illumination. Observing more closely, I saw about 5° above the horizon, and about 12°–15° north of Hartland Point, the appearance of the sun in a fog, but only about one-third the apparent diameter when in the same place. I watched it for about five minutes, when it was gradually obscured by the rising mist. T. MANN JONES.

Northam, Devon, January 17.

Our Latest Glacial Period.

I AM informed that near the Wash, and I suppose at other parts of the coast, the sea at low water is frozen into masses which with the rising tide become floes, and are urged backwards and forwards on the beach. This is, I believe, not a frequent occurrence on our shores, and it would be interesting if any observers could note whether the shingle or the stones embedded beneath the floes, when such are found, have become polished or scratched as by glacial action.

W. ATKINSON.

17 Trafalgar Square, Chelsea, S.W., January 5.

P.S.—My anticipation has proved correct as far as the small bergs in the Thames are concerned, for after a little search I have found in Chelsea Reach chalk blocks with grooves and striations that would be no discredit to a boulder clay specimen. I should be glad to hear of any similar markings on flint, chert, or other hard rocks, or even on limestone or sandstone, and also to learn whether there are, as I think there must be, other recorded instances of the formation of glaciated rocks in the British Isles or the coasts of Europe since Pleistocene times.

January 17.

THE GREAT FROST OF THE WINTER OF 1890-91.

TO find a parallel to this frost for intensity and endurance, we must go back, as regards London and the south of England generally, to the severe winter of 1814, when the great fair was held on the Thames, which for long presented from bank to bank a uniform stretch of hummocky ice and snow. In that year the severity of the winter was more equably felt over the whole of Great Britain than during the present winter. Thus in 1814, the mean temperature of Gordon Castle, near the Moray Firth, for January was 27°·0, whereas during last December it was 36°·5; and, so far as records go, all parts of the United Kingdom suffered nearly alike during that memorable winter.

But during this winter of 1890-91, the contrasts of temperature in the different parts of the country from Shetland to the Channel are altogether unprecedented. In Shetland and Orkney, the mean temperature of December was about half a degree above the mean of the month for the past thirty-five years. In Caithness it was about the average, but on advancing southward the cold was the more intense, till its maximum intensity was unquestionably at Oxford, where the mean of the month was 11° below the mean of the past 35 years. The following short scheme shows generally the geographical distribution of this great frost, the first column giving the depression below the mean at places on the west coast; the second, at places in the interior of the island; and the third, at places on the east coast:—

West Coast.	°	Inland.	°	East Coast.	°
Barrahead ...	−0·9	Inverness	−1·4	Fraserburgh	−0·3
Skye	−1·2	Braemar ...	−1·8	Aberdeen ...	−0·6
Islay	−2·0	Glasgow ...	−3·8	St. Abbs ...	−2·8
Douglas (Isle of Man)	−4·4	York ...	−5·6	Spurn Head	−4·7
Holyhead ...	−6·0	Loughboro'	−8·8	Yarmouth ...	−5·9
Pembroke ...	−6·7	Oxford ...	−11·0		
Scilly	−4·4	Southampton	−8·8	Dungeness...	−8·1

As occurs in all low winter temperatures, the intensity of the cold is most pronounced in situations farthest removed from the ocean. Thus, from Oxford, the intensity of the frost was in all directions less felt. In Ireland, the intensity was pretty evenly distributed, ranging below the average from −2°·5 at Dublin to 4°·6 at Foynes and Killarney.

A very cursory examination of the weather maps of the Meteorological Office shows at once the cause of this singular difference in the degree to which different parts of Great Britain have been subjected to this frost. During the whole of this period atmospheric pressure to the east and north-east of the British Islands, notably over Russia and Scandinavia, has been unusually and persistently high, rising on occasions above 31·000 inches; thus, so to speak, stopping the way to the usual easterly course of the cyclones from the Atlantic over North Western Europe. Thus, in the extreme north of the British Islands, pressure has been lowered below what prevailed to the south, and consequently the preponderance of south-westerly winds has been greater. On the other hand, farther south, barometers have been almost constantly higher than they have been away still farther to southward; and be it particularly noted, low-pressure areas, or cyclones, have been almost constantly present over the Mediterranean, or even on occasions farther south, either formed over this region or drafted in from the Atlantic, with the inevitable result that the whole of Western Europe has been overspread with polar winds from north, north-east, and east, bringing with them a degree of cold which the newspaper press has been chronicling for us at our breakfast-tables day by day.

INDIAN ETHNOGRAPHY.

OUR Indian dependencies form a vast field for ethnological inquiry which we have not as yet sufficiently cultivated; in fact, its importance is realized by but very few. What is really required is a systematic study of the various races of India, carried out according to a definite plan. Independent observers may do, and many have done, much; but by co-ordination more and better work can be accomplished. The Bureau of Ethnology in Washington has for its especial object the investigation and recording of all that relates to the North American Indians, and the splendid series of Reports issued by that Bureau form an invaluable mine of information on American anthropology. Is it too much to ask from our Government that we should have an analogous Bureau of Indian Ethnography? It would not suffice merely to have a department for researches on Indian ethnology, and for the publication of the results; something more than this is wanted. It would be necessary to have a library of works relating to Southern Asia, and to have an elaborately classified catalogue of books, memoirs, articles, and so forth, on every branch of Indian anthropology. Were this done, anyone who wished for information about a particular district would be able to find references to all that was known about the people, their customs, arts, and crafts. The catalogue should be a systematic bibliography, irrespective of the actual contents of the library of the institution, though every endeavour should be made to make this as complete as possible.

Such a Bureau, if properly directed, would serve as a great stimulus to those who are interested in the native races of India, but who require encouragement and direction. There can be little doubt that an immense number of isolated observations are lost for the lack of a suitable depository, the recorders of such observations being fully aware that these are too casual to be of much value; when accumulated, however, the case is very different. Were it known that a record of any obscure or rarely observed custom would be duly filed and so classified as to be readily available to anyone who was studying Indian folk-lore, the probability is that many memoranda would find their way to the Bureau which otherwise would be lost.

It cannot be too often or too strongly insisted upon that now is the time for the collection of all anthropological data in every department of that far-reaching science. To many, results are alone interesting, and there is too frequently a danger to generalize from imperfect data. Unfortunately in no department of science is it more easy to theorize than in this, and those who have not sufficiently studied the subject are often the most given to framing hypotheses which are as easy to refute as they are to make, and it is this which has brought discredit upon anthropology. Posterity will have plenty of time in which to generalize and theorize, but it will have scarcely any opportunity for recording new facts. This century has been one of most rapid transition. The apathy of our predecessors has lost to us an immense amount of information: let not this reproach be applied to us by our descendants.

The change which is everywhere noticeable is from individuality to uniformity. Religious beliefs are less varied than formerly, there are fewer local customs, there is greater uniformity in dress and personal ornament, the tools and weapons of the white man are now cosmopolitan. It is unnecessary to multiply instances: every book of travel directly or indirectly witnesses to these facts. The vulgarization of Oriental fabrics, the degeneration of Japanese art products, also testify to a levelling down, which together with a levelling up is characteristic of our modern civilization.

Every effort should be welcomed which endeavours to place on permanent record local peculiarities of any sort, and it is with pleasure we notice the too short paper[1] in which Herr L. H. Fischer gives the results of his personal investigations on the jewellery of the people of India and on the manner in which it is worn. As the author points out, the Hindoos are very fond of ornament: the ears, nose, neck, upper and lower arms, fingers, ankles, and toes are adorned; but not the lips, as in some African and American tribes.

The culture and history of a people are intimately

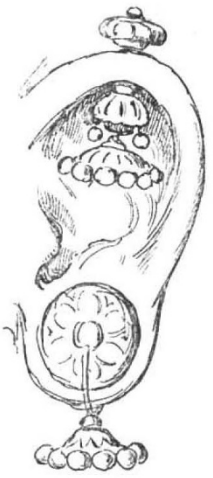

FIG. 1.—Ear ornaments

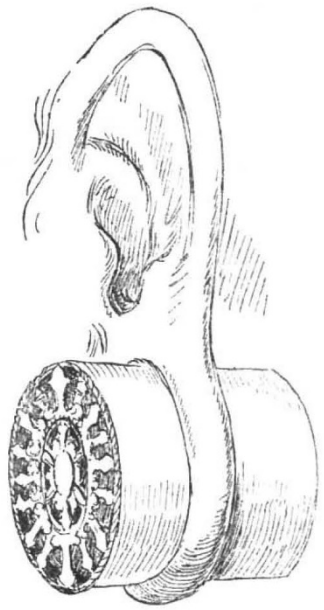

FIG. 2.—Sinhalese ear ornament; this is very similar to an ornament common in the Solomon Islands.

interwoven, and Indian history is so complicated that India at the present time appears at first sight to be a

FIG. 3.—Silversmith.

conglomeration of races, religions, languages, and States which can scarcely be unravelled; and now this is further complicated by the introduction of European culture.

At first it seems almost impossible to discriminate the typical ornaments of the separate race-stems, but in time it is discovered that the lower classes keep to traditional forms. The village smith transmits his art from father to son and grandson, always with the same archaic moulds, the same simple tools, the same designs; and it

[1] "Indischer Volksschmuck und die Art ihn zu Tragen," L. H. Fischer, 30 pp., 51 woodcuts and 6 plates, *Annalen des k.k. Naturhistorischen Hofmuseums*, Bd. v. Nr. 3 (Wien, 1890).

is only the present luxury which induces fashions. The author chiefly turned his attention to the jewellery which the main mass of the people wear, and not to that of the rich, for this appears to be frequently imitated from European articles.

The material which in India is employed for jewellery is mainly silver, pure or in mixture with tin, zinc, and lead; of these, there are many alloys which constitute a gold-like metal. As a rule, yellow metal obtains in the south and white metal in the north-west, silver always predominating. In Peshawur, for example, there is hardly anything but silver. Gold is rare in India.

India possesses all known kinds of precious and less precious stones, but the polishing is as a rule very primitive. Particular provinces appear to have a predilection for stones of a certain colour; thus, in the Madras Presidency especially, green stones are almost invariably worn in the men's earrings. In Jeypore, ornaments of Indian garnets can be bought in great abundance, and the turquoise is characteristic of the Himalaya district. Naturally all kinds of stones are imitated in glass: there are glass arm-rings in South India which are principally made in Poona, Taragalla, and Surat, and are much worn. Ivory, coral, pearls, shells, and other materials are also pressed into the service of personal adornment. Bracelets made from the Changu (*Turbinella rapa*) occur in varied form in the Dacca district. The author only occasionally saw mother-of-pearl fabricated into amulets and in Ceylon into rings.

The author then goes on to describe the costume and types of ornaments characteristic of various parts of India. Numerous sketches of all kinds of jewellery illustrate the paper. There are ten representations of women from different districts scattered in the text, one of which, a Tamil from Trichinopoly, we reproduce as a specimen of the illustrations to the paper. There are also six plates of full-length portraits of women in typical costumes, three of which are in colours.

Specimens illustrative of this paper and collected by the author are to be found in the Vienna Museum. There is also in the Berlin Königliche Museum für Völkerkunde a fine collection illustrating Indian ethnography, which is arranged in a most instructive manner. Maps, photographs, and models are liberally interspersed, and the labelling is exceptionally good. Jewellery is dealt with ethnographically, and not merely as a branch of æsthetics, the use of the trinkets being illustrated by photographs and models. One thing is certain—that is, that Germans need not go further than Berlin if they desire to have an intelligent and comprehensive presentment of Indian ethnology. So firm is the conviction of Dr. Bastian, the energetic Director of the Museum, of the present necessity for gathering up the dying-away remnants of more or less barbaric and savage peoples, that he is once more on a collecting tour—this time in India—and is continually sending to Berlin cases of specimens, regardless alike of cost and space for exhibition. He feels that it is now his duty to collect, and this spirit is manifest in other departments of the Museum, notably also in one illustrative of another of our British colonies. Capt. Jacobsen is one of the best of collectors, and he has brought together an invaluable collection from North America, especially from British Columbia, the long series of grotesque dance-masks being of particular interest.

It is convenient for European ethnologists that these objects are in such an accessible Museum as that in Berlin; but we, as Englishmen, would like to see the ethnography of all our British colonies as fully represented in our own National Museum. It is true there does not at present exist any machinery for making special collections, nor was there in Berlin until enthusiasts like Dr. Bastian and others created it. There are difficulties with regard to funds and storage-room; perhaps Dr. Bastian's plan of ignoring these problems and of securing the specimens is not so very bad after all.

FIG. 4.—A Tamil woman from Trichinopoly.

It may be urged that we already have an Indian Museum. This is true, but that collection is little more than an assemblage of specimens.

A museum has at the present day quite a different object from what it had in the past. The distinction can be put succinctly by an analogy; most of the older museums bear the same relation to modern museums that dictionaries do to text-books. Most people will admit that the perusal of lexicons is somewhat mono-

tonous and dull, and similarly the arrangement of the old class of museums was such as to give the least amount of instruction beyond the bare fact of the existence of given objects.

Large national collections should be exhaustive, and this necessitates a multiplicity of objects, but that should not preclude a scheme of arrangement which would make the specimens yield the maximum amount of information they are capable of giving. The Indian Museum affords an example of the worst style of museum arrangement.

The public has a right to expect that national specimens shall be arranged in the best possible manner, and the Government should appreciate the fact that museums, if properly conducted, afford the most interesting and vivid means for conveying instruction.

ALFRED C. HADDON.

THE APPLICATIONS OF GEOMETRY TO PRACTICAL LIFE.[1]

THERE is scarcely any branch of modern science which has of recent years made such progress as geometry: there is certainly no branch over the purport of which there is so much obscurity or has been so much discussion. On the one hand, geometry, like most sciences, was born of a practical need. The Egyptians,[2] an eminently practical people, were not interested like the Greeks in the properties of the circle for the circle's own sake, but they wanted an art to measure the capacity of their barns and the size of their haystacks, and to plan out their pyramids and great buildings. But above all they were landowners, and to sell property they required to measure land—to measure it in square feet, and not by the time that a yoke of oxen would take to plough it, which was not always an exact or convenient test. So the Egyptians invented land-measuring or surveying, and termed it *geometry*, and the geometricians they called *rope-stretchers*. Thus in the doggrel of an old text-book:—

> To teach weak mortals property to scan
> Down came geometry and formed a plan.

The origin and the early applications of geometry were thus essentially due to the needs of *practical* life.

On the other hand, the Egyptians, having satisfied their immediate wants, left geometry uncultivated, and by not pursuing it on purely theoretical grounds, failed to convert it into that great instrument of investigation which in the end was to master the mystery of the heavens, guide the mariner across the trackless sea, or help the engineer to span the St. Lawrence or Douro.

The next stage in the development of geometry was left to the Greeks, for whom to apply geometry to practical purposes would have been to debase it. They studied geometry for its own sake, much as some of our friends to-day study metaphysics, only, it seems to me, they did it to more purpose. They recognized in geometry a great instrument for sharpening the intellect, and they made it the basis for a sound education. A proposition was to them a delight in itself, and to deduce a new one a distinct intellectual advance. Thus they had the proverb, "A figure and a stride: not a figure and sixpence gained."

I cannot emphasize this purely theoretical tendency of Greek geometry better than by a tale which is told of Euclid by Stobæus:—A youth, who had begun to read geometry with Euclid, when he had learnt the first proposition inquired, "What do I get by learning these things?" So Euclid called his slave and said, "Give him threepence, since he must gain out of what he learns."

I have said enough perhaps to indicate how the two tendencies of modern geometry, and indeed of the whole of modern science, date back to the very beginnings of scientific activity—to the practical Egyptians, whose horizon was bounded by the immediate needs of life, and to the dreamy metaphysics-loving Greeks, who despised practical applications. There are few teachers of geometry who will not have felt at times the burden of these two tendencies. The great mass of material in the form of published papers on higher geometry, many of which can only be understood by the initiated few, and some of which have probably never been read except by their writers—this weighs at times upon the mind and makes one, without despairing of science, cry, "*Cui bono?* For whose good? How can this help the progress of mankind?" On the other hand, how the listless student, bent on struggling through life with the least expenditure of intellectual energy—how he calls up the spirit of the Greek, when he languidly asks his teacher after lecture, "What is the *use* of this? I've got the result in 'The Engineer's Pocket-book.'" For *him* the insight to be gained by seeing the *how* and *why* of a process is of no importance, and the fingers tingle to hand him threepence that he may at least gain something by attending our lectures.

It is not my purpose now to trace these practical and theoretical tendencies through the history of geometry down to the present day. Neither do I intend to emphasize one tendency at the expense of the other. But of this fact I feel clearly and absolutely certain, that a divorce between the two—such as has existed in some of our great mathematical schools—is wholly unnatural, and tends sadly to retard the efficiency of both. What we are slowly but surely learning in this country, owing to the pressure of foreign competition, is that education and theory are needed in all branches of practical life, if we are to maintain our industrial position. But it must be education and theory which is sympathetic to practise, can indeed be wedded to it, and takes upon itself no cynical and superior airs. When we compare on the one side the vast amount of mathematical talent out of touch with all human needs, and on the other the amount of practice which limps along for want of theoretical support, we cannot but be grateful for any institution or foundation which tends to promote a better fellowship between the two. This union of theory and practice, with its offspring the applied sciences, has nowhere in recent times met with more cordial support than in the City of London. Within the last twenty years the science of engineering has been revolutionized; from an empirical and mechanical craft engineering has been raised to the rank of a learned profession. The introduction of theory into engineering practice has been largely due to the progress of modern geometry and the geometrical methods of calculation.

Problems, which when clothed in mathematical symbols only served to appal the practical man, became intelligible to him when hieroglyphics were replaced by curves upon the drawing-board. The success of this particular union of practice and theory is largely, I believe, due to the choice of a geometrical method, to the recognition that form and figure are more easily realizable by the average mind than symbol and numeric quantity.

I have referred to the union of theory and practice which has been so largely realized of late years in engineering instruction because it offers us a striking example, not only of the success of theory as applied to practice, but also of the manner in which that theory, in order to be successful, must be applied. The theory does not need to be superficial, but it must be of a kind which the practical man can grasp; the calculations must be made

[1] A thirty minutes' Probationary Lecture, delivered at Gresham College, on Friday, December 12, 1890, by Prof. Karl Pearson.

[2] The historical facts of this lecture are chiefly drawn from two excellent books—Gow's "History of Greek Geometry," and Ward's "Lives of the Professors of Gresham College."