THE AUTUMN MEETING OF THE IRON AND STEEL INSTITUTE.

WHEN Buxton was selected as the locality for the autumn meeting of the Iron and Steel Institute doubts were freely expressed as to the suitability of the choice. These doubts proved to be groundless, for the attendance of members was larger than usual, and visits to the Midland Railway works at Derby, the London and North-Western works at Crewe, and to the Staveley Iron Works afforded opportunities for instruction, while the beautiful weather conditions caused the Duke of Devonshire's garden-party at Chatsworth, and other excursions in Derbyshire, to be very successful and enjoyable functions.

From a scientific point of view, the paper which attracted the most attention was that on the theory of hardening carbon steels, by C. A. Edwards, of Manchester. As is well known, metallurgists have long been divided into two camps, the "carbonists" and the "allotropists," and at times much heat has been introduced into the discussions which have taken place. The position advocated by Mr. Edwards is to an extent an intermediate one, as it is based on the assumption of the existence of three allotropic forms of iron, known as α, β, and γ respectively. At the same time, the absolute necessity of carbon for true hardening is maintained. After a clear explanation of the elementary facts connected with the phase rule in its application to alloys in general, and particularly to the iron carbon series, the author concludes that the hardness of carbon steel is due to the retention, by quenching, of the solid solution of carbon, or carbide of iron, in γ iron, and that the β-iron theory, as applied to the explanation of the increased hardness of steel, is untenable. The solid solution of carbon or carbide in γ iron decomposes with slow rates of cooling, and some force must be applied to prevent inversion taking place. The force is mechanical, and is caused by the contraction of the outer shell. There is no constitutional difference between austenite and martensite, the apparent difference being due to the twinning of the γ solid solution as a result of the mechanical pressure.

In the discussion which followed the reading of this paper, Prof. Arnold warmly congratulated the author on his contribution, but contended that more facts were required before generalisations were accepted, and pointed out that the cooling curves as given by himself, and confirmed at Charlottenburg, did not agree with those published by Dr. Carpenter. The latter stated that the difference was not one of observation, but of methods of recording and of interpretation. Prof. Turner asked for evidence of twinning, and suggested that twinning in crystalline rocks or in the brasses was the result of annealing after pressure, but that in the hardening of steels there was no such annealing.

Two papers which also led to an interesting discussion were taken together, and dealt, *inter alia*, with the changes on the length of cast-iron bars when cooling in a sand mould. These papers were entitled "The influence of Silicon on the Properties of Pure Cast Iron," by A. Hague and Prof. T. Turner, and "Manganese in Cast Iron, and the Volume Changes during Cooling," by H. I. Coe. It was pointed out that in Prof. Turner's original papers on silicon in cast iron, published in 1885, the materials used were relatively impure, and though the results have been confirmed by very extended practical application, it was thought well to start with the purest available materials and to observe the temperature and contraction changes and the microstructure, which had not been examined in the earlier tests. White iron, when free from elements other than carbon, shows only two slight arrests in the rate of contraction, and these correspond with the eutectic and the pearlite points respectively. On adding silicon or manganese, the iron, though still white, expands during and immediately after solidification. With more silicon the carbon is thrown out of solution, and a marked additional expansion occurs. Though much manganese tends to make iron white, about 0·5 per cent. of manganese, in presence of silicon, produces more secondary graphite, and thus lowers the combined carbon. In the manganese series of white iron the expansions form a regular curve with the percentages of manganese, and minima are found corresponding with the existence of four definite carbides. In the grey-iron series the expansions were relatively large, and the pearlite point disappeared suddenly with about 3·5 per cent. of manganese.

In the discussion references were made to the great detail involved in such an inquiry, and to the need of further work and generalisation. In a paper by S. Hilpert and E. Colver-Glauert, sulphurous acid was recommended as an etching agent for metallographic work. The acid is used as a saturated solution of sulphurous acid in water. It should be free from sulphuric acid, and should be diluted with water to about 3 or 4 per cent. of such acid. The time taken is said to vary from seven seconds to one minute. S. Hilpert, of Berlin, submitted a useful note on the preparation of magnetic oxides of iron from aqueous solutions, and stated that the production of Fe_3O_4 from aqueous solution is only possible through the precipitated FeO dissolving in the ammoniacal residue. The true magnetic oxide is Fe_2O_3 in the form of ferric ferrate, and the magnetic properties of Fe_3O_4 have their source in the acid properties of Fe_2O_3.

The remaining papers of a varied programme dealt with briquetting iron ores, electric power and electric steel refining, the Hanyang iron works in China, the production of rolled **H** beams, and experiments on fatigue in metals.

THE GEOLOGICAL CONGRESS AT STOCKHOLM.

THE eleventh International Geological Congress in Stockholm from August 17–25 has been generally pronounced by the members to have been one of the most successful yet held. There was an attendance of about 900, including representatives of all European countries except Portugal, of Australia, China, and Japan, and a distinguished contingent from America. The excursions at this congress have been unusually various and instructive, and they were heartily enjoyed, thanks to their skilful organisation and management. Before the meeting there were excursions to Spitsbergen, Lapland, and central Sweden; during it to the Archæan areas and glacial deposits around Stockholm and Upsala, and to the classical Silurian sections at Gothland; and after it to the chief iron fields and areas of geological interest in southern Sweden. The library of guide-books issued for the excursions forms an invaluable summary of the field geology of Sweden. The Swedes as a people are characterised by the thoroughness of their work and the charm of their manners; the foreign visitors return impressed by the excellence of Swedish contributions to geology and with pleasant memories of the hospitable reception from all classes, from the gracious courtesy with which the King and Queen received us in the palace to the smiling welcome of the peasants in the field.

So much work was done at the congress that no adequate account of it can be given in a short notice. Five sections and various commissions and committees met simultaneously.[1] The discussions were sometimes not influential, for they often followed the reading of several disconnected papers, and many of the speeches were rather further contributions to the subject-matter than discussions of the papers that had been submitted.

The first formal meeting of the congress was held on August 18, when the honorary president, H.R.H. Prince Gustave Adolphe, welcomed the congress in a graceful speech, referring to the dependence of mining on geology and the increasing importance of science now that it is devoting more attention to practical questions. The King of Sweden then declared the congress open. Prof. de Geer was installed as president, and gave a lecture on "The Geochronology of the last 12,000 Years." He remarked the complete failure of previous attempts to measure geological time in years, and described his determination of the length of post-glacial time in the Stockholm district. He noticed there that the marine post-glacial clays

[1] For notes on some of the meetings the writer is indebted to Prof. Hobbs, Prof. Cole, and Dr. J. W. Evans.

had been deposited in regular layers, which differ in colour and composition; the same succession is repeated time after time, with layers of varying thickness. He early suspected that each cycle in this series might represent one year's deposition, the layers laid down in the summer being thicker, as the floods then carried most mineral matter to the sea, and being brown owing to oxidisation, the autumnal layers being thinner and also blacker, owing to the higher percentage of organic matter. Near Stockholm there are many small linear moraines, each line of which he thought might be the terminal moraine deposited in one year. After thirty years' work he has discovered, by the correlation of the evidence of the seasonally banded clays, of the northward advance of their successive layers as they followed the receding ice front, of the annual moraines, and of the annual delta deposits laid down at the mouths of glacial rivers, that the retreat of the ice from Scandinavia was more rapid and less ancient than had been thought. The ice covered the site of Stockholm only a few thousand years ago, and withdrew at the rate of 200 metres a year. The latter part of the lecture was abridged, but Prof. de Geer announced that at Ragunda he had found a section which showed the full sequence of clays, from a layer formed in 1796, through a succession of lake clays and a fjord clay, to the seasonally banded clays deposited along the front of the receding ice-sheet; and, according to his determination, the ice receded from Ragunda only 7000 years ago. Prof. de Geer concluded his lecture with expressions of hope that the application of his method would allow of positive proof whether the glaciations of Scandinavia, the British Isles, and North America were synchronous.

Prof. Van Hise then delivered a lecture on "The Influence of Applied Geology and the Mining Industry upon the Economic Development of the World." He confined his lecture to the conservation of natural resources, and considered mainly the cases of iron and coal, as the failure of other metals would involve only minor readjustments. The working of coal and iron on a large scale introduced the industrial revolution of the nineteenth century, and gave commercial supremacy to countries endowed with both minerals. A civilisation can exist without iron; but a man with a wooden plough could till only one-tenth as much as with an iron plough, and hence the exhaustion of iron would mean that countries would support much smaller populations. The supply of high-grade iron ores will not last long in the chief iron-producing countries, but the quantities of low-grade ores are so immense that the total failure of iron ores is practically out of the question. Moreover, much of the iron extracted is available for all time. The coal question is more serious, as fuel when burnt is gone for ever, and the supply is so limited that it cannot last indefinitely. At the present rates of consumption, the coal in Britain and Germany may last from 500 to 1000 years, and the United States has sufficient for 6000 years; but if the consumption continues to increase at its recent rate all the coal in seams that can be worked under existing conditions will be used in 150 years; within 100 years rising prices will force men to turn to other sources of power—natural gas, petroleum, tides, and the sea; these, though all possible sources of power, are too expensive. The only perennial source of cheap power is water. The industrial future lies with countries rich in iron ores and water-power. Scandinavia has both, and it is especially favoured, as its recent glaciation has left so many lake basins, which provide easy water storage and the uniform discharge most suitable for the production of power.

Prof. van Hise made an earnest appeal to men of science to ask how long our natural resources can last, and to protest against needless waste. Primitive man and any philosopher at the beginning of the nineteenth century would have felt confident that natural resources would last indefinitely. But it is now manifest that new principles must apply to the conservation of our mineral supplies, and it is our manifest duty to leave our descendants a fair share, so that they may enjoy the comfort and leisure necessary for the intellectual development by which they can attain the godlike destiny of man.

Iron Ore Supplies.

The question of the iron ore supplies of the world was subsequently considered in a conference opened by the Prime Minister of Sweden, M. Lindman, who declared the conservation of iron ores to be more necessary than of coal, as water supply offers a permanent source of power and heat. He stated the measures adopted by Sweden to limit the export of its high-grade ores; they appear to amount to the future nationalisation of the chief iron mines.

Prof. Sjögren regarded the iron ore reserves as practically inexhaustible, and he added some fresh data to those announced in the report on the iron ore reserves of the world. Estimates received from Mr. Inouye, of Japan, show that the reports as to the unlimited iron ores in China are without adequate foundation. According to Prof. Sjögren, the best idea as to the amount of ore available in the less known regions of the world can be learnt by multiplying the area by a factor obtained by dividing the ore reserves, actual and potential, of Europe, the United States, and Japan, by their total area. On that assumption the ore supply available is 425,000 million tons.

Prof. Beyschlag defended the estimates of German ore supplies prepared for the congress from some recent criticisms, and proposed a commission to secure official evidence as to the ore reserves of the United States and the chief iron-producing countries.

M. de Launay, on the other hand, issued a warning against a serious possible source of loss, which is often disregarded by the advocates of conservation. There are in Europe vast quantities of low-grade ores, distant from supplies of fuel or power, that could not be worked in competition with the high-grade ores of many countries not yet iron-producing. If the European low-grade ores are not used now, in fifty years' time they will probably be useless. M. de Launay claimed, therefore, that under such conditions the sound policy is to accelerate by all means the production of these ores.

Prof. J. F. Kemp also repudiated the fears of an iron famine. He predicted a diminished demand on iron ores, as we are now passing from the age of steel to the age of cement, and also further discoveries of ores, such as that in Cuba, which will probably lead to the establishment of large iron works on the Atlantic coast of America. He insisted that the critical point with iron is not the supply of ore, but the exhaustion of the coking coals. Even if all the heat be supplied by electricity, half a ton of coking coal will still be required for the reduction of a ton of ore.

The only speaker in the discussion, Prof. J. W. Richards, of Lehigh, also agreed that the danger is with the coking coal, and he suggested a commission on the supplies of this material.

Glacial Erosion.

The first sectional discussion was on glacial erosion, under the chairmanship of M. de Margerie. Papers were contributed by Profs. Högbom, Penck, Davis and Reusch, and Dr. Nordenskjold, and in the discussion speeches were made by Profs. Wahnschaffe, Baltzer, Heim and Salomon, Dr. G. F. Becker, and Dr. Sederholm. Prof. Penck, in an eloquent summary of his paper, explained the evidence which has led him to attribute the main work in the formation of Alpine valleys to the action of ice. Prof. Davis insisted on the importance of the physiographic study of the question, and the comparison of never glaciated mountains, taken as the "norm" of mountain form, with those that have been glaciated; he advocated the formation of cirques by the "plucking" away of the rocks at the head of a valley, until the whole mountain ridge at the head of the valley may be torn away. Prof. Högbom, while advocating the erosive power of ice, remarked the difficulty of explaining some Swedish valleys that had been filled with ice, which had not removed their soft, pre-glacial deposits. Prof. Wahnschaffe referred to cases where ice had covered soft deposits, and had not even shifted boulders lying on them.

Prof. Reusch described the glaciated valleys near Christiania, which he thought were pre-glacial, and contrasted the effect of low-level ice in deepening and moulding valleys with the planing effect of high-level ice. The powerful influence of pre-glacial structures in determining the course and character of ice-worn valleys was also maintained by Dr. Becker, who attributed the Yosemite and other valleys in the Sierra Nevada to the existence of a vast system of joints, the decomposed rocks along which have been removed by ice. Dr. Nordenskjold insisted that long straight valleys like fjords can only be due to ice erosion.

The adjourned discussion, with Prof. Wahnschaffe in the chair, was opened by Prof. Salomon, of Heidelberg, who remarked that erosion must take place where a glacier presses firmly on the ground; but we must wait for the ice to withdraw before we can study its effects, just as we have to wait for the dissection of a volcano before we can see what has been going on in the depths. He had seen cause to change his mind, and to accept the potency of glaciers as eroding agents, especially where the rock-structures lend themselves to "plucking." Joints in igneous rocks are not always evenly distributed, and thus one part of the same mass may show erosion while another resists. The suggestion of the action of freezing water in the rock-joints under a glacier deserves full consideration. Dr. von Dechy, from his studies in the Caucasus, urged that much seeming erosion was due to the clearing out of previously filled valley floors and of lake basins by glaciers, and by catastrophic glacier-slides. Prof. Wahnschaffe remarked that the Caucasian area was not comparable with that north of the Alps, since no great Piedmont glacier had formed north of the Caucasus. Prof. Heim, in a vigorous speech, said the rock-surfaces were palimpsests of river action and glacier action, and the work of each was thus obscured. While stream action concentrates itself in a portion of the valley floor, a glacier spreads too widely to compare with it in erosive power. So-called "plucked" masses had often merely fallen from above on to the ice, and had come out below. Glaciers have overriden Alpine landslides, but even then without carrying many blocks away. The broad, rounded form of glacier valley floors may even be due to the wandering of a previous stream from side to side within its valley walls. Then comes a glacier, and gives a final touch to the form, overriding the taluses of a previous age at either side.

Prof. Högbom, of Upsala, regarded the great chalk masses, said to have been moved in northern Germany and elsewhere by glacial erosion, as having been prepared by fractures. He compared a great glacier to the overthrust mass in mountain-building, and the ground moraine to the breccia along the thrust plane. Erosion must be greatest under the vertical nose of an advancing glacier, and not much under the glacier as a whole. Prof. E. Stolley, of Brunswick, said the German chalk masses represented genuine plucking and pushing forward. Lakes due to glacial erosion occur even in the North German plain. Prof. Reusch confessed, like Salomon, to having changed his mind. He answered an objection in Heim's speech by showing how a glacier must leave some upstanding masses in its floor, and cannot be expected to plane all equally away. Prof. Penck, on closing the discussion, accepted excavating action of subglacial streams, especially along valley sides, and urged that the only differences between Prof. Heim and himself were now really quantitative.

The Pre-Cambrian Fauna.

The discussion on the sudden appearance of the varied Cambrian fauna showed the firm belief in the evidence of pre-Cambrian life as contended by Prof. Barrois from the graphite of Brittany, by Dr. Sederholm from traces of pre-Cambrian fossils in Finland, and by Prof. Rothpletz from the oolitic pebbles and organic traces in the pre-Cambrian conglomerates of Sweden. The discussion showed a general agreement as to the influence of the absence of carnivorous organisms from the pre-Cambrian seas. Thus, according to Dr. J. W. Evans, creatures then had no need of defensive structures, and according to Dr. R. A. Daly there was, for the same reason, an accumulation of decomposing organic matter in the early seas, and the resultant ammonium carbonate led to the precipitation of the pre-Cambrian limestones; Profs. Sollas and Steinmann both thought that the early organisms had no hard parts, which developed as the organisms became more complex. Prof. Walther suggested that the pre-Cambrian sea consisted of isolated basins, the waters of which differed in chemical composition, and that organisms living in water rich in silica secreted siliceous skeletons, those in water rich in carbonate of lime formed calcareous shells; the phosphatic skeletons of trilobites and some brachiopods were due to life in a sea rich in phosphate, and chitinous shells were developed in fresh-water basins.

In the section on general and regional geology, Dr. Evans exhibited an elaborate and ingenious model to illustrate the movements along the line of the San Andreas fault during the recent Californian earthquake. It is constructed of two sets of flexible wooden strips held together by strings at their common edge; the one part was subjected to slow lateral stresses, and suddenly released from the strain by cutting the strings. Vibrations were thus set up, the amplitudes of which were greatest at the adjacent edges, and a musical note was produced through the friction of metal attachments. Dr. Evans believed the earthquake stresses to be of slow accumulation, the larger vibratory movements after release causing the sensible shocks, the frictional small tremors the sounds.

Prof. Hobbs gave a lecture on "The Fracture Systems of the Earth's Crust," and urged their international investigation, owing to their importance in relation to land sculpture, the course of rivers, the discovery of obscure faults, and earthquake disturbances. Prof. H. F. Reid discussed the results of a recent paper on the California earthquake, and exhibited a model similar in principle, but not in construction, to that of Dr. Evans. Dissent from his views as to the cause of the earthquake was expressed by Prof. Rothpletz, Dr. Oldham, and the chairman (Prof. Hobbs).

An important paper by Prof. Tarr on the advance of glaciers in Alaska as a result of earthquake shaking indicated how the sudden advance and equally sudden subsequent stagnation of many Alaskan glaciers might be accounted for by masses of snow being shaken from the névé regions during the heavy earthquake of 1899. In discussing this paper, Prof. Frech showed how the explanation offered would account for the hitherto inexplicable sudden advances of the glaciers of the Alps.

Dr. H. Stille described the earth movements in the later rocks of north-western Germany, and showed the influence of the Palæozoic areas of the Rhine and the Harz.

Pre-Cambrian Geology.

The petrographic section met on Saturday, in the morning under President van Hise, to consider the principles of pre-Cambrian geology and the cause of regional metamorphism, and in the afternoon under M. Barrois, to discuss pre-Cambrian stratigraphic classification. There were fourteen papers and many speeches. The general result of the morning's discussion was summarised at the close by Prof. Cole as showing the great advance in recent years of the views of Michel-Levy and Barrois as to the formation of crystalline schists by intense granitic injections, which in recent years had been supported by Sederholm in Finland and his own work in Donegal. These views were clearly expressed by a statement of the evidence from Brittany by Prof. Barrois. Prof. Adams opened the discussion by an account of the constant association with the crystalline schists of vast granitic batholites, to which he attributed the metamorphosis. Dr. Sederholm exhibited a map of a Finnish islet on the scale of one-twentieth of natural size, and he described the granitisation of the pre-Cambrian sediments by injection with granite when the adjacent rocks were half melted and plastic. On the other hand, attention was directed to intrusive gneisses elsewhere which had a less metamorphic effect. Thus Prof. U. Grubenmann, of Zurich, contrasted the actions of the gneisses of Scandinavia and Finland with those of the Alps, which had done less in melting the adjacent rocks, but had a greater pneumatolitic effect.

Prof. Coleman described the alteration of conglomerates at Sudbury, Ontario, into rocks that had been mapped as

Laurentian gneisses, and contrasted the slight metamorphism of the Lower Huronian conglomerates of Cobalt with their alteration into gneiss at Michipicoten by infolding with Keewatin batholites.

Dr. Lane stated the three possible sources of the gneissic rocks known as the Laurentian, and from a comparison of the size of their constituents with those of the adjacent rocks concluded that the Laurentians must be due to the ascent of deep-seated fluid material.

In the afternoon meeting various subdivisions of the pre-Cambrian rocks were advocated. Mr. W. G. Miller explained the classification used by the Geological Survey of Ontario, which adopts three main divisions: the Keweenawan for the upper sandstones, the Huronian for the underlying schists, quartzites, &c., and the Laurentian-Keewatin for the basal complex. Prof. Coleman objected to the retention of Laurentian except as a temporary convenience, since the Laurentian are intrusive rocks of various ages. Dr. Sederholm explained the classification he had adopted for Finland and Scandinavia, where the pre-Cambrian system is broken up by great unconformities into divisions, each of which he thought from its thickness must correspond to the groups, and not to the systems, of the post-Cambrian rocks. He objected to the germs previously used, and proposed to call the pre-Cambrian rocks the Progonozoic, and to divide them into three divisions, the Archeo-, Meso-, and Næo-progonozoic.

Another case of supposed Palæozoic schists proving to be pre-Cambrian was described by Prof. J. F. Kemp from evidence displayed during recent work for the New York water supply.

President van Hise supported the threefold division of the pre-Cambrians, and Mr. Fermor the twofold division found more convenient in India, and referred to Sir Thomas Holland's term Purana for the non-foliated pre-Cambrian sediments. Miss Raisin directed attention to the analogous case in the English Midlands, and to Lapworth's term Uriconian for the comparatively unaltered pre-Cambrian volcanic series.

The petrographic section, under the presidency of Dr. Teall, devoted a morning to discussion of the principles of rock classification. Prof. Adams exhibited photographs of the structures he had produced in rocks, including the formation of flaser gabbro or augen gneiss by pressure at temperatures of 450° F. No fresh minerals were produced, but by mechanical movements the material of a massive diabase was rearranged as a gneiss.

Prof. Vogt urged the claim of eutectics as a factor in rock classification. Dr. A. L. Day explained the aims and methods of the researches on mineral formation and stability conducted in the Carnegie Institute, and expressed confidence that their methods could in time be applied to even such complex mixtures as ordinary rocks.

Dr. Whitman Cross defended the quantitative system of rock classification from recent criticisms, and said that the other systems were only less arbitrary in the degree that they were less definite. He referred to Becke's petrographic types—the Atlantic and Pacific—as based on distinctions that could not be sharply defined. Dr. Evans repeated his criticisms on the quantitative system, and the general discussion was continued by Dr. Benett, Prof. Kœnigsberger, and Prof. Tschirwinsky.

Meetings of the other sections were devoted to tectonic geology, especially of Switzerland, to the causes of the Ice age, to polar geology, applied geology, stratigraphy, and palæontology.

At the final meeting it was decided that the next meeting, in 1913, should be in Canada, and the hope expressed that the meeting in 1916 should be in Belgium.

THE THOMAS YOUNG ORATION.

PROF. R. W. WOOD, in delivering the Thomas Young Oration at the Optical Society on Thursday, September 29, described some apparatus with which he has been experimenting recently. The first of these, which he calls the echelette grating, is an instrument occupying a position between the echelon and the ordinary diffraction grating. It is a grating ruled with a crystal of carborundum on gold deposited on copper; the carborundum has the advantage over a diamond point of having perfectly straight sides meeting at an angle of 120°. The spacing is about ten times as coarse as usual. No metal is removed in ruling, but the gold is compressed so as to form ridges and hollows. The sides of these ridges are highly polished and almost optically flat. Such a grating may have various faults, such as having a flat or irregular top to the ridges, or the sides of one groove may be deformed in ruling the next; tests to determine whether the grating is free from faults were described.

A variety of gratings is obtained by altering the position of the crystal in ruling; thus some gratings have their two sides equally inclined to the surface of the plate, and in others there are inequalities in the inclinations of various magnitudes. The gratings thus obtained, with a known form of groove, have been used to determine the causes which throw the greater part of the light of a definite wave-length into one particular spectrum. These gratings bear the same relation to heat waves that the ordinary diffraction grating bears to light waves; thus they are specially suitable for use in investigations into radiant energy, being many times more efficient than prisms of rock salt. Diagrams were shown which demonstrated the greater resolving power of the grating compared with the rock-salt prism. A number of gratings were exhibited, and some of the tests for detecting faults were shown. A demonstration was also given of the ability of these gratings to concentrate the light of a definite colour into a particular spectrum.

Prof. Wood next described his mercury telescope, in which the mirror is a vessel containing mercury, the surface of which is made to assume a steady parabolic form by rotation under gravity. The practical difficulties to be overcome in preventing ripples on the mercury surface due to vibration or to a very slight obliquity in the axis of rotation were described. The mercury vessel is mounted on an axis with two conical bearings, and the whole mount is placed on a stand with levelling screws. To avoid the excessive friction due to conical bearings, the greater part of the weight is taken by a steel ball under the centre of the objective. A magnetic drive was first attempted, but was abandoned in favour of a mechanical connection consisting of half a dozen fine threads of pure elastic, thus any vibrations in the motor are absorbed by the elastic threads. Some star trails taken with the instrument in and out of adjustment were described.

Finally, some photographs of landscapes taken with infra-red light were shown.

THE POLAR ESKIMOS.[1]

ANTHROPOLOGISTS are now beginning to realise the necessity of supplementing the methods of a general ethnographic survey by a more intensive study of smaller groups within limited areas. A good example of this class of investigation is provided by the account of the Polar Eskimos by Dr. H. P. Steensby, who was a member of the expedition commissioned by the Danish Missionary Society in 1909 to establish a station in Greenland.

The tribe known as the Polar Eskimos occupies the west side of the Hayes Peninsula, extending from north-west Greenland towards the west between the Kane Basin in the north and the Melville Sound in the south. At present they number about two hundred souls. Compared with the people of the more southerly west Greenland, they appear to be a different race, the Mongolian type prominent in the latter region being here replaced by that called by Dr. Steensby the Indian. The so-called Mongolian racial characters, the low nose, oblique eyes, flat face, broad and large cheek-bones, are more prominent in the women than in the men. The skull is of the dolichocephalic class. The skin has always a yellowish ground-colour, and the so-called "Mongolian spot" is present in the sacro-lumbar region of children.

Much of the existing culture of the tribe seems to be due to the emigration of a body of their kinsmen from the coasts of North Devon and Ellesmere Land in the early 'sixties, and they present the almost unique condi-

1 "Contributions to the Ethnology and Anthropogeography of the Polar Eskimos." By Dr. H. P. Steensby. Pp. 253—406. (Copenhagen: Bianco Luno, 1910.)