

At the last meeting the report of the Commission on Maritime Meteorology and Storm Warning Signals was considered. The recommendations of the commission regarding day and night signals, drawn up at the meeting held in London in September, 1912, were adopted except for a few points, such as the night signal for a hurricane, which was found to be likely to be confused with other signals already in use. These recommendations have already been described in NATURE (*loc. cit.*). A substantial measure of international agreement in the matter of day and night storm warning signals has thus been attained.

The Rome meeting of the committee was the third which has been held since the Conference of the Directors of Meteorological Observatories and Institutes which met at Innsbruck in 1905. In accordance with established practice another conference of directors should be held before the committee can hold another meeting, and it was agreed to call together such a conference for the year 1915. Holland was suggested as a suitable country for the meeting.

M. Palazzo had been at great pains to entertain his visitors and to afford them opportunities of seeing the geodynamical and meteorological observatories near Rome. On the Tuesday the committee was entertained at a dinner, at which the Chief Inspector of Mines presided on behalf of the Minister of Agriculture, who sent a message regretting his inability to be present in person. On Wednesday the members were received at the International Institute of Agriculture by its president, the Marquis de Cappelli. The whole of Thursday was devoted to an excursion which had for its object the seismological observatory at Rocca di Papa, with which was combined a visit to the Lake of Albano and to Frascati. On Friday afternoon the committee was invited to a meeting of the Physical Society at Rome, where it was welcomed by the president, Prof. Blascona, and subsequently listened to a lecture by Prof. Bjerknes on the fields of force.

On Saturday afternoon, April 12, the military observatory at Bracciano was visited by motor. This observatory has been recently established, and many of the instruments were not yet finally installed. It is fully equipped, not only for ordinary meteorological work, but also for taking aerial soundings with kites, registering or pilot balloons. A pilot balloon ascent was carried out in the presence of the visitors, who were subsequently entertained by the commandant and his officers.

#### NICKEL STEELS IN CLOCK CONSTRUCTION.

IN a pamphlet on "Les Aciers au Nickel et leurs Applications à l'Horlogerie" (Paris, Gauthier-Villars), M. Ch-Ed. Guillaume gives in a simple form an account of the properties of nickel steels and of their application to the construction of compensated clocks, chronometers, torsion clocks, and even watches. The well-known peculiarities of the nickel steels as regards dilatation and variation of elastic modulus and other properties with temperature are briefly described and explained on the ground that the presence of nickel depresses the temperature of the allotropic modification which occurs in iron at 890° C., and at the same time changes the transformation point of iron into a wide range of transformation temperature in the alloys. It is when they are within this widened transformation range that these steels possess abnormally low coefficients of expansion, &c.

M. Guillaume's exposition of the applications of these steels shows, however, that although the alloy-

steel known as "invar" can be produced so as to have negligibly low expansion, that is not the result to be desired for horological purposes. In the case of clock pendulums having an invar rod, with bob and suspension of other metal, the compensation principle of Graham, used in the mercury pendulum, is employed, but the use of a nickel steel of low expansion avoids the use of a liquid and makes the attainment of compensation both simpler and more perfect in its results. A steel of zero expansion would be less convenient.

More striking still is the application of nickel steel of a desired (low) coefficient of expansion to the balance-wheels of chronometers of high accuracy. Here the use of these special steels has made it possible to eliminate the second-order errors arising from the fact that compensation effected for two definite temperatures did not, with the older materials, avoid serious errors at intermediate temperatures, owing to the fact that the expansion curves of the two compensating metals only crossed at two points and lay widely apart at intermediate temperatures.

The elimination of this secondary error has made it worth while to seek other improvements in chronometer construction, so that an almost revolutionary improvement in these instruments has been brought about. For watches in which a compensated balance-wheel is excluded on account of cost, the use of a hair-spring of a special nickel steel, to which some chromium has been added in order to raise the naturally low elastic limit, has resulted in the evolution of a cheap method of producing compensated watches. In this case the abnormal manner in which the elastic modulus of these steels varies with temperature has been utilised.

The similar anomalous variation of the torsion modulus has also been utilised in connection with the construction of clocks with torsion pendulums, and has brought these clocks into the range of reasonably accurate instruments for the measurement of time. They have the advantage of requiring very little driving power, and can therefore run for four hundred days on a single winding.

M. Guillaume points out that these important developments must all be regarded as resulting from the study of the internal transformations of solutions and of alloys and that they have resulted indirectly from the study of nickel steels for purposes of metrology. The gradual and also the transient changes of dimension to which steels of the "invar" type are known to be subject are fortunately too minute to interfere with these applications, provided the steel has been properly aged. W. ROSENHAIN.

#### VARIATIONS OF THE SPECTRUM OF TITANIUM IN THE ELECTRIC FURNACE.

ENHANCED lines are taking a more and more prominent part in the discussion of both terrestrial and celestial spectra, and another valuable contribution to the subject comes from the researches of Mr. A. S. King, of the Mount Wilson Solar Observatory (*Astrophysical Journal*, vol. xxxvii., No. 2, March). The investigation which he has in hand deals with variations in the spectrum of titanium by different temperatures of the electric furnace in order, if possible, to fix the place of the enhanced lines on the temperature scale. As enhanced lines are in general difficult to produce in the furnace, he made the attempt of forcing the furnace temperatures up in order to make them appear in the spectra. This he has very successfully accomplished, and in the process he has been able to observe several re-

markable phenomena bearing directly on the nature of enhanced lines in general, which he describes in the present communication. Using larger dispersion than in his former experiments, and employing thinner tubes in the furnace, he ran the furnace until the tube wore thin with the strong vaporisation of the carbon, and ultimately broke. It was near this breaking period that the important observations were made.

The description of the experiments is given very fully in the paper, and is finely illustrated with reproductions of some of the spectra obtained, but here only the leading features of the research can be stated. The titanium enhanced lines appear in the regular furnace spectrum for temperatures probably somewhat higher than 2000° C., but are very faint compared with the arc lines. At still higher temperatures, the furnace conditions still existing, there is an indication of a slight increase in the relative strength of the enhanced lines. At the stage when the furnace tube burns through, resulting in the formation of a low-voltage arc, the consumption of electrical energy at the point being very large, the enhanced lines of titanium and the spark line  $\lambda 4267$  of carbon appear with an intensity usually attainable only in powerful sparks. Photographs taken with the slit across the entire image of the tube's interior show that the relative strength of the enhanced lines is much greater in the centre of the tube than near the wall, the effect being very pronounced in the case of the carbon spark line. Mr. King also directs attention to the important observation that the vapour in the centre of the broken tube shows a tendency to give a line farther to the red than near the wall, this being shown in the increasing dissymmetry of the lines from the end towards the middle. This effect, he points out, is in harmony with the action of the condensed spark, but can scarcely, in the case of the furnace lines, be ascribed to pressure.

#### ARISTOTLE AS A NATURALIST.<sup>1</sup>

AMONG the isles of Greece there is a certain island, *insula nobilis et amoena*, which Aristotle knew well. It lies on the Asian side, between the Troad and the Ionian coast, and far into its bosom, by the little town of Pyrrha, runs a broad and sheltered lagoon. It is the island of Lesbos. Here Aristotle came and spent two years of his life, in middle age, bringing his princess-bride from the petty court of a little neighbouring State where he had already spent three years. It was just before he went to Macedon to teach Alexander; it was ten years later that he went back to Athens to begin teaching in the Lyceum. Now in the "Natural History," references to places in Greece proper are very few indeed; there is much more frequent mention of places on the northern and eastern coasts of the Ægean, from Aristotle's own homeland down to the Carian coast; and to places in and round that island of Lesbos or Mytilene, a whole cluster of Aristotle's statements and descriptions refer. Here, for instance, Aristotle mentions a peculiarity of the deer on a neighbouring islet, of the weasels by the wayside by another island town. He speaks of the big purple Murex shells at Cape Lectum, and of the different sorts of sponges found on the landward and the seaward side of Cape Malia. But it is to the lagoon at Pyrrha that Aristotle oftenest alludes. Here were starfish, in such abundance as to be a pest to the fishermen; here the scallops had been exterminated by a period of drought, and by the continual working of the fishermen's dredge; here the sea-urchins come into season in the winter time, an

unusual circumstance. Here among the cuttlefishes was found no octopus, either of the common or of the musky kind; here was no parrot-wrasse, nor any kind of spiny fish, nor sea-crawfish, nor the spotted nor the spiny dog-fish; and, again, from this lagoon, all the fishes, save only a little gudgeon, migrated seaward to breed. And though with no special application to the island, but only to the Asiatic coast in general, I may add that the chameleon, which is the subject of one of Aristotle's most perfect and minute investigations, is here comparatively common, but is not known to occur in Greece at all.

I take it then as probable, or even proven, that an important part of Aristotle's work in natural history was done upon the Asiatic coast, and in and near to Mytilene. He will be a lucky naturalist who shall go some day and spend a quiet summer by that calm lagoon, find there all the natural wealth *ὅσον Λέσβος . . . ἐντὸς ἔργει*, and have around his feet the creatures that Aristotle loved and knew. Moreover, it follows for certain, if all this be true, that Aristotle's biological studies preceded his more strictly philosophical work; and it is of no small importance that we should be (so far as possible) assured of this, when we speculate upon the influence of his biology on his philosophy.

Aristotle is no tyro in biology. When he writes upon mechanics or on physics, we read him with difficulty: his ways are not our ways; his explanations seem laboured; his science has an archaic look, as it were coming from another world to ours, a world before Galileo. Speaking with all diffidence, I have my doubts as to his mathematics. In spite of a certain formidable passage in the "Ethics," where we have a sort of *ethica more geometrico demonstrata*, favourite use of the equality of the angles of a triangle to four right angles, as an example of proof indisputable, in spite even of his treatise, "De Lineis Insecabilibus," I am tempted to suspect that he sometimes passed shyly beneath the superscription over Plato's door.

But he was, and is, a very great naturalist. When he treats of natural history, his language is our language, and his methods and his problems are well-nigh identical with our own. He had familiar knowledge of a thousand varied forms of life, of bird, and beast, and plant, and creeping thing: he was careful to note their least details of outward structure, and curious to probe by dissection into their parts within. He studied the metamorphoses of gnat and butterfly, and opened the bird's egg to find the mystery of incipient life in the developing chick. He recognised great problems of biology that are still ours to-day, problems of heredity, of sex, of nutrition and growth, of adaptation, of the struggle for existence, of the orderly sequence of nature's plan. Above all, he was a student of life itself. If he was a learned anatomist, a great student of the dead, still more was he a lover of the living. Evermore his world is in movement. The seed is growing, the heart beating, the frame breathing. The ways and habits of living things must be known: how they work and play, love and hate, feed and procreate, rear and tend their young; whether they dwell solitary, or in more and more organised companies and societies. All such things appeal to his imagination and his diligence. Even his anatomy becomes at once an *anatomia animata*, as Haller, poet and physiologist, was wont to describe the science to which he gave the name of physiology. This attitude towards life, such knowledge got thereby, afterwards helped to shape and mould Aristotle's philosophy.

I have no reason to suppose that the study of biology "maketh a man wise," but I am sure it helped

<sup>1</sup> From the Herbert Spencer lecture delivered at Oxford on February 14 by Prof. D'Arcy W. Thompson, C.B.