

investigations, and their probable value, and pointed out some of the possible methods of correction where such exist. For example, in engine trials there are many possible sources of error. Most of these may be reduced in percentage value by continuing the trial for a sufficient period. But this is not the case with errors which may occur in the indicators, gauges, or spring balances used in the determination of power. In these, unless properly calibrated before trial, very serious errors may be introduced, amounting in some cases to 5 or 6 per cent. of the total power indicated. It is therefore, he said, absurd, even if proper precautions have been taken, to rely upon horsepower measurements to two places of decimals. With regard to tension and compression experiments with standard 10-inch bars, calibration of the testing machine is extremely difficult, and can in general only be carried out over a small portion of the range of the experiments. Deductions have therefore to be made from the less to the greater, with the result that small errors in the calibration will tend to be magnified. Vertical testing machines have fewer sources of error, and can be calibrated with more certainty, than horizontal machines. Extensometers are, however, much more easily applied to a horizontal bar than a vertical, and variable jockey weights, which are requisite if the same accuracy is to be maintained at low loads as at high, are also more readily adapted to horizontal machines. Extensometers can be made and calibrated well up to the accuracy of the testing machine. With standard bars and a measuring instrument true to the ten-thousandth of an inch, the modulus can be relied upon to the second significant figure. It is doubtful if more can be obtained without very special construction and calibration of the testing machine. The difficulty in bending experiments, again, lies in the accurate application of load. Unless the beams are very short or of unmanageable cross-sections, the load measurement must be very delicate if readings approaching the accuracy of those in tension are to be obtained. It is possible that some of the discrepancies in published beam experiments may be due to this cause. The paper dealt briefly with other cases where calibration is specially needed.

Mr. Kenward's paper was of value, both from an historical and a practical point of view. It was illustrated by a number of drawings and photographs.

ANTHROPOLOGY AT THE BRITISH ASSOCIATION.

THURSDAY, August 9.—Dr. E. B. Tylor read a paper on the distribution of mythical beliefs as evidence in the history of culture. The author showed that the wide distribution of several mythical beliefs, such as the idea of souls being weighed in a spiritual balance, and that of the Bridge of the Dead, gave evidence of connecting links between the great religions of the world. The theory that the pre-Columbian culture of America took shape under Asiatic influence was supported by evidence of a similar nature. Thus, in the religion of ancient Mexico four great scenes in the journey of the soul in the land of spirits are depicted in a group in the Aztec picture-writing known as the Vatican Codex: first, the crossing of the river of death; second, the passage of the soul between two mountains that clash together; third, the soul climbing up a mountain set with sharp obsidian knives; fourth, the dangers resulting from these knives being carried about by the wind. There is a close resemblance between these Mexican pictures and certain scenes from the Buddhist purgatory depicted on Japanese temple scrolls. Here are seen, first, souls wading across the river of death; second, souls passing between two huge iron mountains, which are pushed together by demons; third, souls climbing the mountain of knives, whose sharp blades cut their hands and feet; fourth, knife-blades flying through the air. Dr. Tylor also referred to Humboldt's argument from the calendars and mythic catastrophes in Mexico and Asia, and to the correspondence in Bronze-Age work and in games in both regions, and expressed the opinion that the evidence was sufficient to justify anthropologists in considering that ancient American culture was due to a great extent to Asiatic influence.

Dr. Beddoe read a paper on complexional differences between the Irish with indigenous and exotic surnames. The author showed that dark hair and light eyes are much more prevalent among the former class of Irishmen than among the latter.

The following reports were also read:—Report of the Anthropometric Laboratory Committee, report of the Ethnographical Survey Committee, report of the Anthropometry in Schools' Committee.

Friday, August 10.—The greater part of the day was devoted to a joint discussion with the Geological Section on the plateau flint implements of North Kent. The discussion was opened by Prof. T. Rupert Jones, in a paper in which he expressed general concurrence with the views of Prof. Prestwich as to the genuineness and antiquity of the implements found in the plateau gravels. He argued that the gravel in which the flints were found must have been of pre-Glacial Age. Mr. Whitaker could not admit that there was any good evidence to connect the men who worked the flints with pre-Glacial or even with glacial times, as there were no deposits of undoubted Glacial Age in or near the district. Mr. Montgomerie Bell stated his reasons for believing that the collections of flints from the plateau gravels were of human handiwork. He said that all the evidence pointed to the working of a race of men with strongly-developed body but weakly-developed mind, and this was exactly the conclusion we should expect. Sir John Evans said that the evidence as to the Palæolithic Age in Suffolk being locally post-Glacial was irrefragable, and that the principal outcome of the recent discoveries was, to his mind, the fact that the existence of palæolithic man could be carried further back in time than the valley gravels, inasmuch as his implements are now found in gravels on plateaus at far higher levels. General Pitt-Rivers contended that a single bulb of percussion was not in itself sufficient to prove human workmanship. The bulb of percussion shows the direction in which the blow was given, but any hard knock would produce it, and it was necessary that two or three blows at least should have been given in some definite direction in order to prove design on the part of the fabricator. Dr. H. Hicks, Prof. Boyd Dawkins, Sir Henry Howorth, and Lieut.-Colonel Godwin Austen also took part in the discussion. Mr. H. Stopes read a paper on the evolution of stone implements, and the following reports were presented:—Report of the Prehistoric and Ancient Remains in Glamorganshire Committee, report of the Elbolton Cave Exploration Committee, report of the Explorations at Oldbury Hill Committee.

Saturday, August 11.—Mr. Arthur Evans read a paper on the discovery of a new hieroglyphic system, and pre-Phœnician script in Crete. During the exploration of the ancient sites of Central and Eastern Crete, the author had succeeded in bringing to light a series of stones presenting pictographic symbols of a hieroglyphic nature, and was now able to put together over seventy symbols belonging to an independent hieroglyphic system. More than this, he had discovered partly on stones of similar form, partly engraved on prehistoric vases and other materials, a series of linear characters, a certain proportion of which seemed to grow out of the pictorial forms. As in the case of the Egyptian and Hittite symbols, the Cretan hieroglyphics fell into certain distinct classes, such as parts of the human body, arms and implements, animal and vegetable forms, objects relating to maritime life, astronomical and geometrical symbols. Some of them belonged to that interesting class of pictographs which is rooted in primitive gesture language. The symbols occurred in groups, and there were traces of a boustrophedon arrangement in the several lines. The comparisons instituted showed some interesting affinities to Hittite forms. The linear and more alphabetic series of symbols fitted on to certain signs engraved on the walls of what was apparently a Mycenaean palace at Knôsos, and again to two groups of signs on vase handles from Mycenæ. It was thus possible to construct a Mycenaean script of some twenty-four characters, each probably having a syllabic value. The author gave reasons for believing that the Philistines, who, according to unanimous Hebrew tradition, came from the Mediterranean islands, and who were actually called Krethi in the Bible, in fact represented this old indigenous Cretan stock, and that they had here the relics and the writing of "the Philistines at home."

Mr. Arthur Evans exhibited a number of prehistoric objects collected during his journey and explorations in Central and Eastern Crete.

Mr. H. Balfour, in a paper on the evolution of the bow as a musical instrument, gave the aboriginal races of Africa and India the credit of providing us with the prototype of many of our best string instruments.

Miss Weld read a paper on the possibility of a common language between man and beast, in the course of which she mentioned that she had herself reduced a large and savage dog to a state of the most abject terror by imitating some of the deeper tones of his growl.

The Rev. G. Hartwell Jones read a paper on the relation between the body and mind, as expressed in early languages, customs, and myths. The conclusions at which the author arrived were that (1) the primitive condition of the pioneers of civilisation was no higher than that of modern savages; (2) the parallels presented by words and ideas in countries widely separated from one another cannot be satisfactorily explained by mere coincidence; and (3) the civilisation of Western Europe viewed as a whole began in contact with the East.

The following papers were also read:—Prof. A. Macalister, on the heredity of acquired characters; Prof. Arthur Thomson, notes on skin, hair and pigment; Dr. Louis Robinson, the anthropological significance of ticklishness; H. Ling Roth, on the presence of Negritos in Borneo; Prof. B. Windle, on mythical pygmy races; report of the Mental and Physical Condition of Children Committee.

Monday, August 13.—A paper by Prof. J. Kollmann, on pygmies in Europe, was read. Near Schaffhausen, in Switzerland, a prehistoric settlement has been discovered, in which the remains of two races were found interred side by side. The average stature of one of these races was that of Frenchmen of the present day, but the average height of the other race was only 1424 mm., and they must be looked upon as pygmies of the Neolithic period in Europe. There have recently been discovered some living pygmies in Sicily and Sardinia, and in the author's opinion these small types must be regarded, not as diminutive examples of normal races, but as a distinct variety of mankind which occurs in several types dispersed over the globe; and he believes that they have been the precursors of the larger types of man.

The present state of prehistoric studies in Belgium was described in a paper by Count Goblet d'Alviella. The manufacture of flint implements appeared to have been an important industry, extending all over Belgium, and there have been recent discoveries of megalithic monuments, the existence of which was till lately denied.

General Pitt-Rivers described the explorations of British camps and a long barrow near Rushmore. The skeletons of upwards of twenty-five persons found in and around the barrow give evidence of a people of small stature with long, narrow skulls. They belonged to the polished stone age.

The following communications were also received:—Dr. E. B. Tylor, on some stone implements of Australian type from Tasmania; H. Ling Roth, on Tasmanian stone implements; Dr. Émile Cartailhac, on the art and industry of the Troglodytes of Bruniquel, France; Dr. Émile Cartailhac, on a new ivory statuette of a woman in the reindeer period; Dr. Émile Cartailhac, on the close of the stone period on the borders of the Mediterranean; Prof. Max Lohest, observations relative to the antiquity of man in Belgium; General Pitt-Rivers, on a new craniometer; Dr. J. G. Garson, on the long barrow skeletons from near Rushmore; Dr. R. Munro, notes on ancient bone skates; Prof. A. C. Haddon, exhibition of lantern slides illustrating the people of Western Ireland and their mode of life; report of the Glastonbury Exploration Committee.

Tuesday, August 14.—Mr. Theodore Bent read a paper on the natives of the Hadramut. This valley was formerly the great centre from which frankincense and myrrh were exported to Europe by caravan routes across the desert, and the modern inhabitants of this district are quite distinct from the Bedouins of northern Arabia; they have many curious customs and a religion of their own, and are in all probability an aboriginal race.

Mr. J. Gray contributed a paper on the distribution of the Picts in Britain as indicated by place-names. The evidence of place-names shows that probably the whole country from the north of Britain to the south of Gaul was at one time or another occupied by the same race. The pre-Pictish inhabitants were Iberians, and prevailed mostly in Ireland, South Wales, Cumberland, and South Scotland.

The following communications were also received:—Mrs. H. Stopes, on three neolithic settlements in Kent; Lionel Decle, on the native tribes of Africa between the Zambezi and Uganda; Prof. Max Kovalevsky, on the Lex Barbarorum of the Daghestan; J. D. C. Schmeltz, on snails and mussels in the house-

keeping of the Indoneses; Basil H. Thomson, on the ancient religion of Fiji; B. P. Kehlpanalla, on ceremonies observed by the Kandyans in paddy cultivation.

Wednesday, August 15.—Prof. L. Manouvrier described the brain of a young Fuegian, and pointed out that the external morphology of this brain showed little or no distinction from that of a European.

The Rev. Lorimer Fison read a paper on the classificatory system of relationship. The Fuegian system of relationship divide the sexes in any one generation into groups of non-marriageable persons and other groups of marriageable persons, and it was shown that precisely the same groups appeared as the result of the division of the community into two exogamous intermarrying divisions such as are found in Australia. The inference was that wherever the classificatory terms appeared these divisions had existed in the past.

Mr. J. Graham Kerr read a paper on the Tobas of South America. These Indians are nomadic in their habits, and live entirely on the products of the chase. They believe in the existence of numerous minor evil spirits who cause diseases, accidents, and other misfortunes, but the author had not discovered that they had any notion of a supreme deity.

Mr. Alfred P. Maudslay read some notes on native buildings at Chichen Itza, Yucatan, and the customs of the Maya Indians. The author gave an account of some excavations of a burial mound in the Vera Paz of Guatemala, and the discovery of small jars containing the bones of little fingers, probably deposited by mourners. The earliest notices of the great Maya ruins at Chichen Itza were discussed, and extracts were given from a document recently discovered in Seville, in which are described the ceremonies performed by the Mayas at the time of the Spanish conquest.

The other communications received were:—Prof. L. Manouvrier, on a method of valuation of proportional dimensions in the description of the brain; H. Belyse Baildon, notes on some of the natives of British New Guinea; Miss A. W. Buckland, on the philosophy of holes; report of the North-western Tribes of Canada Committee.

SCIENTIFIC SERIALS.

American Journal of Science, August.—On certain astronomical conditions favourable to glaciation, by G. F. Becker. The elements of the earth's orbit undergo slow variations, some of which affect climate. These are the time of perihelion, which affects the length of the two great seasons; the eccentricity of the earth's orbit, and the obliquity of the ecliptic. The winter of the period of maximum eccentricity in the rigorous hemisphere would be intensely cold as compared with that of the period of zero eccentricity, but the difference would be most marked in the tropics. The summer would be intensely hot, and also wet. On the whole, the period would be most unfavourable to glaciation; the snowfall being the smallest, and the warm rainfall the largest that can occur with the present obliquity. A difference of $1^{\circ} 9'$, however, in the obliquity would make the area to the north of the Tropic of Capricorn 1,800,000 square miles greater than it is to-day, this area being rather more than the combined areas of the Mediterranean and the Gulf of Mexico. The area of evaporation supplying precipitation to the northern latitudes would thus be increased, and the conditions would be favourable to glaciation. Thus a glacial age would be due to the combination of a low eccentricity and a high obliquity, more than to any other set of circumstances pertaining to the earth's orbit. The epochs of such combinations should be deducible from astronomical data.—Development of the lungs of spiders, by Orville L. Simmons. The connection between Limulus and the Arachnida can only be established by a study of the development of the lungs and tracheæ of spiders. The lungs arise as infoldings upon the posterior surface of the appendages of the second abdominal somite, in the same manner as described by Kingsley for the gills of Limulus. The tracheæ develop from the next pair of limbs. The lung-book condition is the primitive, the tracheæ of the Arachnids being derived from it. No ground is left for those who regard the "Tracheata" as a natural group of the animal kingdom.—The generation of chlorine for laboratory purposes, by F. A. Gooch and D. A. Kreider. Chlorine may be conveniently generated by the action of hot hydrochloric acid in a half-strength solution upon lumps of potassium chlorate. These