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FRIDAY, JANUARY 21, 1916.

All communications for the Society should be addressed to the Secretary, John Street, Adelphi, W.C.

NOTICES.

NEXT WEEK.

WEDNESDAY, JANUARY 26th, 4.30 p.m. (Ordinary Meeting.) J. ARTHUR HUTTON, Chairman of the British Cotton-Growing Association, "The Effect of the War on Cotton-Growing in the British Empire." SIR DANIEL MORRIS, K.C.M.G., D.C.L., D.Sc., will preside.

Further particulars of the Society's meetings will be found at the end of this number.

NORTH LONDON EXHIBITION TRUST.

In 1865 the Committee of the North London Working-classes and Industrial Exhibition (1864) presented to the Society of Arts a sum of £157, the balance of the surplus from that Exhibition, with a view to the annual award of prizes for the best specimens of skilled workmanship exhibited at the Art Workmanship Competitions of the Society of Arts. The Art Workmanship Competitions were discontinued after 1870, but since that date various prizes have been awarded under this Trust. Prizes were offered to the students of the Artistic Crafts Department of the Northampton Institute, Clerkenwell, in 1903, and have been continued annually to the present time. These have been awarded, for the present year, as follows:—

Senior Section.—Prize of £1 10*s.* and a Certificate to Emily May Bowler, for a hand-wrought Embroidery Cushion Cover.

Junior Section.—First Prize of £2 and a Certificate to Andrea Vecchione, for an Inlaid Mahogany Bureau.

Second Prizes of 15*s.* each and Certificates to Louis Chambers, for a set of Steel Dies and Impressions; and to William Lonsdale Collis, for a hand-wrought Ciborium and Silversmith's Drawings.

COVERS FOR JOURNALS.

For the convenience of Fellows wishing to bind their volumes of the *Journal*, cloth covers will be supplied, post free, for 1*s.* 6*d.* each, on application to the Secretary.

PROCEEDINGS OF THE SOCIETY.

INDIAN SECTION.

A meeting of the Indian Section was held on Thursday, January 13th, 1916; DR. DUGALD CLERK, F.R.S., Chairman of the Council, in the chair.

The paper read was—

THE ROMANCE OF INDIAN SURVEYS.

By COLONEL SIR THOMAS H. HOLDICH, R.E., K.C.M.G., K.C.I.E., C.B., D.Sc.

There would not appear to be much room for romance in the prosaic details of a highly technical profession dealing with mathematical deductions and land measurements. Nor does the actual process of bringing into action an assortment of admirably constructed instruments for the purpose of astronomical or terrestrial observations, and deducing therefrom by intricate calculations the shape of the earth and the exact space thereon which is occupied by any special part of it, lead to much romance.

It is not, therefore, with the contents of those elaborate volumes on the progress of the great triangulation of India, which, while they are records for all time of a magnificent work and a great success, are much too technical for light and popular reading, that we have to do to-day, so much as the early beginnings of surveys in the East—the first dawn of those adventurous excursions into the regions of scientific observation—rendered absolutely necessary by our growing Eastern expansion and the further necessity of defining its limits. There is another

aspect of Indian surveys, too, which is well worth a better record than it has yet received. Along with the solid and steady progress of a great scheme for the accurate mapping of the peninsula of India, and the attainment of a full knowledge of its vast resources and possibilities, there has ever been on the fringe of this internal work a tide of adventure, ebbing and flowing with the rise and fall of political interest in what lies beyond India, which has led to the ingathering of an enormous amount of geographical information—all bearing more or less on India and its destinies—and has resulted in a record of geographical enterprise unsurpassed by any such record in the world. Neither Spain, Portugal, nor Holland, the three great geographical nations of the past, can claim an equal position as peaceful world conquerors in the interests of science.

Now, I am very well aware that when we touch on the subject-matter of travellers' tales, we may find ourselves more deeply involved in the regions of romance than would be quite seemly if taken in connection with so dignified and important an institution as the Survey of India, but I feel sure that you will appreciate the fact that there are two widely different aspects of romance, and most of you will have learnt from experience that the romance of the truth often exceeds in interest that other romance which is born of the wild dreams of fancy. Sir Clements Markham, in his admirable *résumé* of Indian surveys,* has very justly observed that before you can survey a country you must first get there; and it was the getting there that started a whole series of maritime adventures, all of which added something to our preliminary geographical knowledge of the road to India, which commenced in the reign of Elizabeth and lasted until the more prosaic, scientific and certain methods of the Indian Marine service.

It was Captain Keeling who first visited Surat in 1607, and practically opened up the way to India, and it was Hawkins, who sailed with him as his second in command, who made that ever-memorable journey to the Court of the Great Mogul to enlist his favour and his sympathies for the English in their first commercial venture on the western coast of India. It was one of the most romantic episodes of the early exploitation of India, and the "plotts," or charts, which were gathered from the observations of Keeling, and of other adventurers who speedily followed in his tracks, resulted in the "Rules for Navigation," published by John Davis of Limehouse. Hakluyt, Archdeacon of Westminster, was the map-maker of this period. He worked on practical methods by collecting information from certain "noted seamen of Wapping." His researches and his invaluable contributions to the early geography of the East have only lately been duly recognised by a suitable memorial set up in Westminster Abbey; but we owe the Hakluyt Society to his memory, which, under the leadership of Sir Clements Markham, has for many years been giving to the public many of the most deeply interesting of travellers' tales of the past, which would otherwise have been lost or forgotten. About the time of his death, in 1616, the East India Company woke up to the value of their literary and geographical possessions, and Hakluyt's successor, the Rev. Sam Purchas, took official charge of the journals of East Indian voyages. His quaint and amusing style has rendered "Purchas his Pilgrimes" a rival in popularity to the "Pilgrim's Progress"; but whilst the latter is the finest allegory that ever was written, it can and must be conceded to Purchas that he is only occasionally apocryphal.

It is a matter for bitter regret to antiquarians that the gradual collection of the logs and journals of many ancient mariners finally outgrew the means for storing them in the East India Company's office. Many were irretrievably lost, and when the India Office came in for the heritage of the old Company's records in 1860, tons of literary material were turned out; and not only journals, but some of the most interesting of contemporary maps and charts have been missing ever since.

It was not until Rennell's days, in the latter half of the eighteenth century, that any attempt was made to produce a map of Hindustan from land surveys; but meanwhile the very necessary process of charting the coasts proceeded apace, and quite a number of useful young seamen made their names famous by their adventurous methods and successful work. Amongst them Wedgborough and Topping were most conspicuous. Topping became Chief Surveyor in Madras in 1794, and it would be exceedingly interesting to know of what his office and instrumental equipment consisted.

In 1800 the first efforts were made to chart the African coast of the Red Sea. Lord Valencia was the moving spirit in the expeditions (three of them) that were fitted out in India for the purpose, and he has left his name at Annesley

* I must acknowledge my indebtedness to this useful work for much of the information recorded in this paper.

Bay, the harbour from which the Abyssinian Expedition under Lord Napier started some seventy years later. A naval officer, Crawfurd, was sent up to the Abyssinian highlands to interview the Negus, and he left some geographical record of his expedition behind him; but, following his tracks during that memorable expedition in 1868, we found that he was forty miles wrong in his value for the latitude of Antalo. This must not be accepted as any criterion of the general usefulness of the geographical surveys of our predecessors in the last century, for I have long ago come to the conclusion that for keen continued power of observation and persistent attention to detail there were a good many of them that could give points to modern explorers. It was the instruments, not the men, which failed.

Between 1820 and 1830 the first surveys of the Persian Gulf were made. The naval headquarters was Bassidor, on the island of Kishm, one of the hottest naval bases in the world, and the duties of the Indian Navy were remarkably comprehensive. Surveying seems to have been carried on in the intervals of slave-trade suppression, pirate hunting, commerce extension, visiting chiefs with the object of maintaining the political *status quo*, and generally establishing British supremacy in the Gulf. Stories of wild adventure in the Persian Gulf have survived till this day. Not less remarkable was the venturesome survey of Mesopotamia. It would not be too much to say that never, since those first expeditions to the land of the Tigris and Euphrates, have conditions for continuous map-making been possible. Considering the importance of the geographical position of Mesopotamia, its wealth of historical association and its extraordinary capabilities, and the difficulties and dangers encountered during the twenty-six years of surveying which were carried on almost without interruption by officers of the Indian Service, this extraordinary work of map-making may well be regarded as an imperishable record for the old Indian Navy.

In 1837 Captain Lynch, who was second in command to Colonel Chesney during the original expedition which was to decide the future of railway communication with India, traversed the whole course of the Tigris from its source in Armenia to Bagdad. He then connected Nineveh, Bagdad, Babylon and Ctesiphon by triangulation. When he had done with the Tigris he set to work on the Euphrates, connecting the head of that river with the Mediterranean by chronometric measurements, and on his final retirement in 1843 was succeeded by his assistant, Felix Jones. Jones had seen service in the Red Sea Survey and about the coasts of India before joining the staff of Lynch. He boldly made his headquarters at Bagdad in command of the "Nitocris," and, although nearly single-handed and full of other duties than surveying, he carried his explorations into the country of the wild and dangerous tribes of Arabs. In 1844 he was with Rawlinson on the Persian frontier; he explored the ancient Nehrwán Canal system, surveyed the ancient bed of the Tigris, discovered the site of Opis, and exploited the Median wall; in 1852 he made a trigonometrical survey between the Tigris and the Upper Zab, fixing the position of Nineveh; and he completed an extraordinary survey career by making a plan of the city of Bagdad on a large scale. His work as a cartographer in actual mapping was excellent, but his Babylonian sheets were lost in the India Office. At the present time it is interesting to know our authority for the original mapping of Mesopotamia, which has, of course, been largely supplemented and extended since, but Felix Jones (who was finally appointed political resident at Bushire) owned the master hand which was responsible for the basis of all we now know.

The name of Lynch is historic in Mesopotamia. It is to the river steam service of Messrs. Lynch and Co. that we owe much of the success of our Mesopotamian Expedition. It is, indeed, only with the assistance of such a river service that our expedition has been possible. In 1832 the naval service, hitherto known as the Bombay Marine Service, became the Indian Navy, and its first admiral, Sir Charles Malcolm, inaugurated a period of activity in exploration and surveying which might almost be called the golden age of survey romance. He founded the Bombay Geographical Society, which at once conjures up a galaxy of famous names such as no geographical society in the world has equalled—Burton, Speke, Grant, Burnes, Wood, Pottinger, Rawlinson were just a few of them. They gathered in their comprehensive group explorers in all the corners of the Eastern world. A re-survey of the Red Sea became an urgent necessity. It was a dangerous and difficult service; not half of that sea was charted, and unknown and unsuspected risks attended every move.

Southern Arabia, East Africa, South-East Arabia afforded such splendid opportunities for pioneer work then as might well make the

mouths of modern geographers water! One of the most marvellous adventures was that of a midshipman—Midshipman Cruttenden—who walked into Arabia on his own responsibility and visited Dafur and Sanaa, whilst he exploited Yemen. It may be that less suspicion attached to the apparently irresponsible movements of explorers in those days. They were certainly received with less hostility, being regarded generally as interesting visitors who could have no ulterior motive in travelling in countries with which they were totally unfamiliar—slightly mad perhaps, but otherwise harmless. Certain it is that no European would dare now to set his foot as a casual tramp in many parts of Southern Arabia (in Hadramaut, for instance) where he could have moved with comparative freedom less than one hundred years ago.

As British rule extended itself gradually from the south and south-east of India across the peninsula to the north-west, it became abundantly clear that a thoroughly sound knowledge of approaches by the sea route should be fully and carefully acquired. Three hundred years B.C. a careful log had been kept of an Indian river expedition which started from about Attok, finally reaching the Persian Gulf. It had been kept by one Nearchos, the admiral of the fleet of the great Alexander; but a river like the Indus and a coast-line like that of Makran will change its contour and its channels in the course of a few years; wind and current will render them hardly recognisable; so the log of Nearchos was clearly out of date. The Arabs, too, when they carried out their successful invasion of the Indus valley by sea as well as by land, in the eighth century A.D., must have furnished themselves with some sort of a useful chart, for the Arabs were most able geographers and navigators, and by far the most scientific sailors of their time. Since then the channels of the Indus, as an open road to India, did not seem to have been fully explored, and a river survey was inaugurated which was full of remarkable incident and surprising results. The survey staff included Alexander Burnes and Lieut. John Wood, both of them names which will ever live in geographical history. Arrived at Attok, Burnes, accompanied by Wood, started on a mission to Kabul. A mission to Kabul in those days meant something very different from the political or military processions of later years. Our surveyors and explorers of the last century had little to boast of in the way of picturesque accessories such as great retinues and important escorts. They usually found it advisable to do in Afghanistan as the Afghans do, to wear the dress of the country, and to cultivate its social manners. They talked the language like natives, and they passed for natives in a crowd. This expedition was one of the very earliest feelers out into the wild north-west that was ever projected, and we must remember that it did not start from Peshawar and our present frontier, but had to cross a wild stretch of what might, or might not, prove hostile country before reaching the Indus, should it make a start from India. From Attok, of course, which was well within the territory of the alien Sikh, a good deal of this risk was certainly discounted. At Kabul, Burnes and Wood separated. Burnes struck out to the north-west, across the Hindu Kush, to Afghan Turkistan and the Khanates beyond the Oxus, and he brought back with him a story of travel to Bokhara and Central Asia which created a geographical record and a great public sensation. Wood went north-east also to the Oxus with the express object of finding its source. A Lieut. Wyburd departed on a tour of exploration in Central Asia about the same time, and has never been heard of since. This was in 1835. Wood's adventures on his most astonishing journey to the Oxus are as romantic as the most earnest lover of romance could wish. "Wood's Oxus" is beginning to be rather a rare book; but it is a revelation of the difficulties and dangers of individual travel successfully overcome—difficulties and dangers which doubtless still exist (it would be a perilous journey even now), but which are in these days so largely discounted by our knowing all about them beforehand. It is to be noted that when political discussions were straightened out between Russia and ourselves by the determination of a boundary between Russia and Afghanistan in 1883, it was Wood's Lake (otherwise Lake Victoria) which was adopted as the eastern terminal point of the boundary (though it proved to be by no means terminal), and it was the position given by Burnes of his ferry across the Oxus which was to mark the point where the boundary was to follow the river. This, too, presented its difficulties to actual demarcation. The ferry no longer existed in 1883, and the post-house and buildings which once denoted its position had all been washed into the river. Shortly after there followed the war with Afghanistan. Transfrontier explorations were then discouraged by Government, and they have, in fact, remained discouraged ever since. What has been done in later years has been

done more or less reluctantly under the ægis of the Indian Government, and thus a good deal of the romance which clings to individual initiative and effort was knocked out of trans-frontier surveys. We must, however, remember that very much of our prestige in Asia is due to the insistent recognition of the sacredness of European life both on and beyond our borderland. The death of an Englishman amongst frontier tribespeople has to be instantly accounted for, or vengeance by force of arms must surely follow. In no other way can individual security be assured in a land where the murder of a European is one of the chief qualifications for Paradise on the part of the Mohammedan. Very rightly, therefore, does the Government of India discountenance irresponsible travellers who, employed on no mission of political importance, may involve a frontier expedition and much waste of life and money by their indiscretions in the persecution of their own fads or a search for notoriety. But this is a policy which cuts two ways. Whilst it does not imply any radical hostility to the attainment of geographical knowledge in the abstract, it very much curtails the possibilities of seizing on favourable opportunities for securing such knowledge, and it has had a most disheartening effect on the adventurous spirit of military officers, who would gladly follow the example of the geographical heroes of Bombay records, and arrive at a clear understanding of the wild uplands of the borderland which face them in the distance as they kick their heels in idleness along the Indian frontier. Thus for half a century or more we learnt nothing of the wild border hills fringing the great plateau of Afghanistan or Baluchistan, or of farther Kashmir, or the great Tibetan table-land—nothing, in short, of all that which from the military point of view it was most essential that we should know. When we contrast our inherent fear of "complications" arising from indiscreet exploration with the method actually pursued by Russia during the same period, or which would most certainly have been pursued by Germany had she been in our place, we begin to doubt whether that official policy of excessive caution was not misplaced. Indeed, when we started the last great Afghan war in 1878, we found it very much misplaced, for the loss of life entailed by want of topographical knowledge was sometimes deplorable.

It is time, however, to turn to the inauguration of the land surveys of India as apart from Indian naval records; for although the gradual development of so perfect a system of geodetic measurements and its application to the huge area of the peninsula of Hindustan has little in it during its century of steady progress that savours of romance, yet there are certain points in its history which appeal to the imagination, and of the many personal narratives which are hidden away in the immense series of volumes comprising Indian Survey reports there are some which deserve to be rescued from oblivion by reason of the romantic interest which surrounds them. Conceive the India of a century and a half ago, when roads were scarce and railways were not; when the gradual advance of British occupation by force of arms was just a fight maintained by masses of Indian troops trained on European principles and supported by small but valiant companies of Europeans; the land unredeemed from the vast area of forest which spread absolutely unbroken across the continent from sea to sea, wherein were peoples ranging in their degrees of development from the utter savages, or wild men, of Central India—a people who lived in trees and ate their food raw, splitting it to pieces with their nails—through the black and hairy (but intensely proud) community of the Bhils, and the cairn-erecting Stone Age tribes of Gonds, to the ornate and crafty Bengali, or the magnificent Afghan supporters of the Mogul Court.

It is true that, with the exception of the wild man, who has disappeared within the last fifty years, they are all there now; it is true that there are large spaces still in the Indian peninsula on which no white man ever sets his eyes; that there are most undoubtedly deep-shadowed, dark and remote regions within which the hideous rite of human sacrifice is not unknown (one of the last which was brought to light was performed in order to secure a favourable verdict in the Calcutta High Court); but these interesting relics of the past are rapidly disappearing in front of missionaries and deputy-commissioners; and India, with its hotels and its telephones, its motors and electricity, is becoming unromantic and prosaic. But there was romance in the days when the early researches commenced, and it has not been utterly wiped off the slate even yet.

Our earliest Indian surveyor-general, a man who has left behind him an imperishable name, was Rennell. Rennell served under Clive from 1763 to 1782, when he commenced a geographical career which lasted for fifty years. Rennell produced the first map of Hindustan, which was a compilation from route surveys and observations

taken with more or less care during the military expeditions and campaigns which were then incessant. That first map shows what a mass of information already existed before anything in the shape of exact geodetic triangulation was attempted. The maps from which the compilation was built up were very inaccurate, but the patchwork was pieced together with great skill, and Rennell seems to have considered that no more scientific method was really necessary. Surveying in the peninsula of India in those days was just as much of an adventure as it would be in Western China in our time.

The first really picturesque figure which appears in connection with Indian land surveys is that of Lambton. He was the originator of the Great Indian Survey. He gained a commission as officer of the 33rd Regiment, and he served under General Harris in the war with Tippu. Curiously enough, nothing is known of his origin. He never referred to it himself, but he is believed to have been a Durham man, and to have gained his first experiences in land-surveying in America. He was absolutely self-educated. After the fall of Seringapatam, when Lord Wellesley took measures for exploiting and exploring India, Lambton produced his scheme for the measurement of an arc of the meridian and for carrying triangulation across the peninsula from sea to sea. The measurement of an arc of the earth's surface was in those days of the very highest scientific importance, when we did not know the elements of the shape of the earth. Supported by Lord Wellesley, and approved by the Madras Government, Lambton set to work to collect instruments. A three-foot theodolite (*i.e.*, the diameter of the graduated horizontal plate was 3 ft.) was constructed by Cary. It was the first of its kind. It was the father of all the many theodolites that have followed in its Indian wake, and it fitly has closed its career by honourable retirement in a museum. But the start was inauspicious. It was captured by the French on its way to India, and it was only through the graceful courtesy of the French Governor of the Mauritius that it ever reached its destination.

Great was the difficulty in determining an absolute longitude in those days. Observations for its determination were taken at Madras during three different periods—commencing in 1787 and terminating in 1847—and the three results, which differ *inter se* by more than four minutes, have been adopted by the Indian Atlas, the Survey Department and the Admiralty respectively. Imagine the confusion! It lasted up to my time at the end of last century, and has only been finally adjusted by the telegraph. Now we really know where the Madras Observatory is.

This, however, did not interfere with the prosecution of Lambton's great work—the initial series of that magnificent scheme of geodetic triangulation which is dealt with in the ponderous volumes of the Indian reports. It was the temper and the scientific enthusiasm of the man which carried him through. The mere conveyance of so heavy an instrument to the tops of the hills selected as observing stations must have involved an army of carriers, and of jungle clearers. Here and there it was necessary to make use of pagodas, or high towers, and it was whilst being hauled up to the summit of the Tanjore pagoda that one of the guys carried away, and the instrument was dashed with great force against the side of the pagoda. The horizontal limb was distorted and the tangent screw and clamp were damaged. This would have disheartened most men; but we find Lambton shut up in his tent at Bangalore soon after the accident, straightening out the instrument with the assistance of one or two ordnance artificers by an ingenious contrivance of his own, and in six weeks he was back again in Tanjore working with the resuscitated instrument, which indeed had become the prop and mainstay of the Survey until 1830. His energy was unquenchable. At the end of the year 1818 Lambton was joined by a young assistant whose name has lived in Indian annals—Everest—and Everest describes his chief as "an old man with a bald head fringed with a few white hairs, about six feet high, well made and muscular. His complexion was fair, and his eyes, dimmed by long service, were blue. When he roused himself to adjust the great theodolite they shone with lustre, and his limbs moved with the vigour of full manhood." But this was nearly the last flicker of energy, and in June, 1819, he gave up triangulating. He had subjected his assistants recklessly to the same exposure in the worst jungles of India that he faced himself, and Everest had been invalided to the Cape. When he returned in 1822, he was only in time to see the last of his old chief, who died still working in harness on the road from Hyderabad to Nagpur. For many years Lambton received no sort of encouragement from the Government or from any scientific society. It was only when he was made a corresponding member of the French Institute

that the Royal Society conferred on him a fellowship. This was not till 1817.

From John Lambton's beginnings the gradual extension of a complete system of geodetic measurement of the whole vast area of the peninsula has been the work of nearly a century. It may be said to be complete now, but there is still the rounding-off of outlying regions to be considered, and the Great Trigonometrical Survey of India, with its immense record of geodetic investigations—unequalled by that of any other country, excepting perhaps Russia—is still alive. Possibly the word "*finis*" will be written at the end of the last volume of those records by the present Surveyor-General, Sir Sidney Burrard. This is the fundamental basis of all our map-making. It has given us the framework, or anatomy, of India, and on this framework an enormous series of maps, geographical, political, military, and cadastral, has been based. Whatever may be the destiny of India in the future, it must stand as an everlasting testimony to the scientific industry of the British nation. It can never be effaced so long as stone walls can contain the records. But whilst the prosecution of scientific work of this nature within the limits of the Indian peninsula, the painstaking record of infinite observations and the mathematical processes of their reduction at a headquarters office, does not lend itself much to romance, it does lay the foundations of other investigations which are not so strictly scientific, connected with the mapping of India and its borderlands, which may be full to the brim with weird experiences and extraordinary happenings. The ordinary humdrum business of land surveys progressing from year to year has been broken often enough by incidents which it is delightful to recall, and amongst them it is those generally which deal with the Himalayas that are the most striking.

At the beginning of the nineteenth century information about the Upper Himalayas was scanty and apocryphal. It was derived from Chinese sources through Jesuit missionaries, who had been busy in Tibet long before then. A map of Tibet had come into the hands of Father Regis, at Pekin, as early as the year 1711. The worthy father represented its inaccuracy to the Emperor Kanghi. The Emperor despatched two lamas who had been educated by the Jesuits at Pekin to make a better one. They were to visit Lhasa and the sources of the Ganges. In 1717 this map was published in Paris, and this was the source of our knowledge of Tibet and the course of the Sanpo (the Upper Brahmaputra) until the days of the native explorers of the Indian Survey. In 1796 the first surveying expedition into the Himalayas was organised, with the object of determining the source of the Ganges, and it was only in 1805 that the immense height of the Himalayan peaks in Nepal was appreciated; so that we may say that it was just about the beginning of the century that this land of romance beckoned to the explorer to follow some of its fascinating paths and to struggle to the attainment of its vast altitudes. Imagine the sensations of those early observers as they wandered slowly along the borders of the mighty Himalayan torrents through the narrow ways of the foothills, overwhelmed with the richness and the sweet oppression of sub-tropical vegetation, ever gaining something in altitude, till the hills on either side presented wider slopes of slippery grass festooned with flowers as in Kashmir, or else were blankly bare and prohibitive except where they touched the foot of the pine and rhododendron forests, skirting the rugged buttresses of the snow-capped heights. The dawning sensations of reaching to something infinitely high and mysterious is lost in these latter days in the dust and clatter of the tonga or of the mountain railway. But there was the real spirit of romance brooding over the chequered frost-bound and snow-patched peaks of Badrinath and Bandarpoonch then. The tales of Hindu mythology hung in festoons round the seats of the gods; the paradise of the Brahmans was up there, near the sky; all the beauty and the wealth of the mighty Indra were awaiting the pilgrim from the plains. From where the Ganges rushes out in cold torrents from the deep cavern of the Gaimukh it is but a day's stiff climb to the summit of the range intervening between the source of the Ganges and that of the Jumna; and from that range, within an amphitheatre of snow, decked with the beauty of white and purple rhododendron, you may see such a glory of snow landscape as you can find only in the Himalayas. You may find it again in Kashmir, in the Tragbal Pass, or in the eastern Himalayas near Darjeeling; but there is no other of the great mountain systems of the world—not the Alps (which between the Rhone and the Rhine could be dumped into one valley of the main Himalayas) or the Pyrenees, or the Andes—which can strike the imagination dumb with such a realisation of the spirit of romance as can the Himalayas.

It is in this region and beyond it, where the

rock barrier of the Himalayas merges into the plateau of Tibet or the transhimalayan uplands of Kashmir, that the most romantic episodes of the Indian Survey work have taken place, if we except the transfrontier of the western Indian borderland, the highlands of Afghanistan, and the flats of Baluchistan, with their fringe of wild mountains hedging the Indus border. Centuries ago the Himalayas were crossed by venturesome Chinese pilgrims in search of the truth as presented by Buddhism. There must have been thousands of them, and some few have told thrilling stories of stone-spitting dragons and other horrors which awaited them on their Himalayan travels. Still more centuries ago it was the gigantic geographical elbow, formed by the junction of the Himalayas and Hindu Kush, which witnessed all those amazing irruptions into India of Central Asian tribes, which were the prelude to the first recorded European invasion, viz., that of Alexander the Great. Persians, Assyrians, Medes and Parthians all had a look in before the Greeks came. They all pulled up at the Indus, and decided that the hot plains of India were not good for their constitutions. There is consequently a wealth of legend about these regions which it has been to the infinite interest of the Indian Survey officials to investigate and unravel, if by chance they could strike a balance between truth and pure fiction. Farther to the west they have struck the tracks of a great mediæval Arab commercial confederacy who, long after the Greeks, occupied the Indus valley and spread out their commercial enterprises till they had riddled all Asia with their tracks. And they, too, have left their records. So that there has been a substratum of tradition on which to found a series of ancient romances which might easily fill volumes had one the energy and wish to write them. It was the northern Himalayas and Tibet that offered the first field for pioneer research, both as a field for science and for adventure. Some of the most stirring incidents of survey investigations occurred during the prosaic progress of scientific observation. We can imagine the sensations of Everest, for instance, when he figured out in his computations that he must have been observing to the summit of the highest mountain in the world without knowing it. We can picture Bassevi with the spout of a boiling kettle near his mouth, inhaling steam to check the pneumonia which killed him, whilst recording the beats of a pendulum of a measured length to determine the effect of that gigantic upthrow of mountains on the force of gravity. We can imagine Tanner facing the full majesty of Nanga Parbat as it rose from the Indus to its summit when he found himself gazing up and down through 24,000 feet of mountain side. And nothing in its way more thrilling has been done than the passing of our Indian triangulation right through and over the Himalayas to a junction with the Russian surveys, so as to bring Petrograd into direct measurement with Calcutta. The story of it is a splendid record of dangers and difficulties overcome by steady, persistent, determined effort. But these not altogether ordinary incidents in the regular progress of work would probably give place in popular interest to the extraordinary achievements in the work of Asiatic exploration which have been accomplished by specially trained native agents. It is not easy to train the Asiatic to habits of close observation in unaccustomed fields. Heredity and instinct alike make him intensely conservative in habits of thought. He will not lift himself readily out of his environment, and, as a rule, the manners and mode of life, the idiosyncrasies of other peoples, are to him matter of profound indifference. I take it that this is, after all, the same everywhere amongst the untravelled communities of mankind. A narrow outlook means a narrow imagination, and it may be a mistake to suppose that the Asiatic, slow of speech to convey an impression, is not as capable of receiving those impressions as the average European. The Chinese pilgrims who tramped the weary way from Pekin to Lhasa and from Lhasa to Peshawar and Benares, and who now and then (about once in a century and perhaps one in a thousand) kept a rough descriptive log of their journeys, are only aroused to enthusiasm by the evidences of their faith which they find *en route*—the temples, the monasteries, the stupas and the sacred trees—and do not trouble to give any record of the nature of the scenery they passed through, or the people they met, though they may have much to say about the difficulties and risks of the road. Indeed, there is some very graphic writing about Himalayan tracks.

Mediæval Arab commercial travellers and geographers are much more instructive; but then they were probably the best educated and most enlightened travellers of their time. The Indian Survey began by enlisting the services of the best educated amongst those whose nationality and environment rendered them likely subjects for the work of exploring the

high tableland of Asia amongst people who were notoriously hostile to strangers. This was at first. Afterwards selections were made in every class of native society, especially from the military, where it was comparatively easy to judge the promise of ability and enterprise in the comparatively raw product before undertaking the long and expensive work of special education. At first, however, it was the village schoolmaster, the priest, and the travelling lama who offered the best material to work upon, and the results were certainly surprising. If there appeared to be a want of intelligent appreciation of the opportunity thus opened for gaining knowledge of the world and witnessing something of its wonders, there was no such want so far as the processes of route-surveying and the acquisition of simple geographical conceptions were concerned. That process of keeping a sordid record from hour to hour and day to day of the compass direction of the route to be followed from point to point, and the number of paces which were taken in the day's work, implied a concentration of thought on a monotonous and dull routine which would have maddened any imaginative European. Yet never a pace was missed nor a bearing wanting in a record of possibly years' duration, and the pilgrim, armed with a compass and a rosary to help him count his steps, with a false bottom to his box wherein was concealed a sextant to enable him to take simple observations for latitude when opportunity offered, would turn up at the end of a journey with a smiling face and a clean record. Even if he had the bad luck to fall on evil times, to be sold as a slave, or to be robbed and maltreated, his records, concealed in the lining of his coat, in his turban or his waistband, would usually be all there, and his keenness in the evolution of the resulting map work would be absolutely absorbing.

Stories of the astonishing exploits of these adventurers would fill a volume. It is true that they were slow to relate them. The details had often to be dragged out bit by bit. It was thus that the old Kumaon schoolmaster, Pundit Nain Sing, traversed Tibet for the first time from west to east. It was then that we learnt of the vast wealth of Tibet in gold, and that we were able to reduce the romances of the ancient Greeks (who dealt freely with such marvels as gold-digging ants amassing heaps of gold which were guarded by fierce dogs) to a more reasonable hypothesis, which proved once again that there was ever some distorted substratum of truth underlying the wildest tales of Ktesias and his kindred. It was then that the vast plateau region of Tibet was first opened out to the eyes of our imagination—the wide bare spaces of wind-swept upland, the frosted white-edged lakes of intense blue beneath the unclouded azure of the sky, the lines of pilgrims making their silent way to Lhasa, and the dreamland of that green valley of the Upper Brahmaputra with its monasteries, its temples, and its whitewashed towns. But it was that marvellous adventurer who figured as "A—K" in our lists who really first introduced us to Lhasa itself, long before the days of the Younghusband Mission. It was he who made the early plans of that weirdest of sacred cities of the East, and gave us a far-away look in at its temples and processions, its wealth of ancient relics, and the quaintness of its religious rites—strangest of which, perhaps, is the yearly selection of a scapegoat for the sins of the people, the wretch who throws dice with the mayor of the town for the privilege of having all the multitudinous sins and immoralities of the townsfolk shaken out of a yak's tail on to his head, and who always loses the throw. Finally he is thrown out of the community with many rites into the wilderness to die. Then there was the romance of the Brahmaputra. How did it get through that savage barrier of mountains to become the Brahmaputra of India? It was old man Kinthup who practically solved this problem; but I regret to say that years elapsed before the wise men of the East in political array would accept his story as anything better than fiction.

Kinthup was sold as a slave for years. He lost his instruments, but he never lost his way, and he exploited the wonderland of Eastern Tibet in spite of all misfortunes. His evidence as regards the Brahmaputra was considered conclusive by such Indian geographers as were best able to check his narrative. Thanks to the exploits of that splendid young traveller Captain Bailey, Kinthup now lives in honoured retirement with the halo of truthful adventure crowning his scanty grey hairs. His was a live romance.

On the western frontier no less than on the northern are there many thrilling tales which might be told of surprising happenings to those who have been despatched to complete the mapping of wide regions in Afghanistan which are even now only partially known. There was a man in my frontier survey party named Sheikh Mohiudin; he was a brilliant draftsman, a most determined explorer, with a thirst for

geographical information which I have never seen surpassed. But he was a man of ungoverned temper and frightfully rash. He plunged boldly into the deserts north of the Helmund River, and was found after many days dead of thirst with his small party around him. Only one escaped, and he had carried the unfinished map wound under his waistband and so preserved it from damage. He was picked up unconscious by a passing Afghan from the edge of the moist bed of a pool which had probably saved his life, and he was finally restored alive to his party, and through him was the fate of the others known. Indeed, that western frontier is the very home of romantic adventure still, but it is by no means usually connected with Indian Ordnance surveys.

I will conclude with a reference to one occasion on which my own feet trod very closely on the skirts of Greek romance, and which might almost be a story from dreamland. On the pretty flower-bordered Mall at Peshawar, looking northward from the cantonments over the city, the view is closed in by the dark line of frontier hills on the far side of the open plain. But at one point, just showing above the line there, whenever the prevailing frontier atmosphere of dust admits, are three knolls or peaks which might almost be mistaken for a part of the near ridges, but which are in reality many miles beyond them. They belong to the crest of a curved offshoot or spur running out eastward from the Kunar Hills into the Swat country, a comparatively small and isolated mountain system known as the Koh-i-Mor (the mountain of Mor). This is described by classical writers (notably by Arrian) as forming part of the country visited by Alexander the Great when he made his momentous march through the north-west of India. There is no great difficulty, now that we have complete geographical knowledge of all that lies between Kabul and the Indus north of the Khaibar route, in identifying generally, and step by step, the scenes of the Greek engagements with the fierce hill tribes of the north, some of whom are represented in these hills to-day. Place names have changed, but the rivers have held to their courses, and it is surprising how many of the old Greek names are to be recognised even now. I have never been able to ascend the Koh-i-Mor: so far as I know, no European officer has ever done so; but I have been on the neighbouring hills, and the character of the scenery and the vegetation is undoubtedly the same throughout this wild borderland. The wild vine and the ivy of classical reference trail over the rocks and festoon the broken sides of innumerable gullies in rank abundance, and from the wild vine a certain detestable wine is derived, which in these degenerate days would certainly not be worthy of Greek libations. On the southern slopes of the Koh-i-Mor there existed some fifty years ago, according to the early Indian Survey atlas sheets, a large scattered village called Nuzar, or Nusar. It has apparently disappeared—at least, I could find no really sound confirmation of the story of its existence under that name in 1894, although I made diligent inquiries in localities as near the mountain as I could get. I have no doubt, however, that it did exist, for it must have been here precisely that the historical incident occurred which describes Alexander as sparing the leading citizens of Nysa (or Nissa) because they claimed a Greek origin like his own. Some of you no doubt will remember the story. This was after he had been as far east as the Indus, where he fought the memorable fight of Aornos, when he returned westward to hunt the brother of Assakenos, who had taken refuge in the Chitral hills. These worthy citizens of Nysa claimed to be descended from the Greeks who in a dim and distant past had penetrated into the Indian borderland under one Dionysos. What they said was this: "The Nysæans entreat thee, oh king, for the reverence thou bearest to Dionysos their god, to leave the city untouched . . . for Bacchus . . . built this city for an habitation for such of his soldiers as age or accident have rendered unfit for military service. . . . He called the city Nysa (Νύσον) after the name of his nurse. . . . The mountain also, which is so near us, he would have denominated Meros (or the thigh), alluding to his birth from that of Jupiter." Now Arrian, who wrote Alexander's history 100 years later, says: "The city was built by Dionysos, or Bacchus, when he conquered the Indians, but who this Bacchus was, or at what time, or from whence, he conquered the Indians, is hard to determine." Arrian, on the whole, has proved to be a very passable and fairly accurate historian, and there can be little doubt that there were early irruptions into India from Greece long before the days of Alexander, and that this led to a fusion between the Pelasgic invaders and the natives of the country which was more definite and more systematic probably than that which must have occurred during the subsequent Greek occupation of Baktria and the Indus valley. Elsewhere we read of Bacchic festivals under the shadow of Meros, of wild

bands of dancing men and maidens clothed with leopard skins, their spears garlanded with ivy and their heads with the vine, on the green slopes of Meros—a truly delightful reminiscence of the romance of classical mythology to the heat-weary Anglo-Indian gazing at the ribs and ravines of the Koh-i-Mor. So far as Alexander is concerned, then, after sacrifice upon the mountain, the incident ends.

In the winter of 1894–95 I was at work within sight of the Koh-i-Mor, determining the position of a boundary which, amongst other purposes, should divide Kafiristan from Chitral. I had the luck to be able to penetrate some little distance into the country of these inscrutable people, the Kafirs, and to enjoy the opportunity of discussing some of their manners and customs with them. Amongst others was the custom of singing hymns and executing dances in honour of their war god, Gish, on the occasion of any specially successful raid into the territories of their Mohammedan neighbours. I obtained the words of their war hymn, and with the assistance of a Chitrali interpreter I got what I believe to be a fair translation of it. Imagine my surprise when it proved to be a veritable hymn to Bacchus, referring unmistakably to the origin of his birth from Meros, the "three-horned" hill, and appealing for further victories! It was not so very long ago that the Kafirs spread over the Koh-i-Mor to the confines of the Swat valley. They have ceased to do so, but they still cling with tenacity to the tradition that the mountain was once their own. And so we got to the back of the strange insistence of the Kafirs that they are of Greek origin—a tradition which for long years has been a puzzle to Indian administrators. It was an old tradition twenty-two centuries ago, when Alexander passed their way. There are certainly various little conventional habits amongst them which differentiate them from the Oriental, such as sitting on stools instead of squatting like the native; but there is no time to go into further details, nor is this the place for anthropological disquisition. It is but one out of many experiences which befall the Indian surveyor which carry him just for the time out of the routine world of scientific investigation and survey progress into realms which more closely border on real regions of romance.

DISCUSSION.

THE CHAIRMAN (Dr. Dugald Clerk, F.R.S.), in opening the discussion, said the author had given a most interesting, and indeed a most romantic, address. He had shown very clearly the romance of surveying, the adventure and search into the unknown. Romance was not confined, however, even to such adventurous circumstances as those described by the author. Everyone felt the glory of the adventurer and the discoverer, but the romance of the knowledge of the earth, and of all the properties it contained, was necessarily dependent upon such work as the great triangulation to which Sir Thomas had alluded. Before any idea could be formed of the universe at large, it was necessary to know everything about the earth—its shape and its weight, and in that respect the romance of the subject had visited even London. The weight of the earth was first determined by Cavendish, about the beginning of the last century, in Bedford Square, by a rather rough instrument, and since Cavendish's determination English observers had worked hard at the subject. The final, and perhaps the most complete determination of the weight of the earth was made by Professor Boys, who had frequently lectured at the Royal Society of Arts. Boys's discovery of the quartz fibre made it possible to determine the weight of the earth with great accuracy, which, if it had not been for that discovery, would have been impossible. The early determinations of the weight of the earth were made with a silk fibre, a torsion balance, and large weights. The whole principle of the determination of the weight of the earth depended on the attraction between a small weight and a large weight, and determining from that the relative attraction of the earth, and for that purpose it was necessary to know the dimensions of the earth. Given the weight and dimensions of the earth, everything else could be calculated. Without that knowledge all that was known was the relative weight. Professor Poynting also determined the weight of the earth, and made the most romantic discovery that light had pressure. So that even in London there was a certain amount of romance. There was the romance of the discovery of the countless suns of the universe, the rate at which they came to the earth, and the general purpose, if any purpose at all could be traced, of that great universe, all depending and resting upon trigonometrical survey. Without that fundamental knowledge it was impossible to go any further. Romance existed all over the world. There was nothing more exciting, even to an inventor in designing a gas-engine, than to see for the first time some of his ideas actually at work.

MR. DOUGLAS W. FRESHFIELD (President of the Royal Geographical Society) said it was always a pleasure to hear an address by an expert on his own subject, more particularly so when that subject was one in which the listener had taken much interest for many years. It was some forty years ago since he was first brought into connection with the direction of the Geographical Society, and since then he had been more or less in contact with officers of the Indian Survey. In one sense his object, as the Secretary of the Geographical