not less than 19/20 of the earth's radius sufficiently dense and rigid to comply with astronomical tests can be defined, the same might also approximate to the conditions assumed not only by seismologists, but also by physicists. The shell covering such a nucleus would be about 200 miles in thickness. The physical characters of this shell would in all probability change rapidly from those of the crust of the world to those of its nucleus, corresponding to the observed rapid changes in chordal velocities. At a comparatively shallow depth, say 40 miles, high temperatures would result in fusion, and inasmuch as ice, iron, copper and other substances at or near their melting point float on their own solutions, fusion is a state that would partly be promoted by high pressure. At greater temperatures, whatever the pressure might be, fluids would become gaseous, and the gases would be dense, but slightly compressible and viscous. In certain respects, therefore, they would resemble a solid. This is the view of Arrhenius, who assumes a core of gaseous iron the dimension of which is that assumed by Wiechert.

One reason for selecting iron or gaseous iron in an equally dense state is that a nucleus of such material of the specified size will account for the weight of the world as a whole. What, however, is sought for is a body probably a mixture of the commoner elements in a state approaching that of closest crystalline atomic packing, which has a radius 19/20 that of the earth, a specific gravity less than that of iron, but greater than 5·5, which keeps fairly homogeneous, and can transmit compressional vibrations half as fast again as steel. This material may be called *gēite*, a term as much required as *magma* and *crust*, by which gēite is enveloped, and *gēoid*, which refers to the form these materials collectively exhibit.

Whether solid or gaseous, *gēite* may possibly find its chemical equivalent in certain meteorites, and therefore largely consists of iron alloyed with a small proportion of nickel and other elements. If we assume that the shell covering this mixture has a thickness 1/20 of the earth's radius, and an average density of 2·7—the density of the world being taken at 5·5—it follows that the density of the gēite core is 5·96, or approximately 6. The elastic modulus for a core of this density which conveys vibrations with a speed of at least 9·5 km. per second is 451×10^{10} C.G.S., or roughly speaking, a little more than twice the Young's modulus for Bessemer steel (207×10^{10} C.G.S.).

With improvements in seismometrical arrangements, it seems likely that speeds somewhat higher than those here given will be recorded. Within the core itself, a velocity of 9·5 km. per second must be exceeded. For the moment let this be increased to 10 km. per second whilst within the crust let the average speed be 3 km. per second. With such assumptions, if the covering shell is about 40 miles in thickness, the *calculated* times to traverse chords corresponding to axes of 20, 30, 40, 50, 60, 80, 90 and 150 degrees would be 6·1, 7·5, 8·7, 10·2, 11·6, 14·5, 15·7 and 21 minutes. The *observed* times for these paths are 5, 6·5, 8·5, 10·5, 12, 15, 16 and 22 minutes. These approximations between calculations and observations suggest that the region of rapid change between crust and gēite commences where melting temperatures probably prevail.

In venturing these speculations on a geitic core which will satisfy seismometrical and other tests, the fact must not be overlooked that, as earthquake measurements are yet in an embryonic state, figures which have been given relating to the same, although they represent the work of many years, are subject to modification. Amongst the various earth cores which are in harmony with the requirements of astronomy and geodesy, there is at least one which is homogeneous. If the radius of this can be increased 1/7 and it can have the properties of gēite, it will also accord with seismometrical observations.

Other speculations respecting the arrangement and character of materials beneath the earth's crust are based upon the fact that at certain observatories magnetic needles are disturbed by the large waves of earthquakes. These perturbations do not appear to be explained by the assumption that the magnetometers have been tilted. An alternative is to assume that they are due to changes in magnetic intensity possibly brought about, as Capt. E. W. Creak, F.R.S., points out, by changes of stress in a near magnetic medium. If this is the case at those stations where needles are caused to rotate, magnetic intensity and gravity should have abnormal values. This appears to be true for Batavia, near to which there are many volcanoes, indicating the proximity of dense magnetic materials, and for Bombay, where there is basalt, and at no great distance a hidden chain of heavy matter revealed by gravitational observations. At Kew and Greenwich and other stations where needles are not disturbed, magnetic intensity and gravity are not abnormal. Generally speaking, where horizontal force is comparatively low, the difference between the value of g as observed and as expected is also low, and to a certain extent the contrary holds good. On these points, however, until more material has been collected, it is impossible to speak definitely.

What seismometrical observations then lead us to suspect is that beneath the light crust of the earth, which we know to be thinner in some places than in others, there is a magnetic medium of density greater than the crust, which, as we descend in depth, may rapidly pass into a fairly homogeneous nucleus of gēite, the dimensions, physical and chemical characters of which have been suggested. J. MILNE.

THE SOUTHERN CROSS ANTARCTIC EXPEDITION.

THE magnetic observations made in this expedition[1] have been reduced and prepared for printing by Dr. Chree, F.R.S., and M. Bernacchi, and the meteorological by Commander Hepworth, C.B., and Mr. Curtis, of the Meteorological Office, under the direction of Dr. W. N. Shaw, F.R.S., secretary of the Meteorological Council, and the results have been published by the Royal Society. In this expedition, fitted out by Sir George Newnes, the magnetic observations were made in about equal proportions by M. Bernacchi and Lieut. Colbeck, R.N.R., other observers also giving their assistance in the meteorological work.

The magnetic observations consist of determinations of declination, horizontal force, and inclination, made at Cape Adare, in latitude 71° 18′ south, and longitude 170° 9′ east, with some detached observations of inclination at other places. At Cape Adare observations of declination were made on a number of days in the months of April, May, October, November and December, 1899, giving a mean easterly declination of 55° 49′. Corresponding observations for horizontal force give a mean value (C.G.S. units) of 0·04143, and observations for inclination a mean value of 86° 34′. Observations for the diurnal variation of declination were made on three days, in April and May, 1899, and January, 1900, respectively, giving on the whole a diurnal movement of some 2°, that on the April day

[1] Magnetic and Meteorological Observations made by the *Southern Cross* Antarctic Expedition, 1898–1900, under the direction of M. Borchgrevink, Commander of the Expedition.

being very much greater than that on the day in May —three times as great—indicating in a short time a seasonal change that seems to require further observation to confirm. The material is insufficient for much to be said as regards diurnal variation of horizontal force.

Dr. Chree adds the remark that though at first sight the changes in declination seem quite out of proportion to the changes of the force, this is not really the case, but that, as a matter of fact, the changes in direction and intensity are occasioned by disturbing forces which are of the same order of magnitude. He makes some comparison also with results found in the *Erebus* and *Terror* voyage.

There are notes of aurora. On one occasion, May 30, 1899, it is remarked that the movement of the magnet was most conspicuous during the active time of the aurora. Dr. Chree adds that many of the observations were taken in disadvantageous circumstances, and with a limited instrumental outfit, so that some of the conclusions arrived at should be accepted with reserve, at the same time remarking that the zeal and care of the observers under physical discomfort seemed to merit this attempt to do full justice to their work which, it is thought, might help to direct attention to special points of inquiry as regards other expeditions setting out, or likely so to do.

The meteorological results include a daily record of barometric pressure, air temperature, depression of wet bulb, direction and force of wind, character and amount of cloud, bright sunshine and precipitation, from March, 1899, to January, 1900, the observations (excepting of the last two mentioned elements) being taken at intervals of two hours day and night in the months of June and July, and in the remaining months at intervals of two hours from 9h. a.m. to 9h. p.m., in all cases accompanied by descriptions of weather; there are also various monthly abstracts of meteorological phenomena. Interesting descriptions of the numerous appearances of aurora are given, but whether synchronising or not with unusual magnetic motion does not directly appear, excepting on the one occasion already mentioned. The meteorological section is preceded by an introduction by M. Bernacchi explanatory of various matters, at the end of which he says it is of course premature to attempt to give a truly satisfactory description of the prevailing winds and temperature conditions in high southern latitudes until one year's observations at numerous stations on Antarctic lands are obtained, but expresses the hope that the Cape Adare observations may yet make our knowledge of the region less hypothetical than before.

NOTES.

THE death is announced, in his eightieth year, of Prof. Julius Victor Carus, professor of zoology in Leipzig.

THE German Association of Naturalists and Physicians will hold its seventy-fifth annual meeting this year at Cassel, on September 20–26.

THE annual meeting and conversazione of the Selborne Society will be held on Tuesday, May 5. The president, Lord Avebury, will occupy the chair.

AN international agricultural conference will be opened at Rome on April 13. Sir Thomas Elliott, secretary to the Board of Agriculture, will represent the Board at the conference.

LORD BLYTHSWOOD has been elected a member of the Athenæum Club under the rule which empowers the annual election by the committee of nine persons "of distinguished eminence in science, literature, the arts, or for public services."

THE University of Toronto has, *Science* reports, received subscriptions amounting to 6000*l.* toward a convocation hall, of which sum Mr. Chester Macy has given 1000*l.*, and Prof. and Mrs. Goldwin Smith 400*l.*

THE following are the subjects of lectures arranged for the Wednesday evening meetings of the Society of Arts after Easter:—"Modern Bee-Keeping," by Mr. W. F. Reid; "Automatic Wagon Couplings," by Mr. T. A. Brockelbank; "The Construction of Maps and Charts," by Mr. G. T. Morrison; and "Preservation of Big Game in Africa," by Mr. E. North Buxton.

THE Carnegie Institution has granted 1200*l.* to be expended under the direction of Dr. T. C. Chamberlin, of the University of Chicago, in research relative to fundamental problems in geology. The Institution has also made a grant to Dr. J. E. Duerden, late curator of the Jamaica Museum, to assist him in his work on the morphology of recent and fossil corals.

THE council of the Geologists' Association has arranged an excursion for April 18 to New Cross to examine the reopened cutting south of the L.B. and S.C.R. station, which shows the junction of the London Clay and the beds below. This interesting section will be hidden again shortly, and geologists who have not yet examined it will be glad to hear of the excursion, the details of which were arranged too late for insertion in the April circular of the Association.

REPLYING in the House of Commons to a question by Mr. Schwann asking what is the present position of Mr. Jamsetjee N. Tata's scheme for a scientific research institution in India, and what support has been given to the scheme by the Government of India, Lord George Hamilton, the Secretary of State for India, said that he understood that Mr. Tata's scheme for a scientific institution is in abeyance for a time.

A MINERAL survey of Ceylon has been commenced with Mr. A. K. Coomaraswamy as director, and Mr. J. Parsons as assistant. It is intended to carry on investigations for three years, the results afterwards to be embodied in a report on the mineral resources of the island. Chemical work in connection with the survey will be carried out at the Imperial Institute, South Kensington. The headquarters of the survey are for the present to be at Peradeniya.

A CORRESPONDENT of the *Lancet* reports that Mr. Henry Phipps is so pleased with the purposes to which the Viceroy decided to devote his donation of 20,000*l.*, viz. between a central agricultural laboratory and a Pasteur institute for southern India, that he has increased his gift by another 10,000*l.* The Government of India hopes to be able to carry out measures for combining agricultural education, scientific research, and practical experiment in one locality.

THE Paris correspondent of the *Times* announces that Dr. Roux, of the Pasteur Institute, has been awarded the Prix Osiris of 100,000 francs by the Institute of France. We learn from the same source that the prize owes its existence to the generosity of M. Osiris, and is now awarded for the first time. It has been founded as a stimulus to original discovery and valuable work in the domain of science, art and letters. In unanimously deciding to give the prize to Dr. Roux, the Institute of France has recognised the high value of his scientific labours in preventive medicine and bacteriology.