12½ per cent of the total exports of domestic products, while in 1903, as already indicated, agricultural products formed 63 per cent and manufactures over 29 per cent of the total.

The value of domestic manufactures exported had

never reached so much as \$100,000,000 prior to 1876, and in 1896 for the first time crossed the \$200,000,000 line. Since 1896, however, the growth has been rapid, the total exceeding \$300,000,000 in 1899, passing the \$400,000,000 line in 1900, and remaining above \$400,000,000 constantly since that date, with a prospect that the total exports of manufactures for the fiscal year 1904 will exceed in value those of any previous year.

SCIENCE NOTES.

Dr. Hildebrandsson has presented his report to the International Meteorological Committee respecting the position, number, and dimensions of the permanent air currents of the globe. The summary of this report as the result of direct observations is as follows: (1) Above the heat equator and the equatorial calms there is throughout the year a current from the east, which appears to have very great velocities at great altitudes. (2) Above the trade winds there is an anti-trade current from the southwest in the northern, and from the northwest in the southern, hemisphere, respectively. (3) This anti-trade wind does not extend farther than the polar limit of the ordinary trade winds, but is deflected more and more to the right in the northern, and more and more to the left in the southern hemisphere, until it finally becomes a current from the west above the crest of the tropical high-pressure belts, where it descends to supply the trades. (4) There is an anti-trade upper monsoon above the districts at the equatorial margin of the trades, the anti-trade in winter and the equatorial current from the east in summer. (5) From the tropical high-pressure belts, the air pressure decreases on the whole as it approaches the poles; while the air of the temperate zone is drawn into a vast polar whirl turning from west to east. The air of the higher strata flows away from the whirl, and the air of the lower strata flows toward the center of the whirl. Furthermore Dr. Hildebrandsson asserts that the theory that there is a vertical circulation of air from the equator to the higher regions, finally falling at the poles, is altogether a fallacy. Dr. Hildebrandsson's report is a valuable and important contribution to the science of the new meteorology, and destroys many existing notions respecting the permanent air currents of the world.

Before the Institution of Civil Engineers, on December 22, Dr. T. E. Stanton read a paper on the resistance of plane surfaces in a uniform current of air. The paper deals with the results of experiments made in the engineering department of the National Physical Laboratory on the distribution and intensity of the pressure on thin plates and combinations of plates placed in a uniform current of air, and is intended as the first part of a research on the nature and distribution of the pressure of the wind on structures. By a uniform current of air is meant a current in what is known as "eddy motion" as distinguished from stream-line motion, the mean velocity at any point in the direction of flow being uniform across the current. This condition of motion is considered to be the nearest approximation to that of winds of fairly high intensity. The main object of the present research was to determine, if possible, a general relation between the velocity of the current, the dimensions of the plates, and the resultant pressure, as it was felt that experiments in the open air could not be undertaken with any prospect of success until some general relation of the kind has been established. The results of the experiments show that, under the given experimental conditions, a definite relation of the kind existed, and may be stated thus—for similar and similarly situated plates or combinations of plates in a uniform current of air, the intensity of pressure is the same for the same velocity of current and general atmospheric conditions. On the assumption that the motion of the wind approximates to that of a uniform current as defined above, the above relation shows that the distribution and intensity of the pressure of the wind on structures may be studied experimentally by means of models of the structures set up in a current of air produced by means of a fan, as in the present case. In illustration of this, the results of experiments made on models of roofs and lattice girders of simple form are given in the paper. Tabulated results are also given for the cases of parallel plates at varying distances apart, plates inclined at varying angles to the direction of the current, and the rectangular plates of varying ratio of length to width.

The Belgian and French governments have come to an agreement relating to the establishment of telegraph communication between the Congo Free States and the French Congo. Under the agreement a submarine cable is to be laid between Brazzaville and Kinshassa, the cost of which is to be borne equally by the two countries concerned. It is proposed to use Morse registering apparatus in the stations at either end of the cable. The tariff will probably be 2½d. a word, with a minimum rate of 10d. per message.