

to be the wish of the Society. You therefore, Gentlemen, if you choose me once more, must take upon yourselves the responsibility of re-electing your weather-beaten chief, who on his part can only assure you that, if you do so, he will put forth in your cause whatever energy is left in him.

In the mean time I may say that the losses in our staff have been well made up; for whilst our accomplished Secretary, Mr. Clements Markham, remains, Mr. Laurence Oliphant, the well-known traveller in many countries, takes the place of Mr. Spottiswoode; and the post of Assistant-Secretary is already occupied by a true traveller and good geographer, Mr. H. W. Bates, the author of that popular and instructive work, 'The Naturalist on the River Amazons.' The man who, in pursuit of the beauties and truths of natural history, has spent eleven years of his life in regions known to few Europeans, and who has since published so striking an account of them, will, I anticipate, be found to possess all the qualities of a good Assistant-Secretary and Editor of our publications.

Since our last Anniversary we have made an addition to our members of eighteen distinguished geographers of foreign lands, as mentioned in the Report of our Council; and in this act we have not only honoured ourselves, but have greatly augmented our means of obtaining the best and freshest knowledge of the advances of our science in France, Germany, Switzerland, Russia, South America, the United States, Portugal, and Denmark.*

In former years I have had, as I now have, the satisfaction to announce that the numbers of our ordinary Fellows have increased, and are increasing, and that our losses by death have been small in comparison with the great accession of new Fellows. In fact, the elections made in two of our ordinary days of meeting would replace the whole number we lose by death during the year. If this prosperous, flowing tide should continue, we may really reach that stage of augmentation for which no place of meeting would suffice, and then we may be obliged to limit our numbers, and fill up the annual vacancies only.

OBITUARY.

I naturally commence the record of the losses we have sustained in the deaths of our Associates with a notice, however brief, of that good and well-beloved man, my immediate predecessor, the late Lord

* See Council Report, Appendix F, p. 25.

ASHBURTON. Born in the last year of the last century, William Bingham Baring succeeded to his father, the first peer, the great merchant prince Alexander Baring, whose name is bound up in geographical annals, as having been the chief British Commissioner, assisted by Colonel Mudge, R.E., and my friend W. G. Featherstonhaugh, in settling the boundary between the United States and British America. Receiving part of his education in Geneva, he gained good classical honours at Oxford, where he was a member of Oriel College, and where under Whately, the late Archbishop of Dublin, and Davison of Oriel, he acquired that taste for general knowledge which he ever retained. During the administration of Sir Robert Peel, and when a member of the House of Commons, he occupied the official posts of Secretary of the Board of Control, of Paymaster of the Forces, and of Treasurer of the Navy.

As soon as he became possessed of the title and the great landed estates of his father, Lord Ashburton was enabled to exercise liberally his love of true beneficence; and on numberless occasions he quietly and unostentatiously, but zealously, occupied himself in acts of well-considered encouragement of merit, and in countless works of charity; whilst his exertions to improve the education and condition of the humbler classes were unceasing.

In his capacity of President of this Society, I had perhaps more opportunities of estimating his hearty devotion to our cause than most of my Associates, and I can sincerely declare, that nothing but ill health ever prevented his personal attendance at our meetings; and that even when pressed by illness, his thoughts were anxiously directed to our well-being and advancement. When able to be among us, his elegant and appropriate Addresses, his genuine friendliness, and participation in our proceedings, endeared him to all the Fellows of this Society. It has been incorrectly stated that he resigned his office on account of ill health; for, threatened as he was with the malady which ultimately proved fatal, he strove to do his duty throughout his biennial term of office. As his malady increased, his health underwent so great a change for the worse, that but for the unremitting and soothing attentions of the devoted and accomplished lady who mourns his loss, his life could not have been protracted as it was to the 23rd of March last.

In short, our late President was a man of so guileless and honourable a stamp, that no one could have had much intercourse with him without loving him; and those who knew him best will join with me in asserting that few men of our generation have

passed through life more usefully or blamelessly, or left behind them truer feelings of regard and affection, than William Bingham Lord Ashburton.

Rear-Admiral JOHN WASHINGTON, C.B., F.R.S.—In the year 1858 it was my province, in reviewing the meritorious life of that eminent hydrographer and noble character, Rear-Admiral Sir Francis Beaufort, to solace my Associates with the reflection, that the British Navy and this Society hailed a most worthy successor in our former Secretary, Captain Washington. Alas ! he also has now been taken from us. Born in 1800, John Washington entered the Navy in 1812, and saw much active service in the frigate *Juno*, in the waters of the Chesapeake and on the American coasts. Afterwards, in the *Sibyl* frigate (Capt. Forrest) he was occupied in pursuing the American Commodore Rogers up to Spitzbergen. In this voyage he acquired much scientific knowledge under the then master of the vessel, afterwards Sir W. Bain, in making astronomical and magnetical observations. Following up this knowledge in the Royal Naval College at Portsmouth, he there obtained a prize gold medal in 1816 ; after which he served three years in the *Forth*, both on the North American Station and in the Pacific. While on this last service he nearly lost his life through a sailor's falling upon him from the mast, and throwing him senseless into the sea, from which he was only rescued by extraordinary efforts.

When appointed Lieutenant in 1821, and obtaining leave to come home, he disembarked at Valparaiso, and crossed the Andes to Mendoza, riding over the Pampas to Buenos Ayres. Returned to England, he was transferred to the *Parthian*, and passed two years in the West Indies ; and afterwards, obtaining leave, he travelled in France, Spain, and Italy, improving himself in languages. Going to sea again in 1827, he was four years afloat in the Mediterranean, in the *Weasel* and the *Dartmouth* ; and during this service he explored the interior of Morocco in company with the English Consul-General Drummond Hay, making astronomical observations in his route, and fixing the true position of places hitherto undetermined. A memoir containing these observations was a communication to our Society in the first year of our existence, and published in the first volume of our Journal.

Constantly occupied in useful studies, he obtained the rank of Commander in 1833, and was ever active in promoting the success of our then young Society, when, in 1836, he succeeded to our first Secretary, Commander Maconochie. Once placed in that office, I

well recollect what vigour he infused into all our proceedings, whether in stimulating important travels and enterprises, or by greatly improving our publications, in the editing of which he laboured assiduously, assisted only by a single clerk. It was he, indeed, who introduced among us the practice of annually reviewing the progress of geography in the past year, a practice which was not adopted by our Presidents until that distinguished scholar the late Mr. William R. Hamilton set the example in 1839. I am reminded by the eloquent and admirable sketch of his life by M. d'Avézac that a very important anonymous suggestion made by Washington, and signed A. Z., which was addressed to the President and Council of the Royal Geographical Society, and suggesting the Antarctic Expedition of James Ross, was never printed, though it was recorded in the Bulletin of the French Society. After five years of invaluable services to this Society, Washington, in 1841, took the command of the *Black Eagle*, in which ship he brought the late King of Prussia to England. My friend, Baron Alexander von Humboldt, being the King's chief adviser, the favourable impressions produced on the mind of the illustrious traveller by the knowledge and acquirements of the ex-Secretary of the Geographical Society were such that, on the recommendation of that Sovereign, Washington obtained the rank of Post-Captain. Up to the year 1847 he was employed as a Nautical Surveyor in the *Blazer*; and on many parts of our own coasts he set that example of scrupulous exactitude of observation which had been duly impressed upon him by his revered chief, Beaufort, to whom in 1855 he succeeded as Hydrographer of the Admiralty. In this new post, following the bright example of Beaufort, he introduced the same spirit of action and order which he had so efficiently applied to the improvement of our Society, and was a thoroughly conscientious, indefatigable, and clear-headed Director of that laborious office. In it, besides compiling for us annually that excellent résumé of all the British Nautical Surveys of each year, which forms so highly valuable a portion of our Journal—which is now continued through the goodwill of his successor, Capt. Richards—Washington lost no opportunity presented to him by his official position, of rendering us essential service in promoting every geographical expedition of importance. Deeply imbued, like many a gallant seaman, with the profoundest sense of the obligations and duties of a Christian, he had all along taken the liveliest interest in every exploration of Africa which might tend to the improvement of the natives and the abolition of the trade in slaves. It

was therefore with especial zest that he backed up Livingstone when the latter had resolved to execute his second journey; and it was chiefly owing to the energy of Washington that the bold traveller was furnished with the steam-vessel by which the ascent of the Zambesi river was to be accomplished, though the expense of fitting out a vessel drawing less water for the ascent of the river Shiré fell entirely upon Livingstone. Nor had Washington been less conspicuously and untiringly active in supporting Lady Franklin through all her efforts in search of her missing husband; and if others had been as true-hearted in that cause as those lamented men, Beaufort and Washington, that heroic lady would not have been left to spend her own fortune in doing that which it was the bounden duty of the country to have accomplished. From repeated conversations on this subject with both of these eminent men, I know how truly they grieved with myself on the loss of national dignity and right feeling which that apathetic conduct involved.

Admiral Washington was one of those men of highly nervous temperaments, and feeling hearts, who inevitably fall victims to their zeal and sensibility, whilst duller men plod on and live. Exhausted by over-exertion in his office, he obtained leave of absence to travel on the Continent, in the hope that his shattered health might be restored; and with this object he repaired to Havre. There he made at first some progress, particularly when reanimated and rejoiced by the arrival of his second son, Henry Halford, from the Chinese station; when suddenly he was struck down by an order that the youth should sail to the Pacific. With natural impatience he hastened, ill as he was, to London, to try to avert his disappointment; but having failed, his despondency and ill-health increased, so he wandered into Switzerland on a forlorn-hope, and only returned to Havre to die in the sixty-third year of his age, happily attended by his affectionate wife and his youngest son, Francis Palmer.

With the sincerest regard for the personal character of Admiral Washington, and the deepest sense of the great services he rendered to this country, and to this Society in particular, it is indeed most gratifying to reflect that ample justice has been done to his memory by our distinguished Foreign Member, M. d'Avézac, in a notice of his life and works, read before the Geographical Society of Paris; whilst the honours which were paid to his remains by all the authorities, as well as by the inhabitants of Havre, on the

occasion of his interment, will never be forgotten by the numerous friends of John Washington. This is indeed one of those kindnesses which will the more link us on in bonds of continued friendship with our powerful allies and worthy rivals, the French. Admiral Washington was a Fellow of the Royal Society, and of many scientific and philanthropic establishments.

PORTLOCK.—By the decease of Major-General Joseph Ellison Portlock, of the Royal Engineers, our Society has lost a truly sound geographer. He was the son of Captain Nathaniel Portlock, R.N., who circumnavigated the globe in the days of Captain Cook, and died one of the Captains of Greenwich Hospital. His son, who was born at Gosport in 1794, was educated there and at Tiverton, and finally at the Royal Military Academy at Woolwich. Young Portlock obtained his first commission in the corps of Royal Engineers in 1813. In 1814 he was sent to Canada, where he served till September 1822, and took an active part in the war with the United States. He was at the siege of Fort Erie, and, when the army retreated, was the engineer who constructed the lines and *tête-de-pont* of Chippewa, at which Sir Gordon Drummond made his successful stand and saved Upper Canada. After his return from foreign service Lieutenant Portlock was appointed in 1824 to the Ordnance Survey, then under the direction of Colonel Colby,* and was one of the assistants of that able officer, in companionship with Lieutenants Drummond and Larcom, in preparing the materials for the measurement for the base of triangulation. Accompanying Colonel Colby to Ireland, he worked with the Trigonometrical Surveyors on Divis Mountain, near Belfast, where the first observations of distant points were made with the heliostat, then recently invented by Lieutenant Drummond, R.E., afterwards Under Secretary for Ireland. Becoming the leader of the trigonometrical branch of the survey in Ireland, Portlock underwent great hardships on the bleak coast of Donegal, in one part of which, though two of his soldiers perished, he perseveringly held on until he brought his observations to a successful issue. Completing the triangulation on various Irish mountains, he remained, in 1827, under canvas at heights of 2000 feet above the sea, till the middle of January. Up to that time he had been accompanied by Lieutenant, now Major-General, Sir Thomas Larcom, K.C.B., at present

* See my sketch of Colonel (afterwards General) Colby's eminent services, in the Address of 1853, when I presided over the Society. Vol. xxiii. p. lxix.

Under Secretary for Ireland, but thenceforward he continued his labours single-handed. In short, he indefatigably pursued his observations with the great theodolite in all the chief mountains of Ireland, until the network of the principal triangles was completed; whilst by observations across the Channel, mainly effected by the employment of heliostats, the Irish triangulation was united with that of England and Wales.

Portlock also undertook the laborious duty of correcting the discrepancies which arose between the established points of the great triangulation and the junctions of the detailed work of the field-surveyors, and, provided with assistants, he so advanced these operations that in one year two millions of acres were completely surveyed. With such ceaseless labour in observation, calculation, and horizontal triangulation, Portlock united an elaborate system of vertical measurements. The altitudes were first deduced from the level of the sea by actual levelling to bases of altitude, and from those bases transferred, by angles of elevation and depression, to the summit of every mountain, hill, and station, at distances averaging a mile asunder, on which the minor levellings of the detail survey depended. This also was at first performed in the separate districts, but ultimately generalised into a system. With this view, Portlock personally carried a line of levelling across Ireland, from the coast of Down to that of Donegal, and caused similar lines of levelling to be observed in other places. The result was, to furnish a more general and homogeneous series of altitudes than had ever before been accomplished. It is true that even the accuracy thus obtained proved insufficient for those increasing wants and that improved knowledge which the scientific works of the day soon afterwards called for, though his contributions went far beyond the original intention and requirements of the survey as contemplated by Parliament. Those wants were also met and supplied in Ireland by an elaborate system of special spirit-levelling, crossing the island in every direction, and terminating at stations on the coast, where tidal observations were simultaneously made. These observations were thoroughly executed by Captain Cameron, who had been trained chiefly under Portlock; and they furnished the material for the admirable paper by the Astronomer-Royal, published in the Transactions of the Royal Society of London.

The triangulation and altitudes of all Ireland being completed, Portlock was employed to carry out the views which Colonel Colby had formed at the commencement of the survey in regard to a

geological survey of Ireland, but which the more pressing wants of the topographical branch had caused to be suspended. For that work, on which Portlock's abilities might have been equally developed, the time was past for making it a part of the survey, and, after a single volume had been published, other public arrangements were made, and the Geological Survey of the British Isles was established under Sir Henry de la Beche. It is, however, my bounden duty, as a geologist, to state that this volume of Portlock on the geology of Londonderry is a perfect model for fidelity of observation and minute attention to phenomena.* To the quickness of his eye, and his resolution to surmount difficulties, we also owe the first detection in Ireland (Tyrone) of those trilobites and other organic remains which enabled him to identify those rocks with the Silurian rocks of England and Wales very shortly after my first classification of these older palæozoic rocks. In short, he not only described the physical and mineralogical features of those tracts, but even so correctly described and named all their imbedded organic remains, that his work will always be considered one of those stock pieces of science to which geologists are largely indebted. On many occasions, as he rose in rank from captain to field-officer, Portlock showed, not only so a great a love for geology, but also so true and solid an acquaintance with the science, that in the years 1857 and 1858 he was elected to occupy the chair of the Geological Society of London; in which he was not only distinguished for his sound judgment and courtesy as a President, but also for the faithful and elaborate research shown in his Anniversary Addresses. He was, in truth, a geologist quite after my own heart; for in him an acquaintance with rocks, minerals, and fossils was united with the full knowledge and feeling of a true physical geographer.

When his duties as a trigonometrical surveyor were completed, Portlock reverted to the active military duties of his corps, and was employed as Commanding Engineer at Corfu in the erection of the fortifications now in process of demolition. Afterwards he commanded the Engineers at Portsmouth and at Cork. In 1853, much to his honour, he wrote a memoir of the life of his old chief in the Ordnance Survey, General Colby, whose modesty had prevented his rendering justice to himself, who had done so much and

* In 1858, Portlock acted as President of the Geological Section of the British Association at Belfast.

said so little of his deeds. Subsequently General Portlock became the Inspector of Studies at the Royal Military Academy at Woolwich; and, lastly, a member of the Council of Military Education. Failing health—the result, doubtless, of his extraordinary labours—bringing on paralysis, and compelling him to resign the last-named office, he returned to a pretty spot near Black Rock, Dublin, called Lota; where, soothed by the attentions of his devoted wife, he died on the 14th February, 1864.

For much that is given in this sketch of my lamented friend I am indebted to his distinguished brother Engineer officer Major-General Sir Thomas Larcom, with whom I cordially agree in thus summing up our estimate of the man:—"The characteristics which shone forth in Portlock during his well-spent life, whether as a soldier, a geographer, or a geologist, were,—undaunted courage in facing difficulties, Spartan endurance and invincible perseverance in overcoming them. Endowed, when in the zenith of his career, with a frame and nerves of iron, he exhibited such a vast power of continuous labour that he achieved every object he had in view; whilst great ability and a pure love of knowledge were in him guided and governed by the highest sense of honour and moral rectitude."

General Albert de LA MARMORA.—Our list of Foreign Members has in the last year been deprived of the name of one of those brave soldiers of whom Italy has reason to be proud, and who, in the latter part more especially of his distinguished career, has been a most devoted and successful contributor in the advancement of geography. Albert de La Marmora, who died last year at Turin in his 75th year, and was born at the same place in April, 1789, was the second born of eight brothers of an ancient noble family, four of whom became distinguished General Officers. Entering the military service when the North of Italy was united with France under the First Napoleon, his education was completed at the Military School of Fontainebleau, in which he was well instructed in mathematics by the famous Puissant. After some years of local adventure he served in the army which, advancing from Italy, retrieved the defeat of Aspern; and he fought in the great victory gained by the first French Emperor at Wagram. Although a serious malady compelled him to leave the army in 1811, he was called again into activity, and, taking part in the battles of Lutzen and Bautzen, he obtained the Cross of the Legion of Honour. He was also engaged in the disastrous battles of Gross Beeren and Leipzig; and, when the

star of Napoleon set in 1814, La Marmora, returned to his native city, still holding, after eight years of hard service, the rank of Lieutenant only. Our own fine old soldier, Lord Clyde, was, in a similar way, long an unknown brave subaltern.

In the year of peace which followed the short war of 1815, his active spirit led Albert de La Marmora into liberal demonstrations, which caused him to be exiled to the Island of Sardinia. This event, which seemed untoward, proved however to be most beneficial to geographical science. It threw this zealous man upon his own resources, and he began to work out the geography of an island, which, though it gave for a long period a title to a crowned head, had been hitherto quite misrepresented in the scientific maps of European countries. In subsequent years, regaining his freedom and proper position, he advanced to higher rank and occupied public stations of importance; among which was the Directorship of the Royal Naval School at Genoa. An active adherent of the gallant but unfortunate Charles Albert, he received from that King, shortly before his abdication, the rank of Lieutenant-General; and under the present King of Italy was decorated with high honours.

Having thus briefly sketched his public career, it is now my duty to unite, as your representative, with the Geographers of France and Italy, and I trust of every country of the civilized world, in doing honour to the memory of the man who devoted his best energies for many years to the completion of that beautiful map of Sardinia, for the construction of which we placed him in the list of our Foreign Members. This work is not only an example of accurate and skilful workmanship, in the representation of a tract highly diversified in outline, but has been admirably illustrated by the well-filled volumes which he published on the Natural History, Antiquities, and Geology of his favourite island, so that the labours which he commenced in 1819 were not really terminated until 1860. Whilst my eminent contemporary M. d'Avézac, in his Address to the Geological Society of France, speaks with the warmth of a friend and admirer of General Albert de La Marmora for his description of the Antiquities of Sardinia, let me assure you that at a late period I also rejoiced to converse with the deceased General, when I found that he was as zealously intent upon doing all justice to the geological structure of the island. Not content with consulting M. de Verneuil and myself as to the age of the rocks he was describing, he employed competent persons, particularly M. Vecchi, in drawing and describing all the fossil organic remains. In short, he has by

his encyclopædic and praiseworthy labours so united Sardinia with Piedmont, as thereby to constitute the strongest reason, independent even of the rights of regal inheritance, why the race of inhabitants of that fine island should never be severed from the Italian kingdom. It is as a benefactor to humanity in its widest sense that the memory of this true devotee to the cause of science and letters will be preserved to future ages, when the names of many a greater official personage of our time will have passed into oblivion.

The Earl of ELGIN and KINCARDINE.—The late Earl of Elgin was a Fellow of our Society, and it is but a brief time since you heard his voice in this room, unostentatiously describing the results of those great events which have revolutionised the relations between the European world and the most remote and most civilised empires of Asia. The late Earl, born in 1811, was educated at Eton and Oxford, and was the friend and contemporary in years with such statesmen as Lords Dalhousie and Canning, and William Gladstone.

With a slender patrimony, and no other advantage to begin life than an ancient Scot's pedigree, Lord Elgin fought his way to eminence by force of talents, assiduity, and integrity, and was truly the builder of his own fortune and renown. Diplomacy was the branch of administration, including colonial administration, in which he rose; and here, from the magnitude and importance of the transactions in which he happened to be engaged, but still more from the skill with which he conducted them, he is entitled to rank among the first diplomatists of our time. His first responsible office was that of Governor of Jamaica, from which he was transferred to the more important and difficult office of Governor-General of Canada, which he discharged with skill and efficiency, conducting to a successful issue those negotiations with our frontier relatives, which, founded on the solid bases of freedom, justice, and equality, ought to insure peace and contentment to the parties concerned. But by far the most valuable services which Lord Elgin rendered to the State were those which he achieved in China and Japan. The first mission to China began in 1857, and lasted two years; the second began in 1860, and terminated in the same year; so that in all, between China and Japan, he passed three years of most laborious and responsible employment. This successful diplomacy has thrown open to us four new ports in China, and as many in Japan. You can judge to what extent we are already profiting by his Lordship's services, when I state that the value of the exports and imports of Britain and her Colonies with the two empires already reaches the yearly sum of 40,000,000*l*.

Such services as these will assure to Lord Elgin a record in our national history.

The operations which have led to these great results gave the Earl of Elgin an opportunity of displaying that self-reliance, promptitude of action, and political courage, which eminently distinguished his character. The news of the outbreak of the great Indian rebellion having reached him on his route to China, he at once appreciated the extent of the danger, and, on his own responsibility, diverted the whole naval and military expedition from its original destination. By his command, the force which was meant for the Peiho proceeded to the Ganges, and largely contributed to the suppression of the insurrection; for it was in time, not only for the protection of Calcutta, but for the capture of Lucknow. In this last crowning achievement, performed at the distance of 600 miles out of the bounds of their own special element, even the Navy took part; for who can forget the part played in it by the gallant William Peel and his sailors?

Shortly after his return from China, Lord Elgin was promoted to the most lucrative, but also the most difficult and responsible, office under the Crown—the Government of India; and assuredly none of his predecessors brought to it so large and various a practical experience, while in talents he equalled the most distinguished of them. Had his life been spared, his talents, energy, and industry would have been equal to the cultivation of the grand field which was now opened to him. He proceeded to India in 1861, and died at his post in 1863, at the age of 52, much too early for his country and his friends; the malady which proved fatal to him being an organic affection of the heart—without doubt, the effect of long, laborious, and anxious public services on a peculiarly sensitive constitution.

In dying at his post in India, this eminent public servant was spared the misery which befell his predecessor, Lord Canning, in the loss of his wife; for, happily, the accomplished Countess of Elgin, who had devotedly followed her lord to the East, has survived, and will doubtless so bring up her children as to lead them to emulate the great deeds and virtuous life of their noble parent.

The death of the Admiral of the Fleet brings me to notice, however briefly, one of the distinguished seamen of Nelsonian days. Sir W. HALL GAGE, G.C.B., entered the Navy in 1789. He was present as Lieutenant of the *Minerve*, under the command of Lord Nelson, when that vessel captured the Spanish frigate *Sabina*. He next took

part in the cutting-out of the *Mutine* from under the batteries at Teneriffe. When in command of the *Uranie*, the boats of that vessel, in company with those of the *Doris* and *Beaulieu*, cut out the French National ship *La Chevrette*, of 20 guns and 350 men, which was considered one of the most brilliant exploits of the kind ever performed. He served as Commander-in-Chief in the East Indies from 1825 to 1830, and on the Lisbon station from 1834 to 1837; and from 1842 to 1846 he acted as Senior Naval Lord at the Board of Admiralty. Sir William joined the Royal Geographical Society in the year 1845.

Rear-Admiral Octavius VERNON HARCOURT, fourth son of the late Archbishop of York, entered the Navy in 1803, and in the *Calcutta* performed a voyage round the world in 10 months and 3 days, which at that period was thought a very remarkable feat. He served as a Lieutenant in 1809, in the Baltic, with distinction; and in 1813, when in command of the *Challenger*, took part in the siege of San Sebastian, and afterwards commanded the *Blossom* and *Doris* on the South American station. Admiral Harcourt took an active interest in many charities, and at his death bequeathed a large sum of money for their maintenance.

Rear-Admiral FOWLER entered the Navy in 1793, and sailed as Lieutenant with Captain Flinders on a voyage of discovery to New Holland. He was afterwards wrecked on the Cato Reef, when in command of the armed storeship *Porpoise*; but he ultimately succeeded in reaching Canton, where he embarked on board the *Earl Camden*, East Indiaman. In consideration of the assistance that he afforded to Captain Dance in beating off the powerful French squadron under Linois, he was presented by the East India Company with a sum of 300*l.* to purchase a piece of plate, and the Patriotic Society awarded him a sword. He served in Sir R. Calder's action, 1805, and took part in the expedition to Walcheren, 1808.

Captain William ALLEN entered the Navy in the year 1805. He served in the *Standard* at the passage of the Dardanelles, under Sir Thomas Duckworth, and was engaged in the reduction of Java.

Captain Allen served in the *Wilberforce* steamer on her memorable expedition up the Niger, of which he published an interesting account; and in the year 1855 he produced a work in 2 vols. on the 'Dead Sea and the Overland Communication with the East.' In this he advocated the cutting of a canal so as to admit the Mediterranean into the Dead Sea, and entered extensively into a comparison

between this route and that by the proposed Suez Canal. Captain Allen took an active part in the proceedings of the Society, and spoke occasionally at our meetings.

Captain W. A. WILLIS entered the Navy in 1811. He served as Flag-Lieutenant to Sir G. Cockburn, in the West Indies, and afterwards in command of the *Jaseur* and *Frolic*; and in 1845 he was granted a pension for wounds received in the service.

Richard THORNTON.—I have now to speak of a gifted and promising young man, Mr. Richard Thornton, of Bradford, who has lost his life by his zealous exertions to extend our acquaintance with the geography and geology of Eastern Africa. I am proud to say that Richard Thornton received his scientific education in the Royal School of Mines, over which I preside, and that, being desirous of accompanying Livingstone in his last explorations, I confidently recommended him to the good will of the great traveller. When Livingstone last left our shores in March, 1858, young Thornton, then only nineteen * years of age, accompanied him as geologist. Qualifying himself during the voyage and at the Cape of Good Hope in making astronomical calculations, and being also a good sketcher of ground and capable of constructing maps, he was as well adapted to lay down the physical geography of the Zambesi River as to describe the various rocks which occupied its banks.

In looking over his accurately-kept diaries, in which he never failed to register every fact, I find that he made upwards of 7000 observations, to fix relative geographical points and to determine altitudes, on the banks of the Zambesi. In leaving the tertiary rocks of the Delta behind him, and in ascending that river to the rapids, he described numerous rocks of former igneous origin; and, still further inland, various seams of thick and good coal (of which the Portuguese may very largely avail themselves); proving, by the associated fossil remains, that the coal was of the old and best age of that mineral.

His health having failed, he was for a while estranged from the Zambesi expedition, through a partial misunderstanding between his chief and himself. This having been completely done away with, when my young friend returned to work out and complete his labours in the Zambesi region, I should not here allude to it, if not to recount the important services he rendered in the mean time to

* Born 5th April, 1838.

geographical and geological science, by becoming *ad interim* the scientific companion of Baron C. von der Decken, in his first survey of the Kilimandjaro Mountain, from Zanzibar and Mombas.

Having recently examined the diary kept by Mr. Richard Thornton in that journey between Mombas and the highest point the travellers reached, and also on their return to Mombas, or between the last days of June and the 10th of October, I have no hesitation in saying that the labour is so graphically detailed, every movement so accurately recorded, the transactions with the various native tribes so clearly explained, and every hour of the 120 days' expedition so well accounted for, that, with the contoured map of the region which he prepared, together with many sketches of the form of the ground, I can really fancy myself, like his leader and himself, struggling to reach the snowy equatorial summits. The numerous obstacles opposed by the native chiefs, and the manner in which, after so many "showrys" or palavers, all difficulties were overcome; the perfect description of the habits and dresses of the natives—of the metamorphosed structure of the rocks—the vegetation of each zone of altitude—all these are given; whilst every moment of clear weather in that humid region was devoted to star and lunar observations, or to theodolite measurements of altitude, and the fixing of relative geographical points. All this, too, was scrupulously performed by Thornton, notwithstanding occasional attacks of fever, to which the Baron and himself were subjected.

I cannot but hope that these diaries of an accurately minute philosopher, or at least large portions of them, will appear in print; for I have read few writings more instructive and characteristic. In fact, until Baron von der Decken and Thornton carried out this expedition, no other African traveller has ever had presented to him such a vast variety of scenes of nature, within so limited a compass, as those which are seen in ascending from the eastern seaboard to the banana-groves on the skirts of the snow-clad peaks of Kilimandjaro. As the account of this first ascent has been given to Continental Europe in German, so we may rejoice that our Thornton's English version of the same may soon appear; whilst Baron von der Decken, our Medallist of this year, unites with me in the expression of admiration of the undaunted efforts and able assistance of his companion.

In truth, in his letters to myself, besides what is noted down in his diaries, Thornton correctly described (and for the first time) the nature of each rock of that region; by which I clearly learned

that igneous rocks, whether syenites or porphyries, had penetrated micaceous slaty metamorphic strata, and that streams of vesicular lava, which occur on the flanks of the mountains, indicated clearly that the loftiest summits, now capped with snow, had been raised by the extrusion of a great subaërial volcano.*

If his life had been spared, this fine young man intended, as he wrote to me, to endeavour to traverse Africa, and compare its East and West coasts with each other, as well as with its vast lacustrine centre. Anxious, however, to finish off in the mean time those labours in the Zambesi which he had so far advanced, he rejoined his old chief Livingstone, and was on the point of completing the map of a mountainous tract on the north bank of the stream, when, in over-exerting himself, he fell a victim to that fever which has proved so fatal to our missionaries, to the devoted wife of Livingstone, and which, on more than one occasion, has nearly deprived of life that great traveller himself.

One of his companions for a time on the Zambesi, the Rev. Henry Rowley, in writing to me of the never-flagging zeal and unconquerable energy, as well as of the generous nature and high character of Richard Thornton, adds:—"Axe in hand, he would cut himself a path to the top of a thickly-wooded mountain, never leaving it till the setting sun made further observations impossible."

In reviewing the journals and diaries of Richard Thornton, I am lost in admiration of his patient labours of registration, when combined with his vivacity of description. With such a delineator in words as Thornton, and such an artist as Mr. Baines—who has sent home such admirable coloured drawings of South-African scenes, particularly of the falls of the Zambesi—those of us who are destined never to be able to penetrate into the southern part of Africa, may quite realise to our mind's eye the true characters of that grand continent. Through the devotion of the brothers and sisters of the deceased traveller, the whole of his voluminous notes and observations have, I am happy to say, been carefully copied out and transmitted to us; and I am confident that every one who examines them will declare with myself, that Richard Thornton was so gifted and rising an explorer, that, had he lived, his indomitable zeal and his great acquirements would have surely placed him in the front rank of men of science. He died on the 21st April, 1863, at the early age of twenty-five years.

* In the subsequent expedition, when Baron von der Decken reached the greater altitudes, he found in addition trachytes and obsidian.

E. Osborne SMITH.—By the decease of my respected friend, Mr. E. Osborne Smith, the Council has lost a valuable auxiliary, whether in the management of our finances, in preparing the annual Reports, or in every way rendering himself useful. Possessed of sound good sense, and endowed with a most genial disposition, he was truly an important link between the popular and scientific portions of our large body; and on numerous occasions was of real service in calming irritation and in promoting harmony and goodwill among us.

As the Treasurer of the Club of the Society, his cheerfulness and large-heartedness rendered him a general favourite; and all its members have united with me in deploring his loss, whilst they cherish the memory of his good deeds. He had been for many years the Actuary of the Reliance Life Assurance Company, which office gave him full opportunity of displaying his mathematical abilities; and it is believed that the laborious work of computing a long series of important and intricate calculations brought to a crisis the illness that terminated his well-spent and useful life.

Mr. Osborne Smith was a Fellow of the Society of Antiquaries, and also of the Zoological, Statistical, and Ethnological Societies; and was a member of Council in the two last bodies, as well as in that of our own Society. He died on the 25th April, 1864, in the sixty-fifth year of his age, deeply regretted.

Beriah BOTFIELD.—Beriah Botfield, M.P., was a man of cultivated mind, who expended much of his large fortune in the promotion of antiquarian researches, and in the publication of literary works of merit. The chief of these works are—various Tracts upon Bibliography, communicated to the Philobiblion Society; Prefaces to the first editions of the Greek and Roman Classics, and of the Sacred Scriptures; Stemmata Botevilliana; Expenses of England in the 13th and 14th centuries; and Notes on the Cathedral Libraries of England. In addition to these, Mr. Botfield made various communications to the Society of Antiquaries, which have been duly noticed by the President of that body, Earl Stanhope.

William CUBITT.—William Cubitt, M.P., was one of the most marked of that class of good and earnest men who, owing their success in life to their own exertions, rise to posts of distinction. He began life as a seaman; but in due time, following the bent of his genius, he studied architecture, and became a most successful builder. In truth, William Cubitt was the architect of his own fortune. He rose to the loftiest civic dignity of these kingdoms, attaining at the same time a seat in Parliament. Mr. Cubitt was so justly popular, and so much esteemed for his good sense, probity,

and engaging manners, that he was twice chosen Lord Mayor of London, and died infinitely regretted by a large circle of friends and admirers.

John Watkins BRETT.—Though not the scientific originator of submarine telegraphy—an honour which was won by Professor Wheatstone*—Mr. Brett was distinguished by being the first to show, by the actual experiment of laying a gutta-percha wire across the British Channel, in 1850, that the scheme was feasible. He had indeed called the attention of Government to the subject in 1845, with the view of connecting Britain with her colonies. He afterwards (1846-7) endeavoured in vain to carry out his project under the Government of Louis Philippe, though he had obtained a concession. At last, through his energy and ability, he obtained a renewal of the concession from Louis Napoleon; and in 1850 an experimental line was submerged by Mr. Brett between Dover and Cape Griznez, by which the *first* submarine message was sent from one country to another; ‘The Times’ of the day remarking, “the jest of yesterday has become the fact of to-day.” The present cable between Dover and Calais was laid in 1851, and the Dover and Ostend line in 1853; the latter under a concession from the King of the Belgians. The next trial was in the unknown depths of the Mediterranean, under concessions from the French and Sardinian Governments, and resulted, in 1854, in uniting the Island of Sardinia with the Continent of Europe. It would be superfluous to trace further Mr. Brett’s connexion with telegraphic enterprise: suffice it to say, that in 1856 he was mainly instrumental in forming the Atlantic Telegraph Company, of which he was one of the directors. It is rare to find a highly cultivated taste for the fine arts combined with an enterprising mind, yet such was eminently the case with Mr. Brett, as proved by his well-known, choice and varied collection of works of art. Mr. Brett died on the 3rd of December last, at the age of 58, bequeathing one-tenth of his large property to charity.

C. G. PULLER.—C. G. Puller, Esq., a respected friend of my own, was one of the representatives of Hertfordshire. He was a conscientious, enlightened, and zealous Member of Parliament. He died most unexpectedly, after a very short illness.

Arthur PAGET.—Mr. Arthur Paget, the heir of a great estate, was

* From the year 1840 onwards Professor Wheatstone familiarized the public with the feasibility of Submarine Telegraphy. I have before me documents which leave no doubt on this subject, and a jury of the International Association at Paris in 1855 unhesitatingly assigned this scientific honour to Wheatstone.

too early cut off: in the spirit of adventure and from love of geographical pursuits, he had visited America, the Pacific Islands, Continental India, Java, with others of the Malayan Islands, and Northern Africa. In China, during our last operations against the Imperial Government, he served as a volunteer, sharing in the perils and privations of his military companions.

The other deceased Fellows, who have not taken a prominent part in our proceedings, or have been noted as authors or public characters, are—Mr. Henry Ancell; Mr. Thomas Blackwell, an able Civil Engineer; Mr. David Barclay, Mr. William Jackson, Mr. George Lee, Mr. Thomas Molson, the Rev. W. Oxenham, Mr. Thomas Parr, the Rev. G. C. Rowden, Mr. John N. Ryder, Mr. W. Richardson, and Dr. Tronson.*

BRITISH GEOGRAPHY.

Admiralty Surveys.†—The Admiralty Surveys at home and abroad have made adequate progress during the past year, although, owing to the completion of some Coasts, and the retirement of officers, certain reductions have taken place.

English Coast.—Staff-Commander Calver, in the *Porcupine*, has re-surveyed the estuary of the Thames, a work which, owing to the shifting nature of the sands, was much required. He has sounded over an area of 240 square miles, and will, during the present year, continue to trace the changes to the north-east, along the coasts of Suffolk and Norfolk, till they disappear. The ever-changing character of the sands off these shores, and especially in the vicinity of Yarmouth and Lowestoft, calls for continued activity on the part of our Surveyors; and under the skilful and energetic superintendence of the officer charged with this service it is hoped that all the requirements of navigation, vast as they are, will be fully provided for. Captain George Williams, in the *Bann*, has completely re-surveyed and elaborately sounded the Scilly Islands, within a radius of 10 miles: his soundings cover an area of 550 square miles. During the present season he will be employed in completing the deep-sea soundings on the south coast of England, between the Eddystone and Portland. Commander George M. Alldridge, in the *Asp*, has

* I have learnt, too late for notice, that General Monteith is dead. The labours of this experienced geographer must be recorded next year.

† As prepared by the Hydrographer, Capt. Richards, R.N.

surveyed Caermarthen Bay, with the rivers Taff and Towey; thus completing the north shore of the Bristol Channel. This officer, after a long, active service, extending over thirty years, has retired with his promotion, and has been succeeded by Commander David Aird, who during the present season will continue the sounding of the southern shore of the Channel, between Minehead and Hartland Point.

The Survey of the Western Hebrides, under Captain Otter, is satisfactorily completed; and no delay will take place in the publication of this important part of the Scottish seaboard, on a scale commensurate with all the requirements of the seaman. There remains now to complete the entire western coast of Scotland but a small portion of the Island of Tyree, Skerryvore, and its off-lying dangers, with the deep-sea soundings in the same neighbourhood, which, under the direction of Captain J. E. Bedford and Mr. Stanton, will no doubt be brought to a close by the end of this year.

Captain Bedford and his Assistants, during the past season, have surveyed 142 miles of the exposed coasts of Coll and Tyree; and sounded over an area of 137 square miles, besides other details.

Commander Thomas has completed the shores of Benbecula and Harris, and retires with promotion after a long and unbroken period of active service of over thirty years.

The Survey of the Channel Islands, under Staff-Commander John Richards, has made good progress during the past season, and is being continued with that care and minuteness which a coast-line beset with so many hidden dangers necessarily requires.

Mediterranean.—The Surveys in this sea and the Grecian Archipelago, under Captain Spratt, c.b.,* and Commander Mansell, have steadily progressed during the past year. The examination of the different banks in the Malta Channel, the Survey of Tripoli, and the Island and Channel of Corfu, are among the most important works which have been completed. It will be learned with regret by all geographers that Captain Spratt, who has passed the greater part of his professional life in the active duties of the Mediterranean Survey, and for the last twelve years most ably conducted it, has resigned his important command. The records of this Society have year by year feebly recorded the benefits which have been conferred

* No stronger proof of the high estimation in which Capt. Spratt is held by men of science and art can be given, than that he was last year selected as the first out of many candidates in the list of the nine persons who are annually admitted into the Athenæum Club as "*eminently distinguished* in science, letters, and the arts, or public service."

on science and navigation by the energetic labours of this talented officer; but his works themselves will remain an enduring monument of his skill and industry for ages yet to come.

Commander Mansell, the late coadjutor of Captain Spratt, has taken his place; while Lieutenant-Commander Wilkinson has succeeded to that of Commander Mansell.

Newfoundland.—Captain Orlebar, with his Assistants, has surveyed 114 miles of the eastern coast of Newfoundland, between Cape Race and Cape Spear, including plans of several bays and harbours, and has sounded over an area of 1330 square miles: his work is in process of engraving.

Nova Scotia.—The examination of this coast, under Captain Shortland, is rapidly drawing to a close. During the past season 125 miles of sea and harbour shores have been completed, and 177 square miles sounded over.

West Indies.—The West India Survey, under Mr. Parsons, includes during the last year portions of the Islands of St. Vincent, Antigua, and St. Lucia. Mr. Parsons has now commenced the examination of Grenada.

Bermuda.—In consequence of the increased draught of our modern ships, and in order to ascertain whether any alteration has taken place in the depth, consequent on the growth of the coral, it has been considered necessary to make a re-examination of some of the narrow and intricate channels leading to this important depôt; and Captain Pullen is now employed on this duty.

Vancouver Island.—It was announced in our last Annual Report that the Survey of this important island, with the adjacent coast of British Columbia, had been completed. The *Hecate*, lately engaged on this duty, has arrived in England, and the work has been deposited at the Admiralty, by whom it will be published for the benefit of navigation without delay. The fruits of this Survey are already apparent in the rapid development of the resources of this region as a coal and timber producing country, and also of its fisheries. A company is incorporated for the establishment of a graving-dock in the harbour of Esquimalt, which will have the effect of drawing to the shores of this rising colony the ships of all nations from one end of the Pacific to the other. The Survey of the northern shores of British Columbia is being continued by Mr. Pender, late Chief-Assistant in the *Hecate*, who, with an able staff, has already made good progress with the work.

Australia.—Under the combined efforts of the four officers in

charge of the different Surveys, considerable progress has been made in the delineation of the shores of this great country; the expenses being borne equally by the Colonies and the Home Government.

Commander Hutchisson, in South Australia, has completed the upper portion of Spencer Gulf, including 167 miles of coast, and has sounded over 964 square miles. He was, in his little vessel of 100 tons, to leave South Australia, and, passing round the eastern coast, by Torres Strait, take up the examination of the northern shore about Cambridge Gulf, that coast having lately been added to the territory of South Australia.

Commander Cox, in Victoria, has completed the Survey of Port Phillip and its approaches, but has been considerably retarded in his little vessel, of 65 tons, by the furious gales with which this part of Australia was visited during November and December, 1863. On the coast of New South Wales, the Survey under Commander Sidney is proceeding as rapidly as the means at his disposal will allow; but in consequence of the wreck of H.M.S. *Orpheus* at the entrance of Manukau Harbour, in New Zealand, he was directed to proceed to that colony and make a re-survey of the dangerous bar of that harbour. This duty Commander Sidney has effected, and returned to his survey in Australia. The new Survey of the Manukau Bar is in course of publication.

Mr. Jeffery, in Queensland, has surveyed part of Hervey Bay and the entrance of Mary River; and, now that he has been provided with a suitable vessel, no doubt the examination of the sea-coast of this thriving colony will advance rapidly. But by far the most important event which has occurred in the annals of Queensland is the establishment of the new settlement at Cape York, in Torres Strait. The Government have lately dispatched a small detachment of Royal Marines to commence this work; and H.M.S. *Salamander* has been also sent from England to aid in the enterprise.

Under these favourable circumstances, coupled with the daily increasing prosperity of Brisbane, and the rapid extension of the white population towards the north, we cannot doubt but that the whole eastern coast of Australia will ere long be opened up to navigation and commerce. In truth, we are now beginning to reap the fruits of those long years of toil and industry—the rewards of that skill, patience, and perseverance which produced to the world the magnificent survey of 800 miles of channels within the reefs of this coast; a survey which, when commenced, must have appeared

almost a hopeless undertaking, but which has led to the opening of a safe highway, soon to become the beaten track between India and Australia. In connection therewith, let not the names of King and Blackwood, and Owen Stanley, be forgotten: well may the companions of these gifted men, who still remain, feel proud to have participated in a work which will ever remain a monument of their perseverance and their skill, and among Nautical Surveys will stand unrivalled.

China and Japan.—The opening of new ports and the rapid extension of the world's commerce with these countries have taxed to the full the energies of our Surveyors during the past year.

The *Riflemen*, under Mr. Reed, has been employed in defining the limits of the great central reefs which encumber the China Sea, and in clearing the two highways from Singapore to the north, viz. the N.E. and Palawan routes. This is a most important work, not only involving much time, but the greatest care and vigilance: real dangers have been correctly placed, and many imaginary ones, hitherto a source of constant anxiety to the seaman, have been expunged from our charts. Still much remains to be done in both these great thoroughfares before they can be pronounced free from danger. It is with regret we learn that Mr. Reed has been compelled through ill health to resign the command of this portion of the China Survey, which he has conducted with so much energy and ability. He has been superseded by Commander Ward, the officer who formerly commanded the *Actæon*, engaged on a similar duty.

The *Swallow*, under Mr. Wilds, has been employed in the northern portion of the Chinese waters. Its commander has made new chronometric measurements between Hong Kong, Shanghai, Nagasaki, Yokuhama, and the Korea, and surveyed 700 miles of coast-line, including part of the Korean Archipelago; Chin Chu Bay, on the south coast of Shan-tung; also the harbour of Amoy, a good plan of which was much required.

The re-survey of the estuary of the Yangtsze Kiang is now in course of progress, great alterations having taken place in its shoals since the Survey of Captain Collinson in 1842.

During the year 1863 twenty new Charts have been published by the Hydrographic Office of the Admiralty, besides numerous additions and corrections to others. The number of Charts printed during the same time has amounted to 150,517. Tide Tables have likewise been prepared by Staff-Commander Burdwood for 3000

places. Sailing Directions have been prepared by various officers : for the South and East Coasts of Africa, by Captain de Horsey, R.N. ; for the Persian Gulf, by Captain Constable and Lieutenant Stiffe, of the late Indian Navy ; and for the Gulf of Aden and East Coast of Arabia, by Commander Ward, late Indian Navy. A fourth edition of the 'China Pilot' has also been issued. This work has been thoroughly revised, and much additional information introduced from our late Surveys of the Coasts of the Yellow Sea, the Gulfs of Pe-chili and Lian-tung, the Sea and Islands of Japan, by Staff-Commander King. The 'South American Pilot,' Part 1, is just complete, and contains directions for the Eastern Coast of America, from Cape St. Roque to French Guayana, by Staff-Commander Penn.

Various other books of Sailing Directions are being revised or brought out anew, with all the dispatch which the means at the disposal of the department will permit, and the interests of navigation so urgently call for. Lighthouse Lists for every coast have also been published under the direction of Commander Dunsterville, R.N. ; together with Hydrographic Notices of newly-discovered Rocks, Shoals, &c., with other information useful to navigation in general.

ORDNANCE SURVEY OF THE UNITED KINGDOM.*—The Plans of the six Northern Counties of England having been drawn on the large scales of 25 and 6 inches to the mile, have been reduced to and engraved on the scale of 1 inch to a mile ; and although the engraving of the hill features upon a few sheets is not yet finished, the Map of England and Wales, for all practical purposes, may be said to be finished and published. The 1-inch map of Ireland, in outline, reduced from the 6-inch plans, has also been engraved and published ; together with many of the sheets with the hill features represented.

In Scotland the survey of Buteshire, Forfarshire, and Kincardineshire, on the large scale, was finished during the last year, and considerable portions of Aberdeenshire and Argyleshire have also been surveyed. All the southern portion of Scotland, including Perthshire and Forfarshire, has been engraved and published on the 1-inch scale. The principal cultivated district of Scotland remaining to be surveyed extends from Peterhead to Inverness ; and for the purpose of expediting the work in this quarter, officers are stationed

* Prepared by Colonel Sir H. James, R.E.

at Aberdeen and Inverness, and another will shortly be sent to Banff. The importance of proceeding also as rapidly as possible with the survey of the Highlands, is now fully recognised; and rooms have been prepared at Fort Augustus to receive another officers' party.

The publication of the Reports of the Royal Commission, and of several Select Committees of the House of Commons, has had the effect of fully enlightening the public as to the importance of having a complete cadastral or large survey of the United Kingdom. Last year Her Majesty's Government gave directions for the whole of England and Wales, south of Yorkshire and Lancashire, to be re-surveyed, and the plans drawn on the scales of 25 and 6 inches to a mile, like those of Scotland; and the first vote for proceeding with this great work was passed by the House of Commons this year without opposition; but with an objection, on the part of some Members, to the insufficiency of the amount voted for prosecuting the survey with the rapidity which is desired.

The principal triangulation, and the initial levelling of the United Kingdom, have been published; and the Survey Department is therefore in a position to proceed with the detailed survey in any part of England and Wales. During the last year the survey of Middlesex was finished, with the exception of the detail-plans of the city of London, which has already been published in outline, and large portions of the counties of Surrey, Kent, Essex, Devonshire, Cornwall, and Hants have also been finished. The estimated cost of completing the Cadastral Survey of England and Wales is 1,400,000*l.*; but with a grant amounting only to 75,000*l.* for England, Ireland, and Scotland, or about 25,000*l.* for England and Wales, it is obvious that the means is very disproportioned to the magnitude and cost of the work.

The extension of the Triangulation of the United Kingdom into France and Belgium was published in 1862. This was undertaken for the purpose of connecting our triangulation with that of Europe, so that we now have a connected triangulation extending from the West of Ireland to the Ural Mountains, and the data for completing an arc of parallel in the latitude of 52° N., extending over about 72° of longitude. Operations are now in progress for determining the difference of longitude between selected stations along the course of the arc; and as, on account of the "personal equation" of every observer, it is necessary that the same individual should be employed at every station, the Russian officers, Colonel Forsch and

Captain Jilinski, of the Imperial Staff, who commenced their observations at the eastern extremity of the arc, are now working their way westward, and are expected to arrive in this country to observe at Greenwich, Milford, and Valentia in July next.

The publication of the facsimile of Domesday Book by the Photozincographic process was finished last year. The original MSS. are contained in two volumes, designated 'Great Domesday Book' and 'Little Domesday Book,' containing 760 and 900 pages respectively. The facsimile has, with one or two exceptions, been published by counties, in 32 volumes, and 10,280 volumes have already been printed. This copy of the Great Survey of the Conqueror has been received with great satisfaction by the public; and the production of a series of County Maps, showing the position of the several manors or properties mentioned in it, is now contemplated.

GEOLOGICAL SURVEY OF THE UNITED KINGDOM.—Besides an enumeration of the new geological maps which have been published in the last year, of the Southern and Central Counties of England, and large portions of Ireland and the South of Scotland, I have explained in my Report to Parliament, that in the coming years a sufficient number of surveyors will at once be employed in working out the structure of the North of England. Whilst it is an obvious duty of the Geological Survey to develop the great mineral resources which exist in the northernmost English counties, the public must recollect that the Ordnance Maps of that region, on which alone our work can be carried out, have only recently been brought towards completion. Until this was effected, I deemed it to be highly desirable to finish off the geology of the districts around the metropolis, particularly with a view to the greater supply of water for a vast population from subterranean sources. Now, however, that these southern districts have been geologically surveyed, no time will be lost in applying vigorously to the North the same processes as those by which the structure of Wales and the southern and central counties of England has been eliminated. In a few years, therefore, I hope to see maps and sections published which will fully illustrate the older rocks of the lake regions of Cumberland and Westmorland, as well as of the rich coal-fields of Yorkshire, Durham, and Northumberland.

NEW PUBLICATIONS.—In respect to the publication of works on geographical subjects within the last two years, I cannot pretend to have a due acquaintance with many of them. The most remark-

able maps which have come into our possession have been mentioned in the Report of the Council; and a certain number of those which have been published abroad will be further alluded to in what I have to say on various foreign countries. In addition to these, some of the maps and original articles in Petermann's 'Mittheilungen' may be passed in review in this place. I would more especially mention the articles by the accomplished editor, on the physical and statistical survey of the Austrian Empire, illustrated by nine coloured maps: Sartorius von Waltershausen's survey of Etna, with a topographical map printed on the same sheet with a map of Kilimandjaro, as surveyed by Baron C. von der Decken; the two being given on the same scale to facilitate comparison between the two mountains; the articles by Petermann on the sea-bottom of the British seas and the cartography of the Mediterranean, as delineated in the excellent maps of these regions in Stieler's Atlas; and, lastly, the maps in illustration of the geographical and other results of the Swedish expedition to Spitzbergen. With regard to British publications, there remain a few which seem to me to deserve a passing commendation in this Address.

The Index Geographicus of Keith Johnston; or an Alphabetical List of the principal places on the Globe, with the latitudes and longitudes, is a most useful addition to every good library.*

Phillip's New Imperial Library Atlas, edited by Messrs. Bartholomew and Hughes, Fellows of our Society, is a clearly-defined and attractive work. The chromo-lithographic colouring of the maps is effective, and the divisions are not obscured by the insertion of too many names. The accompanying Index Geographicus at once enables the reader to find any place on the map.

A work about to appear has just been put into my hands, entitled 'A System of Universal Geography,' by Dr. Muir of Glasgow, one of our youngest and most industrious Associates. It forms a large volume, and conveys in a compendious style some of the latest information on the various countries of the earth. From its plan of arrangement the work appears to combine the advantages of a gazetteer and those of a text-book for schools and families.

Mr. Murray has just published two volumes of the Travels of M. Mouhot, by his widow, a descendant of Mungo Park. The travels are in Siam, Lao, and Cambodia, and have near 100 beautiful illustrations: they describe the most remarkable ruins of temples and palaces which have ever been discovered, comparable only for

* Blackwood and Sons.

magnitude to the Pyramids and temples of Egypt. The book is dedicated to the Royal Geographical Society.

Mr. William Simpson, one of our Fellows, who has spent much time in delineating the natural features of Upper India, the Himalayas, Tibet, and Cashmere, has brought home a series of coloured paintings of great beauty, which, I hear, are about to be published. The sources of the Ganges and the Jumna, the fine scenery of Rajpootana, and the Falls of Gairaoppa, in Mysore, are as strikingly represented as numberless buildings are elaborately and artistically worked out.

Among the elementary publications, I may direct attention to an useful little work, by the Rev. Alexander Mackay, entitled 'Elements of Modern Geography.'* In a former Address I ventured to commend the 'Manual of Geography,' by the same author; and the present production is an improved and careful epitome of that work, which can be recommended as a text book to be used in the educational establishments of the country. Considering that the author is—as I know myself—actively employed as a minister of religion in the heart of Aberdeenshire, remote from access to libraries and the great marts of knowledge, I cannot but admire the assiduity and research displayed in the preparation of this elementary treatise.

Foreign Cartography.—On the detailed progress of Cartography in foreign countries I must delay the attempt to give a *précis*, except with respect to Russia; and on the great strides made by the geographers of that empire I will presently dilate. It is, however, my duty to notice, that though engaged in a gallant and strenuous defence of their country, the Government of the ancient kingdom of Denmark did not omit to comply with our request, to transmit to our Society all the sheets of their Topographical Survey up to the time of their presentation.

Of these maps, which when completed will number seventy sheets, about one-fourth are already finished and in our possession, and I can truly say that I never saw more beautiful specimens of cartography. They embrace many details, more, indeed, than those of our own Ordnance Survey on the small scale, and are usefully combined with hydrographical charts on the same scale, exhibiting the soundings and sand-banks; an agreeable effect being produced by slightly tinting the water. Even on the scale of $\frac{1}{80000}$, or one inch to a mile

* Blackwood and Sons.

and a quarter, all the elevations are delineated by contour lines, their height in feet being given. Not only are the houses and farmsteads marked, but also the minor enclosures and wooded and marshy tracts; so that this map may be favourably compared with any work published by other and larger nations. Several excellent geological maps accompany this valuable donation to our Map Office.

It also gratifies me to place on record a kind act of the Government of Copenhagen in acceding to a request I recently made through his Excellency the Danish Minister, M. Bille, when the Elbe was blockaded, to grant a passport to the ship in which the river steamer of our Medallist, the Hanoverian Baron C. von der Decken, is to be translated from Hamburgh to the East Coast of Africa. The passport was at once sent, for happily scientific explorations were considered as sacred by the Danes as they were by the French when the Austrian frigate *Novara* was circumnavigating the globe during the Crimean war.

We have to thank the Prussian Government for transmitting to us the detailed map of the course of the Weser, from its sources to its mouth. This map is on twenty-one sheets, on the scale of $\frac{1}{200000}$, or three miles to an inch.

Lastly, from Switzerland our excellent correspondent, M. Ziegler, has transmitted for the Society a copy of the maps recently published by the Federal Post-office department; representing the railways, postal routes, and telegraph stations of the Confederation. The maps are accompanied by a table of distances between the towns, and are remarkably clear and well executed. The important question of the determination of heights in Switzerland has much occupied the attention of Swiss geographers, and a committee has been appointed by the Federal Government to reconsider the subject, in consequence of the levelling of railroad lines having shown a difference of 2 to 3 mètres from the determination as given in the official maps of General Dufour.

RECENT PROGRESS OF GEOGRAPHY IN RUSSIA.—Judging from the grandeur and importance of its operations, the Geographical Society of St. Petersburg may well be styled "Imperial." He who will peruse the *Compte-rendu* of the proceedings of that body, as ably prepared by the Secretary, M. Besobrasoff,* cannot fail to admire the wide and laborious surveys which have been effected, the number of valuable maps which have been prepared, and the various sciences

* Translated into French from the Russian.

affiliated to geography which have been enriched by researches amid regions hitherto for the most part unexplored by any traveller, and most imperfectly known to geographers. Founded on the model of our own Society so recently as the year 1846, the Imperial Society of St. Petersburg has now, indeed, become a most important body under the presidency of the Grand Duke Constantine, assisted by that enlightened nautical surveyor and circumnavigator Admiral Lütke.*

Whilst the practice in England, and our habits, have led us to separate ethnology and statistics from geography,—the parent Royal Society, the Linnæan and Zoological Societies, and the younger body the Ethnographical Society, gathering papers on the various subjects closely allied to geography,—the Geographical Society of St. Petersburg embraces all these cognate branches, and combines them with physical geography and travels; separate sections for each subject being organized with separate presidents, irrespective of the officers and council of the general body.

As I had the honour, when this Imperial Society was founded, of being named, in association with Humboldt and Ritter, one of the three first elected Foreign Honorary Members, simply because I had assisted in working out the structure of portions of that vast empire, I naturally take sincere pleasure in pointing out to my Associates the successful strides which this body has made, and particularly in the last few years, in extending our acquaintance with large portions of Northern Asia, as well as in the construction of accurate maps, and the diffusion of sound knowledge in statistics, natural history, and ethnology.

Independently of the justly famous measurement of an arc of the meridian from the North Cape to the Black Sea, carried out by the astronomers and surveyors led by Struve and Tenner, on which I have dilated on previous occasions, the geographical explorations of Eastern Siberia and the borders of the Chinese Empire have been so conducted as to throw quite a new light on the physical geography and natural history of those vast regions. These surveys were organized in so judicious a manner that they were almost certain to produce good fruits. Thus, while to M. Schwartz, of Dorpat, and his assistants, was entrusted the preparation of the topographical maps, to MM. Schmidt and Glehn were allotted all geological and mineralogical inquiries; whilst M. Radde, assisted

* Admiral Lütke has recently been advanced to the dignity of President of the Imperial Academy of Sciences.

by other able men, was responsible for the zoological and botanical departments.

With such sound pre-arrangements we need not therefore be surprised, that these explorers should have made observations which call for great changes in all pre-existing maps, and at the same time greatly enriched the domain of natural history. Among the most important of the new features which characterize these researches, and which are perspicuously pointed out by M. Besobrasoff, the following may be mentioned. The physical section of the East Siberian expedition has ascertained that many of the existing notions of the configuration of the vast basin watered by the great river Amur and its affluents are not only very inexact, but are often diametrically opposed to the truth. The connection, for example, of the lofty mountains proceeding from the eastern side of the lake Baikal, and called Yablonoy, with those termed Stanovoy on the north-east, has no existence. On the contrary, it has been ascertained that in this region, as in the interior of other continents (a phenomenon to which Humboldt first directed attention), the true parting of the waters often proceeds from comparatively low plateaux situated among much loftier mountains, through which the rivers escape in deep chasms. In this way the watershed of Eastern Siberia is found to proceed from the north of the lake Baikal, a little to the north of 56° N. lat., and to throw off the affluents of the Lena to the north, and those of the Amur to the south. We also learn that in a more eastern or lower portion of the great Amur, the chain of Bureia has a different outline from that which has been assigned to it. The sudden southward deflection of the mighty Amur from the Cossack station of Pashkoff is determined by a lofty mountain-ridge striking from east to west, and not from north to south, as formerly represented on maps. This stream has, in fact, found an issue by a profound fissure, with precipitous cliffs on either side, of which gorge it takes advantage. If we turn to the western portion of this region of Siberia, we find that there also researches have produced a great change in our previous knowledge. The form of the Saians Mountains, which range eastward from the Altai, has undergone considerable modification, as determined by the observations of Schwartz and Kryjine.

Practical cartographers will consult with much profit the maps, almost completed, of these hitherto ill-defined tracts, and geologists are awaiting the description of the rocks and their contents, whilst ethnologists are looking for accounts of those curious tribes of

Mongolian and Russo-Chinese Tartars, of which the late Mr. Atkinson and his relict have given us such lively sketches. In the mean time we may be quite sure that the splendid and abundant collections of animals and plants brought to St. Petersburg will be found to illustrate the direct dependence of the animal and vegetable products on the physical geography and climatology of the region. It is by such a well-devised and richly-endowed expedition as that of the Survey of Eastern Siberia that geography attains its highest distinctions; and I am sure that all those whom I address will rejoice with me, that a Society founded on our model should in so few years have attained a distinction which entitles it to the grateful thanks and approval of all geographers.

Whilst the Russian Geographical Society has thus carried scientific explorations, and applied its science to newly-acquired, wild tracts in Northern Asia, and to important outlets for the commerce of the empire, its members have not been less actively employed in enriching their country with valuable data, in cartography, ethnology, and statistics.

When I travelled in Russia, upwards of twenty years ago, the greatest of all desiderata, and which, as a geological explorer, I felt most, was the want of a good general map of the country. That work, which was commenced by the Imperial Geographical Society in 1857, has been completed, and the map was issued for sale last year. This most important work, embracing the Caucasus, has been followed by another still more scientific,—a Geographical and Statistical Dictionary of the Empire, of which some parts have already been published. Thanks to the very numerous journeys and surveys which have been made, this Dictionary will be a striking record of the substantial advances which Russia has achieved in the last quarter of a century.

In an Address like this, in which it is my duty to refer to geographical progress in many countries, I cannot do justice to the Imperial Society as regards numerous other subjects which this body has, in the most exemplary manner, combined with the extension of the higher branches of physical science. Inquiries of real utility to the nation, such as in times gone by were executed in England by the Society for the Diffusion of Useful Knowledge, have been made in various branches of statistics, showing how zealously the Russian Government is labouring to dispel ignorance, and thus, by extending true knowledge, to enable all classes the better to appreciate and value the vast improvement,

amounting to a social and peaceful revolution in the condition of the people, which the present Emperor has so liberally and beneficially introduced. Some of these good measures were, indeed, on the point of being carried out in the western Governments bordering on the kingdom of Poland, when the outburst of the insurrection in the latter seriously interfered with the development of the material prosperity and improvement of the country.

In reference to the establishment of telegraphic communication with China across Siberia, in which, as I announced to you last year, our associate Mr. Grant was busily employed, it is satisfactory to know that the Russian portion of the enterprise is so far completed, that the telegraph station at Irkutsk, distant 5700 miles from St. Petersburg, was opened five months ago (2nd December, 1863), and thus messages will be, as it were, instantaneously conveyed, which formerly required 23 days. To no country, indeed, is telegraphic communication of more vital consequence than to Russia, in which a Government messenger, carrying the most important despatch, would have occupied a month in conveying that which is now the affair of hours, if not of minutes.*

Further results of the expedition of Eastern Siberia and the borders of China, including all the river-system of the Amur, have recently appeared in the publication of a large map in 7 sheets, on the scale of 40 versts to an inch. This work, executed by M. Schwartz, is accompanied by a general detailed *aperçu*. The same author has also prepared a cheaper map on a smaller scale and embracing a much larger region of Siberia. M. Schebunin has executed a detailed map, on the scale of 5 versts to an inch, of Sakhalin, which shows great changes in the form which has been given to this large island in all preceding maps; he also contemplates de-

* In the lately-acquired territory of Eastern Siberia a new colony has been founded, to the south of the Amur, on the Usuri River which waters the richest country of that region.

The general reader as well as the geographer will be highly gratified by a perusal of the work of Le Comte Henri Russell-Killough, entitled 'Seize mille Lieues à travers l'Asie et l'Océanie' (Paris, Librairie Hachette, 1864), which the author has transmitted to me since the Anniversary. The author's journey across Siberia and the Desert of Gobi, in the depth of winter, is in fine contrast to his descent in the summer of the great river Amur to its mouth, amid the most luxuriant and magnificent vegetation. I cite this work, when speaking of the geographical researches of the Russians, as giving so attractive a description of the scenery as to render many a traveller anxious to visit that magnificent gigantic stream, the Amur, during those months when it is open to navigation. In short, whether as respects Eastern Siberia, China, Japan, our Australian Colonies, or our Indian Empire, I gladly commend the work of Comte Henri Russell as a graphic sketch by a quick observer and a lively and agreeable writer.

tailed maps of other tracts, including the course of the rivers Amgun and Bureia.

From the researches of M. Schmidt the geologist, aided by the botanist Glehn and the topographer Schebunin, we learn that the region beyond the Sea of Baikal is distinguished by a great variety of geological formations. Crystalline rocks, however, abound, and the unaltered sedimentary fossiliferous formations are much less extended. Among the latter, the Devonian and Jurassic deposits have been best recognised. The latter has the petrographical characters of the Jurassic rocks of the Caucasus, and contains certain beds of coal, which in one spot is said to pass into graphite. Further eastward, and along the Saigon or chief mountains, and on the Amur below the junction of the Zeia, there are spread out great fresh-water formations of tertiary age, whilst in the great island of Sakhalin very recent marine tertiaries repose on true chalk and cretaceous deposits. Having discovered what he believes to be many transitions between crystalline rocks and unaltered sediments with fossils, M. Schmidt is of opinion that all such changes have been brought about in an aqueous manner, and not by any plutonic or igneous action. The ingenious author is obliged, however, to admit the existence of obsidian in one place, and has not yet developed his proofs in favour of his novel system, in which, if I have not been misinformed, he seems to carry the chemical and Neptunic ideas of Bischoff to what I cannot but consider an extravagant length.

From such theoretic speculations it is indeed comforting to myself, as a practical geologist, to turn to the more recent labours of my distinguished friend M. Abich in the peninsula Apcheron and the adjacent parts of the Caspian Sea. There, the apparition of new islands in the sea, and the eruption of the mud volcanoes on land, show, according to him, the close connection which exists, in a natural history point of view, between the ancient igneous phenomena so apparent throughout the Caucasus and the analogous but much more puny eruptions of the present day, as exhibited in the north-eastern flank of that great chain, where one of the islands (Kouman) was thrown up in 1861.

After five years of active labour and assiduous researches in Eastern Siberia and in regions rarely visited before, and some where no naturalist had preceded him, M. Radde has, as it were, completed our acquaintance with the zoology of these vast regions, parts of which only had been visited by Pallas, Middendorff, and Voznesensky, and recently by Maack and Schrenk. The last of these tra-

vellers gave indeed an excellent idea of the natural history of the region of the Amur; but M. Radde has done more, in gathering together a complete fauna of Eastern Siberia. He has prepared zoo-geographical maps of all the regions he traversed, in which he has shown, by means of colours, the limits of the range of each group of animals. His comprehensive geographical researches, which led him to divide Northern Asia into three zoological and botanical zones, are of a high order of merit. These regions are Siberia proper, to the southern limit of which the reindeer ranges, and in which the Siberian cedar grows; the region of the Mongolian Steppe; and the region of Northern Manchuria.

Confirmed as these grand zoological deductions are by the determination of the collateral plants of each, I am led to believe that, since the earlier days of Humboldt, there is no work on natural history which has more tended to complete the general views of the true physical geographer. This grand publication of M. Radde has directly resulted from the direction of the Imperial Geographical Society and the support of the Government; and we hope soon to be able to admire the illustrations of numerous natural types hitherto wholly unknown to men of science.

Another contribution to the physical knowledge of these countries is a pamphlet on the climate, by my valued friend M. Middendorff, the justly-celebrated traveller in Northern Siberia. The work entitled 'La Contrée de l'Amour,' by M. Maximowicz, is also a most important addition to the literature of the Geography and Natural History of Siberia.

Irrespective of natural history as a branch of geography, one phenomenon has been brought out in strong relief by the physical section of the expedition to Eastern Siberia, viz., that in the basin of the Amur, as in the island of Sakhalin, the right bank of the river is steep and precipitous, and the left bank low and flat. I pointed out the same phenomenon twenty years ago in regard to the great rivers Volga, Oka, &c., in European Russia.* The probable explanation of this striking phenomenon is that the flat regions on the left bank of each river were formerly broad riverine sheets, and by the elevation of land, the destruction of forests, and other causes, have been so desiccated that the waters have at length found their natural boundary in the escarpment of rocks which rise successively from the low regions of the north to the loftier ranges of the south.

* See 'Russia in Europe and the Ural Mountains,' vol. i. pp. 21, 650.

An expedition under M. Anosoff in search of a gold region on the Chinese frontier, reported as such by fugitives, has returned without success. They found that this tract had been extensively washed for gold, and, from the remains of buildings, &c., it is supposed this district of country had been occupied by a powerful people, but the gold seems to have been nearly exhausted.

In further developing the geography of the Kirghis countries between the Russian and Chinese boundaries, the Imperial Geographical Society have been so fortunate as to secure the services of M. C. Struve, who, assisted by M. Potamine, an accomplished Cossack, has been for some time exploring the water system of the Black Irtysh, and who, when last heard of, had passed the mountains, containing graphite, which separate the basins of Baikal and Tszai-San. The great lake of Tszai-San with its fisheries had already been occupied by Russia; it receives no streams from the north; the basin of the Black Irtysh is entirely distinct from that of the Ulangur. The explorers found the mountains of the South Altai to be much nearer to the Lake Marka than is represented on maps; this highly picturesque sheet of water being embosomed in lofty mountains. In these Asiatic explorations the Transilian, or country of the seven rivers (Semi-vetchurt), must not be forgotten as having been examined by Colonel Golubeff and Colonel Babkoff at the east end of the Lake of Tszai-San.

Coal has been found in the mountains of Karatau by Colonel Tcherniaieff, which, though of poor quality, may prove of importance to Russia in feeding her new flotilla on the Sea of Aral, with fuel by transit along the great river Syr Darie. The present supply of coal for the Aral region comes from the coal-field of the Donetz in South Russia, a distance of about 1200 miles over the Caspian Sea and Desert of Ust Urt.

Among the important expeditions recently undertaken and directed by the Imperial Geographical Society is that which, under the guidance of the eminent naturalist M. Baer, aided by M. Radde, has examined the Sea of Azof. All the results of this inquiry are not yet fully known; but whilst we ascertain that the amount of sediment and detritus poured out by the Don and other streams into this inland sea necessarily diminishes the depth of its waters, yet, this operation not being so rapid as some persons have supposed, a long period will elapse before navigation will be materially impeded.

The conclusion of the Russian report had not reached me when this Address was read; but in the part transmitted I am glad to find that the eulogies which I passed, at the last Anniversary, on the labours of M. Khanykoff and the Russian Expedition in Persia quite accord with the well-digested analysis of M. Besobrasoff.

Arabia.—We have been much gratified within the last few months by the lively and exciting narrative of his journey across Arabia, given to us by Mr. Gifford Palgrave. This enterprising traveller, who took high honours at Oxford, and has since been a wanderer over many regions of Asia, travelled in the character of a physician across the northern and central parts of this great, but little known, peninsula; and, with the exception of Major Sadleir, who is described as having travelled with the silence of a bale of goods *in transitu*, he is the only one of modern explorers, who, crossing the very heart of the country, emerged on the Persian Gulf.

Although Mr. Palgrave has fixed no latitudes nor longitudes, he yet travelled far beyond the adventurous Wallin of Finland, who only reached Haïl. His sketch of the people of the inland kingdom of the Wahabites, and their capital Riadh, and the clear distinction he draws between the wandering Bedouins and the regularly governed, civilised, and strict Wahabite Mahomedans who live in the central towns, are so very instructive, that the Council have warmly approved his labours by conferring on him a testimonial. I trust that Mr. Palgrave will elaborate the eloquent communication he made to us, and which is given *verbatim* in Vol. viii. p. 67, of our Proceedings, by producing a work worthy of his abilities and research. I can truly say that on no occasion have I seen the Fellows of the Geographical Society more gratified and excited, than when Mr. Palgrave narrated his adventures in crossing Arabia; and surely, as respected the deep interest created, I was fully borne out when I termed his narrative the Thousand and Second Arabian Night's Tale!

Little as we know of the interior of Southern Arabia, I am reminded by my friend the Rev. C. Forster, that there are evidences tending to sustain the accuracy of Ptolemy, when he speaks of four rivers in that region. In the parts of Arabia traversed by Mr. Palgrave, a river, after fertilising whole valleys, disappears under the sands, and re-appears no more. So is it in the south. For, even on that very coast, so well surveyed by the ship *Palinurus*, and where no rivers were discovered, a river, the mouth of which is lost under sands, was discovered by the late Rev. Thomas Broockman, who

examined that coast in an Arab *dhow*, proceeding from Aden to Shehr, and landing continually in spots where no large ship (like the *Palinurus*) could approach. This river is considered by Mr. Forster to be the Caña Canim of Ptolemy; and a lithographic sketch of it is given in his 'Sinai Photographed,' and is described at pp. 349, 352 of that work. Mr. Forster further believes, from the accounts given to Mr. Broockman, that another of Ptolemy's four rivers, the Prion, runs parallel to the coast-ridge, and is lost in interior sands. Not pretending to give any opinion upon the question of whether these rivers be really two of those mentioned by Ptolemy, it is gratifying to find that, as in Africa, so in Arabia, modern discoveries go to sustain the accuracy of that great ancient geographer.

Hindustan.—The Report of the operations of the Trigonometrical Survey of India during 1862-63, is full of interesting professional details. This great Survey, which was commenced upwards of fifty years ago, and which has since been so ably conducted by our distinguished Associates, Sir George Everest and Sir Andrew Waugh, is one of the most important results of our rule in India; and the present Report by Major J. T. Walker, R.E., as one of a series containing the history of the Survey, is of great value. In addition to the general review of the proceedings for the year, it contains two Reports, which are complete in themselves and of special interest, namely, an account by Mr. C. Lane of a portion of Independent Tipperah, and a reconnaissance, by Captain J. P. Basevi, R.E., F.R.G.S., of a portion of Jyepore, in Gondwana. These are parts of India hitherto unknown, and which have never before been visited or mapped.

The important observations of Captain Godwin-Austen on the region of the Western Himalayas will be commented on under the head of Glaciers (p. 221).

Major Showers, of the Indian Army, has recently published some interesting letters upon two practical questions connected with the geography of India: the one refers to the terminus of the Madras Railway on the Malabar coast—the other to the proposed port at Sedashegur. Major Showers gives good reason for preferring Narakal—6 miles north of Corhin, as the ocean terminus of the railway—to Beypoor, which is 80 miles farther to the northward, the latter being an open roadstead exposed to the full force of the south-west monsoon; whilst at the former place, the sea within the area of a square league, forming the anchorage, is in all weathers perfectly calm. If the account which Major Showers gives of this locality be correct—and he appears to write

from personal observation as well as on the authority of the resident Marine Officers—the calmness of the sea along the Narakal shore is one of the most remarkable phenomena of physical geography in the world, and well merits further investigation. With respect to Sedashegur, which is regarded with so much interest at present, as the proposed outlet for all the cotton-produce of the Southern Mahrattan country, Major Showers's opinion is decidedly unfavourable. He shows, in the first place, that the construction of a breakwater in the open sea, without which the port would be inaccessible during the monsoons, would be attended with the utmost difficulty, owing, on the one hand, to a sea-bottom of soft yielding mud, and, on the other, to the working season being limited to an interval of seven or eight months' duration; and he shows, in the second place, that if the port were formed, it would be almost impossible to maintain a regular communication with the interior, owing to the natural obstacles—especially from floods—as well as the extreme unhealthiness of the surrounding tract of country.

Formosa.—Mr. Swinhoe, who had well prepared himself for such a task by a long residence in China, has given us a very clear account of the geography, ethnology, and natural history of this island. The value of this communication from H.M. Vice-Consul at Formosa was pointed out at length to the Society by Admiral Collinson, who formerly surveyed its shores, and by Sir Harry Parkes, who gave to the meeting an instructive sketch of the history of European, Chinese, and Japanese relations with the islanders. The prospects of increased trade with this large and fertile island, now that it is opened under Lord Elgin's treaty to Europeans, were discussed, and the statements of Mr. Swinhoe confirmed regarding the superiority, as ports, of Tam-Suy and Ta-Kow to the port Taiwan, which was the one originally selected.*

The Malay Archipelago.—At the meeting of the 8th June, 1863, we were gratified by the reading of a Memoir from the pen of that eminent naturalist, Mr. A. R. Wallace, on the Malayan or Indo-Australian Archipelago.† After eight years, passed in that highly-interesting region of islands of all dimensions, from the vast and still little known Borneo, and the still less known New Guinea, to the remote and semi-barbarous Timor, Mr. Wallace came before us with a well-established natural boundary-line between one large

* See 'Proceedings Royal Geog. Soc.,' vol. viii. p. 23; also 'Proceedings of British Association for Advancement of Science,' Newcastle Meeting, 1863.

† See Proc., vol. vii. p. 206.

region of the islands of the Archipelago and another; the one being Asiatic by its animal and vegetable life, the other having an Austro-Malayan type.

Indicating how the Asiatic Islands were probably once connected as *terra firma*, and pointing to the various oscillations of the surface, in these lands so replete with volcanoes, Mr. Wallace happily shows how, by simply traversing one gut or channel occupied by a deep sea, only 15 miles wide (between Bali and Lombok), the traveller is at once transported from the Asiatic to the Australian kingdom of natural history. This physical separation he considers to be one of great antiquity, whilst the separation of the mass of Asiatic lands to the west of it into innumerable smaller parts (yet all being a community of Asiatic type), is viewed as being of posterior date.

Whilst this philosophic Memoir naturally gave great satisfaction to my learned and sagacious friend, Mr. John Crawford,* who has passed many years in the Indian Archipelago, I must also be allowed to say that it gave equal satisfaction to myself, from the skilful manner in which the author brought to bear all his lore in the various branches of natural history, to sustain his grand geological inductions as to the enormous changes which have successively occurred in the physical geography of those diversified regions.

It is, indeed, to be remembered with pride (particularly by us, who cheered on Mr. Wallace when he left these shores ten years ago on his adventurous travels), that no such results as these could have been laid before geographers when the sciences of Zoology, Botany, and Geology were in their infancy. The work of Mr. Wallace is, therefore, a true index of the advance which has been made in geography, in the correlation of the most arduous and extensive researches and observations of the traveller and statist with every branch of natural history science.

Australasia.—The great and important discoveries made in hitherto unexplored tracts of Australia having been largely dwelt upon in last year's Address, I will confine myself now to mentioning several collateral subjects, which have recently been brought forward in respect to that vast portion of the terrestrial surface of the globe.

The intention, to which I alluded at the last Anniversary, of colonising portions of North Australia by South Australian settlers, to proceed thither by sea, is about to be carried into effect. A North

* See Mr. Crawford's most valuable work, 'A Descriptive Dictionary of the Indian Islands and adjacent Countries' (Bradbury and Evans, 1856), with a map of the Asiatic Archipelago.

Australian Settlement Company has, indeed, been formed, the chairman of which is Sir Richard Graves M'Donnell, the late Governor of South Australia, and under whose administration M'Douall Stuart made that remarkable journey from Adelaide to the Indian Ocean,* which has led his brother colonists to make this great venture. If success should attend the bold enterprise, whether brought about by a settlement in Van Diemen's Gulf, or in the Queen's Channel of Cambridge Gulf—the latter of which I should think much preferable (see my last Address)—then it is almost certain that a separate North Australian Colony must be established, inasmuch as it will be impossible that the Government of Adelaide should rule a population separated from them by a distance of 1300 miles, much of the intervening space consisting of tracts of almost impassable sands and forests.

If such a colony should be established, and it be afterwards found impracticable for Englishmen to labour in the open air in so warm a latitude, I trust that Hindoos, Malays, or Chinese may be used for that purpose; for, by whatever means effected, I shall rejoice in seeing the realisation of a project, which I have advocated at meetings of this Society for many years. I am fully persuaded that, with the rich products of that region, the fine bays of the sea on the south shore of the great Indian Ocean must, sooner or later, be occupied by a great maritime nation like our own, which already possesses the other three sides of this vast continent.

Already, indeed, we know that, under the auspices of the Governor of Queensland, Sir George Bowen, and for the purposes of trade and commerce, a new settlement has been made at Cape York, the northernmost point of this continent. From the same authority we learn the results of the important naval survey of the inside of the Great Barrier Reef, as completed by Commander Robinson. On this point I must refer you to the full explanatory comments of Sir Charles Nicholson and the Hydrographer, Captain Richards, as given in the report of the meeting on the 11th April last, which is to be seen in our Proceedings.

We now know, from the high authority of Captain Richards himself, that, although twenty years ago the inner route from Cape York to Moreton Bay was the most intricate passage in the world, it is

* Whilst these sheets are passing through the press I have received copies of the 'Journals of J. M'Douall Stuart,' which have just been published in a handsome volume, by Messrs. Saunders and Otley; edited by Mr. Hardman, and illustrated by Mr. Angas, with an excellent map by Weller. The work ought to be in the hands of all who are interested in Australian exploration.

now rendered as navigable as the English Channel, thanks to the labours of our naval surveyors. It was, indeed, most gratifying to find Captain Richards characterising that survey as one of the most gigantic and splendid undertakings ever carried out by any nation; and I repeat, what I have said before, that every true geographer will gratefully cherish the recollection of those bold and skilful seamen, Captain F. Price Blackwood, Captain Owen Stanley, and their successors, through whom the east coast of Australia has been opened out to the navigation of the world.

The mooted question of the extent to which the successful propagation of flocks of sheep can be carried in advancing towards the Equator from our old settlements in Australia, which was vigorously discussed last year, particularly when the journeys of Landsborough and M'Kinlay were under our notice, has been revived, and will no doubt continue under discussion until the perseverance of our countrymen shall have decidedly settled that limit by experience. As far as ascertained data go, it had been found that in Australia sheep have thriven up to 19° south latitude, which alone gives us an enormous range for the flocks of new settlers.

Amid the few regions of which we have acquired little or no additional knowledge in the last quarter of a century, we may certainly place New Guinea. Hence it gave me much pleasure when the attention of the Council was directed to a proposal of Sir Charles Nicholson to endeavour to explore the southern coasts, bays, and rivers of that great mass of land, from the new settlement of Cape York. I trust that the Admiralty (looking only to the narrow channel which separates New Guinea from Cape York) will lend a helping hand in such a survey, as soon as circumstances will permit.

New Zealand.—From Australia and tracts lying to the north of it, let us turn to the southern portion of Australasia, New Zealand; where, despite the war which has unfortunately prevailed in the northern island of the group, great advances have been made in delineating the physical geography and geological structure of the provinces of Canterbury and Otago, in the middle island.

Three Papers of great interest have been communicated to the Society, which throw additional light upon the physical geography of the hitherto unsurveyed districts of the great middle island of New Zealand, and contain new facts illustrative of glacial action. I consider it, indeed, to be a fortunate circumstance for our science, that these regions should have been

visited by such men as Dr. Hector, Mr. M'Kerrow, and Dr. Haast. We may now compare their observations with those of Professor James Forbes and others in the Alpine regions, and those of Dr. Thomson and Dr. Hooker in the Himalaya Mountains, of which I shall have occasion to speak at some length in explanation of my own views as a geologist upon this interesting topic of glacial action.

The first of these papers to which I call your attention is that which relates to the successful journey across the province of Otago, by my friend Dr. Hector, so distinguished already by his explorations in North America and British Columbia. Leaving the town of Oamaru, his party proceeded by the right bank of the Waitaki River, and then, following the course of the tributary Ahuriri, crossed Robinson's Saddle. At the Wanaka Lake the party left the outposts of the settlers, and proceeded into the *terra incognita* by way of the Matukituki River, which empties itself into the lake upon its western shore. Forming a central camp here, Dr. Hector with two men proceeded up the valley, and after exploring in a northerly direction, without success, for an available route, advanced on foot, and reached the glaciers which form the source of the river. Ascending a saddle-shaped mountain by a steep climb, partly over the glacier, they found its elevation to be 5500 feet above the sea. The view obtained of the mountains was extensive and grand; Mount Aspiring, enveloped in ice, 10,000 feet high, on the right; and Mount Richards, with its enormous glacier which forms the source of the Jackson, on the left. It was here that the track of gigantic birds, supposed to be the *Dinornis*, which was first taken for a native pathway, was observed. After a vain endeavour to follow the course of the Jackson River to the sea, owing to the density of the woods, they were compelled to return, having reached a point 8 miles from the west coast.

Another Paper on New Zealand is a Reconnaissance Survey of the Lake districts of the Otago province, by Mr. M'Kerrow, who states that 4883 square miles have been surveyed and classified into Pasture, Forest, Lake, Barren, and Swamp. The bearings of the survey from the true meridian and a datum line for altitudes are given. In his remarks upon the configuration of the country, Mr. M'Kerrow calls attention to the great and sudden differences of elevation that diversify its surface. The mountains rise from 4000 to 9000 feet, and the line of perpetual congelation in that latitude has been determined to be 8000 feet. The mountain-ridges lying

in a N.N.E. and S.S.W. direction, are directly athwart the track of the prevailing wind from the Pacific Ocean; and it was noticed that the snow-line on the north-west side (the side exposed to the wind) of the mountain-ridges was higher than upon the south-east or the sheltered side; thus showing that the wind has a very decided influence in producing this effect. The flood-marks show a rise and fall of water almost incredible, and the deltas at the mouths of the rivers are invariably and rapidly advancing into the lakes. The value of the latter as reservoirs, restraining the floods, is particularly expatiated upon, and the greater extent of the lakes at a former period is pointed out; while attention is called to the varied influences at work which produce a condition of "unstable equilibrium" in the atmosphere, producing storms of great violence.

The third Paper is a most important account of the highly interesting journeys of the provincial geologist, Dr. Haast, of whose deeds I was led to augur most favourably, in consequence of the high character which he brought with him from Vienna, as testified to me in a letter from my eminent friend, M. von Haidinger. In the year 1861, the rivers Ashburton and Rangitata were traced by Dr. Haast to their sources in Mounts Arrowsmith and Tyndall. In 1862, the course of the River Tengawai was followed, and the mountain-range crossed to Lake Tekapo, the affluents of which were traced to the Godley Glacier and Mount Darwin. Lake Pukaki was visited, and its sources in the declivities of Mount Cook ascertained; and the Naumann Range, from whence the Dobson and Hawkins take their rise and flow into Lake Ohau, was explored.

In 1863, Dr. Haast proceeded from the Orihi River along the coast to the Waitaki River, which he ascended, and followed the course of its first tributary on the left bank (the Ahuriri) to its source, visiting also the western shore of the Ohau Lake. The Hawea Lake was crossed from south to north, and the River Hunter explored to its source in Mount Ward. Lastly, the Wanaka Lake was traversed; the River Makarora traced to its origin, from whence he crossed over a pass, 1012 feet above the sea, and descending a river (which has since very properly been called the Haast), he reached the western shore of the island near Open Bay.

As a general commentary upon these remarkable journeys, Dr. Haast observes, like Mr. M'Kerrow, that a longitudinal mountain-chain of great magnitude, forming the watershed of the island, runs from north-east to south-west. The continuity of this chain is broken through only in a very few places, otherwise it presents

high and abrupt walls of great altitude throughout its whole length in the Canterbury province, wherein it reaches an estimated height of 10,000 feet. Dr. Haast describes the different passes through this chain, and in particular that pass which he considers to be unique in physical geography, and through which he penetrated to the western shore of the island, over a ridge not more than 1012 feet high.

In the course of these explorations he has availed himself of the opportunity of remarking and commenting upon the features of glacial action, which he has thoroughly described in all its different phases, and illustrated by a series of very beautiful, coloured sketches upon a large scale. The sketches are now deposited in the archives of our Society, and, together with the admirable description which accompanies them, will enable the physical geographer to compare the results of Dr. Haast's observations with those which have been made amid the glaciers of the Alps and of the Himalaya Mountains.

In one of his interesting communications, Dr. Haast describes the zealous efforts made by Mr. Whitcombe, after traversing these Alps, to reach the mouth of the Taramakau River; and I must refer you to our 'Proceedings,' vol. viii. No. 3, p. 58, for a very touching account of the manner in which that excellent scientific observer lost his life.*

It appears that Mr. Albert Walker, with his brother and Mr. McFarlane, passed through a country on the west coast which had hitherto proved inaccessible, *i. e.* from the mouth of the Taramakau river to that of the Wanganui. Mr. Walker sent his account of this arduous journey to our late Assistant-Secretary, Mr. Greenfield; but through the confusion incident to the illness and death of that gentleman, this document has not yet been read or noticed.

As your attention was directed at the last Anniversary to the rapidly increasing produce of gold in the western parts of the province of Otago, it is unnecessary that I should recur to that important feature in the structure of New Zealand.

AMERICA.

British Columbia and Vancouver Island.—Though unable to comprise within the limits of a short memoir any detailed description of British Columbia, Lieutenant Palmer, R.E., who has served in that

* I earnestly hope that chromo-lithographic copies of those very remarkable coloured sketches of the New Zealand Glaciers will be soon published. Glacialists and Alpine travellers should possess them.

colony four years and a half, has given us a very clear and sensible sketch of the geography and chief capabilities of that vast, and, as yet, very imperfectly explored region. Subtended on the west by the densely-wooded coast or Cascade range, with its long and deep bays, and on the east by the flanks of the much loftier Rocky Mountains, a band of plateau-like and undulating country, of about 100 miles in breadth, watered by the Fraser and its tributary streams, is the tract which may eventually be best rendered capable of yielding produce for the support of the mining population. The chief gold mines, which lie in the mountainous tract of Cariboo, to the east of the plateau land watered by the Fraser, are well described, and we learn how the earlier proprietors traced up the precious metal, from the banks of the Fraser and Thompson Rivers, till they reached those western watersheds of the Rocky Mountains, in which, doubtless, vast amounts of mineral wealth lie hidden. The picture of the difficulties which the miners have to encounter is thoroughly well drawn, whether as to the want of provisions, or the excessive cold, and all the disadvantages of a new settlement in a wild and sterile land. In fact, gold mining is only beginning in British Columbia, and the few creeks in which diggings have been so successful will be followed up by discoveries of gold in the quartz veins of the slaty rocks. In British Columbia, as in California and Australia, those quartz reefs, be they veins or altered beds, range from north to south, or rather from north and east to south and east. Now, when we correlate this fact with similar data, as obtained from the auriferous regions of Australia and Russia, in all of which, as well as throughout the great chain of the Andes, the same prevailing north and south strike of the quartz bands is dominant, science has still to search for an explanation of this most striking physical phenomenon, to which I have directed attention in several publications upon the distribution of gold.*

The memoir of Lieutenant Palmer is concluded in the following words, which are, I think, entirely borne out by the facts he has adduced:—"From its geographical position, its mineral wealth, the great salubrity of its climate, and its valuable natural products, British Columbia, with good management and by a process

* See 'Russia and the Ural Mountains,' vol. i. p. 472 *et seq.*; 'Siberia,' 2nd edit. pp. 479 *et seq.*; Addresses to the British Association, Royal Institution Royal Geographical Society, *passim*; and several other works, from 1846 to 1850, including the article in the 'Quarterly Review' of 1850, entitled 'Siberia and California.'

of gradual development, is likely to take rank as not the least important of the Colonies of the Crown."

This opinion has been ably sustained by Colonel Moody, under whom Lieutenant Palmer served, and who, from having been a Crown Commissioner for some time, is a most competent and reliable authority.*

Thanks to the admirable Nautical Surveys, chiefly conducted by that able hydrographer, Captain Richards, who now directs the construction of all the charts of the Admiralty, the singularly diversified coasts of the noble island of Vancouver have been accurately delineated. Fortunately for our science, Captain Richards had a medical officer on board his ship, Dr. C. Forbes, R.N., who has brought out, in a most efficient manner, all the data relating to its resources and capabilities as a colony. In introducing his subject, the author well says, that "the romance and mystery which hang over the scenes first visited by Cook and Vancouver, have now given way to a hopeful reality, and the emigrant sees before him a land full of promise and of hope."

After an excellent descriptive sketch of the whole region, Dr. Forbes dilates on its physical geography, geology, hydrography, and meteorology, and then treats of the political geography and statistics of the rising colony; so that I can safely refer any one who wishes to obtain a true acquaintance with this great flanking buttress of British Columbia—this key to the influence which a British fleet must ever exercise in the Pacific—to the valuable Memoir of Dr. Forbes, which will soon be printed in our volume, and also to a valuable Prize Essay by him, published by the Colonial Government. The author expresses his sense of the impossibility of doing justice to all the resources and capabilities of Vancouver Island: but in pointing to it as a commercial emporium between two great wealth-producing countries, to the certain rewards attending steady industry, the prospect of good settlements, and the excellent system of education established for the youthful part of the colony, all these, he justly says, are "sound attractions, to draw thither the capitalist, merchant, working farmer, miner, and skilled mechanic, and even the honest labourer." †

South America.—In South America, steam navigation and railroads are fast adding to our knowledge of rivers and lands hitherto very imperfectly described.

* See 'Proceedings,' vol. viii. No. 3, p. 91. † See 'Proceedings,' vol. viii. No. 3.

The Survey across the Upper Provinces of the Argentine Republic, for Mr. Wheelwright's gigantic scheme of a railroad over the Andes to unite the shores of the Pacific with those of the Rio de la Plata, has led to the collection of fresh information regarding those provinces. Mr. Hutchinson, H.M. Consul at Rosario, on the Parana, from whence the railroad is to run to Cordova, has lately made a journey through them, of which he has transmitted the details to this Society through the Foreign Office, with an excellent map by Dr. Burmeister (now Director of the Museum of Natural History at Buenos Ayres), containing corrections made by himself and by Mr. Coghlan, one of our Fellows who is engaged in engineering works of considerable importance for improving the navigation of the great river Salado, which runs through them—information which will be very useful to geographers. (See Stanford's New Map of South America.)

With reference to Mr. Wheelwright's project, recent advices from Chile allude to the Survey of a Pass by the Planchon over the Andes, in about lat. 35°, to the south of the province of Mendoza, communicating with Curico in Chile, through the valley of the river Teno—which seems to offer on many accounts a better line for the projected extension of his railroad from Cordova than that originally projected by La Rioja to Copiapo; the elevation of the Pass in question not exceeding 6000 feet instead of 16,500, the height to be surmounted according to the first plan described in Mr. Wheelwright's Paper in the 31st volume of our Journal, and which was reconsidered at the last meeting of the British Association.

This Pass, now called a new discovery, appears to be the same as that called De las Damas, or The Ladies' Pass, which was carefully examined sixty years ago by a Spanish officer, Zamudio, who reported to the Viceroy of Buenos Ayres that it might be made practicable for wheel carriages at a very small expense. His account of it is given in De Angelis' Collection of Records of the Rio de la Plata, a copy of which is in our Library.

One of the most interesting Papers read this year to the Society is the narrative, translated from the Spanish, and communicated by Sir Woodbine Parish, of Don Guillermo Cox's journey by a Pass over the Andes to the south of Valdivia, not 3000 feet high, to the great lake of Nahuel-Huapi, on the eastern side of the Cordillera, and of his descent for the first time of the river Limay, which falls into the Negro, and which, from its junction with the Limay, was ascertained to be navigable throughout its whole course across Patagonia to the Atlantic, eighty years ago by Don Basilio Villarino, whose

Diary, also communicated to us by Sir Woodbine Parish, is given in the 5th volume of our Journal.

Señor Cox, though prevented by an accident to his boat from completing his object of passing down the Negro to the Buenos Ayrean settlement of Carmen at its mouth, has had the satisfaction of uniting his work with Villarino's Survey, and of proving that from the lake of Nahuel-Huapi, on the eastern side of the Andes, there is a continuous water-communication to the Atlantic, the future importance of which it is difficult to estimate.

The observations which, on the reading of this memoir, fell from our medallist Admiral FitzRoy, who so distinguished himself in the survey of all the coasts of the southern extremity of America, including a visit to a portion of the region explored by Señor Cox, will be read with deep interest.*

Sir Woodbine Parish, who perhaps has studied the geography of that part of South America more than any other living individual, and who spoke so effectively on the same occasion, is of opinion that Señor Cox's exploration, made under great difficulties and entirely at his own cost, deserves the highest commendation. A detailed account of his travels and adventures amongst the Indians who inhabit the eastern sides of the Andes has been published in Chile, in a volume replete with information regarding the habits and customs of those tribes, as well as on the topography, botany, and geology of that part of the Andes. A copy of the work has been transmitted to me, and it is to be hoped that some one will undertake to publish a translation of it, for the benefit and instruction of all who are interested in the present and future of those countries.

I may add, in relation to this portion of the continent, that, in the Bulletin of the French Geographical Society for March and April, 1864, there is a memoir by Mons. B. Poucel on the province of Catamarca, one of the remotest and least known of the districts of the Argentine Republic. The memoir contains much information on the climate, productions,† and trade of the country, as well as many corrections of errors existing on all the maps of the region published

* See 'Proceedings,' Royal Geog. Soc., May 9th, 1864.

† Some interesting facts relative to the climate, pasturage, and productions of the Falkland Islands are given by Admiral Sullivan in a letter to the 'Times,' dated Dec. 31, 1863. He resided there during three winters and two summers, and made large experiments on the capabilities of the colony for grazing purposes, having had 1400 head of wild cattle tamed, and leased 40,000 acres of land. Speaking highly of the climate and pasturage, he strongly recommends that the eastern island be made a penal settlement.

in Europe. Mons. Poucel has spent thirty years of his life in these countries.

We are indebted to Mr. Hinchliff, one of the Fellows of this Society, and well known as an adventurous member of the Alpine Club, for a very graphic account of a tour made by him last year in Southern Brazil and the Eastern Provinces of the Rio de la Plata, under the title of '*South American Sketches*,' in which his vivid descriptions of the excitement of life amongst the Gauchos are such as, I doubt not, will lead other equally enterprising spirits to follow his good example, and bring us fresh stores of information from those new countries, especially when they learn from Mr. Hinchliff's book how easily they may be reached; "for," as he says, "the limits of a barrister's long vacation are sufficient to allow of his passing five weeks in the cool season amidst the glorious vegetation and unrivalled scenery of Brazil."

The peopling of the fertile plains of the River Plata is now progressing with great rapidity; and as exact information on the nature of the new population which is pouring into these southern parts of America is not easy to procure, a memoir,* recently sent to this Society by our Corresponding Member, Signor Cristoforo Negri, is worthy of mention, as supplying data showing the large Italian element that these growing new countries will contain. The result of Signor Negri's inquiries is that, at least, 8000 Italians annually leave the ports of Italy for this region; and that 100,000 emigrants have departed within the last 25 years, the number still increasing from year to year. This drain is from the most industrious classes of the population, and the advantages to the Spanish republics are correspondingly great; for, according to Signor Negri, all but an insignificant fraction naturalize themselves in their new home.

While on the subject of South America, I have pleasure in announcing that the indefatigable explorer, Mr. Richard Spruce, who has for fifteen years been unceasingly employed in scientific labours in the valley of the river Amazons, and in the Andes of Ecuador, is on his way to England. Of his great services to botany it is not for me to speak, but his geographical work is fully entitled to special notice at my hands. Mr. Spruce left England in the year 1849, and landed at Pará, whence he proceeded up the river Amazons, and explored several of its least-known affluents. In 1849 he ascended and made a map of the river Trombetas, an

* See the '*Corriere Mercantile*,' Genoa, 29th September, 1863.

important tributary of the Amazons which was hitherto unsurveyed. In 1853 and 1854 he ascended the Rio Negro, Cassiquiari, and Orinoco, exploring and mapping the river Cunucunúma, a tributary of the Orinoco, and the river Pacimoni, which flows into the Cassiquiari. The maps of these three rivers were made by means of cross bearings and astronomical observations, and will form an important addition to geographical knowledge. During the years 1855 and 1856 Mr. Spruce ascended the river Huallaga, and in 1857 he successfully surmounted all the difficulties of the navigation of the rivers Pastaza and Bombonaza, and reached the Andes of Quito. He has since been engaged in exploring the southern part of the republic of Ecuador; and during 1860 he was employed by the Secretary of State for India, in co-operation with our Secretary, Mr. Clements Markham, in collecting *chinchona* plants and seeds in the forests at the foot of the mountain of Chimborazo.

After fifteen years of such incessant toil in the cause of science, exposed to innumerable dangers and privations, the health of Mr. Spruce has been much impaired; but I trust that the renovating air of his native land will restore it, and that geographers, as well as botanists, will be put in possession of the fruits of his valuable researches.

I conclude my notices of South American explorations, by observing that travellers or emigrants intending to proceed to Brazil, or to any part of the River Amazons, will find a very convenient hand-book for their guidance in a small volume published by Mr. Belmar, a French gentleman, entitled, '*Voyage aux Provinces Brésiliennes de l'Amazonie, en 1862; précédé d'un rapide coup d'œil sur le Littoral du Brésil.*'

GLACIERS.

Glaciers of the Himalaya Mountains and New Zealand compared with those of Europe.—On the Powers of Glaciers in modifying the Surface of the Earth, and on the Agency of Floating Icebergs.—In the last Anniversary Address* I directed your attention to the state of Greenland as it is, in order to impress upon the minds of our Fellows who have not attended to the connection between existing geography and the ancient conditions of the globe, that Scotland and large

* See 'Proceedings,' vol. vii., No. 4, and 'Journal,' vol. xxxiii.

portions of Northern Europe must, at a period anterior to the creation of man, have been in the same condition as that in which Greenland and its adjacent seas are now. In other words, that, in the glacial epoch of geologists, certain elevated tracts were permanently occupied by fields of snow, with glaciers descending from them to the bays and cliffs of the sea, and that the erratic blocks which we now find spread over central England and the plains of Germany are simply the relics of icebergs which floated over wide tracts then submerged, and which, on melting, dropped them on the then sea bottom.

In the last session the vivid descriptions of the glaciers of Western Tibet, by Captain Godwin Austen, and of the glaciers of the middle island of New Zealand, by Drs. Haast* and Hector,† have specially attracted the attention of the Society; and I am therefore led to dwell on these grand terrestrial phenomena by giving a general view of the results of glacial action, both terrestrial and subaqueous.

When the first of those Memoirs was read, Dr. Hugh Falconer, who had passed several years in that same region of the Tibetan Himalayas, enlarged upon the scenes which had been so graphically delineated on maps by Captain Godwin Austen. He then referred us to the works of those who preceded and followed him in examining that region, and reminded us of the names of Moorcroft, Trebeck, Jacquemont, Vigne, Strachey,‡ and Thomson.

In considering the subject of glaciers, I am bound specially to call

* Dr. Haast (as before-mentioned) has sent to our Society a series of coloured sketches of the Glaciers of the Western Coast of the Province of Canterbury, which for striking effect seem to me never to have been surpassed by any delineator of icy regions. The juxtaposition of these glaciers to a splendid forest vegetation, and amidst mountains which are close to the sea, and yet rise to 10,000 feet above it, the depth of the gorges, and the height of waterfalls issuing from the ice, are all very remarkable.

† By a letter just received from Dr. Hector, dated 20th January, 1864, I learn that not only has he ably explored the region occupied by glaciers in the province of Otago, but has also visited, in a steamer, the wonderful fiords on the western side of the island. He is now preparing a work on the geological structure of the colony, in which he will show that the lakes on the eastern slopes of the country are true rock basins, which were once occupied by glaciers, and the bottom of one of which sounded by him has a depth of 1250 feet, or considerably below the sea. Although Dr. Hector does not go so far as to express his belief that these rock-basins have been scooped out by ice, he suggests that they have been filled and shaped by glaciers. He avows, however, that he has to read up much on this subject, and I only regret that this portion of my Address cannot probably be in the hands of my distinguished friend before his final conclusions may be published.

‡ In 1847 Lieut. R. Strachey visited and described the glaciers of the Pindur and Kuphinee Rivers, and applied to them the excellent Alpine classification of Professor James Forbes.

your attention to the last-mentioned of these explorers, Dr. Thomson, who first well defined the characters and extent of the glaciers of Western Tibet. In addition to a masterly description * of the physical geography of the regions he traversed, the work of Dr. Thomson is also so rich in botanical, climatological, and geological researches as to be a model for geographical explorers. Thus, his original observations on the enormous lacustrine deposits, replete with the remains of fresh-water shells, accumulated formerly at vast heights above the sea, are to my mind the grandest and clearest proofs of how the feeders of the Indus in bygone periods were dammed up by rock barriers, which later acts of upheavement may have disrupted, or by gigantic transverse or terminal glaciers and their moraines. In truth, therefore, the parallel roads of Lochaber in our Highlands, to which I adverted last year, have their grander analogue in the vast horizontal terraces of the mountains of Tibet. Again, among the remarkable data set before us in that work, is the striking fact that in the trans-Sutlej region of the Himalayas, the glaciers which descend from the southern flank of a range of mountains are longer than those which occur on the northern flank of the same. This is accounted for by the author on the grounds of the great amount of moisture proceeding from the ocean being arrested and condensed into snow by the first great range of heights which it encounters. The same phenomenon was, indeed, met with in Sikhim by Dr. Joseph Hooker, in the eastern portion of this great chain. Unlike his precursors, Thomson, when he wrote, was already conversant with the true laws of glacier movements, as well as the most remarkable of their effects, as pointed out in various works by Agassiz and other writers upon the Alps, and he specially refers to Professor James Forbes; for, though many an ardent traveller had preceded him, Thomson was the first who clearly distinguished the glaciers of the Himalayan Mountains from the snows whence they issued, and who at the same time pointed out the lateral and terminal moraines which they evolved. That which Thomson did for the western or Tibetan portion of this lofty chain of mountains was, in like manner, admirably done by Dr. Joseph Hooker for the eastern mountains of Sikhim, in his most attractive work.†

All these observers, whether in India or in New Zealand, have taught us that the glacial phenomena, though on a much grander scale in the Himalayas, are precisely analogous to those in Europe.

* 'Travels in the Western Himalayas and Tibet.' 1852.

† See 'Himalayan Journals.' 1854.

The application, however, of accurate topographical surveying, and the ascertainment of the precise length and breadth of those grand rivers of ice, were wanting. Captain Godwin Austen has effected this, as regards those vast glaciers proceeding from the Mooztagh, which lie to the west of those descending from the Karakorum Pass, described by Thomson. Having measured the length and breadth of these masses, he has enabled us to know that one of them, which feeds the powerful affluent of the Indus called Shiggar, has a length of 36 miles, and is therefore upwards of three times the length of any existing glacier of the Alps; though it will presently be shown that some of the old Alpine glaciers were considerably longer. Well, indeed, may we account for these grandiose dimensions now existing in the Himalayas, when we recollect that the passes by which travellers proceed to Yarkand have a height of 18,000 feet, and that the great Karakorum Peak rises to 28,200 feet, above the sea. Captain Godwin Austen is, I understand, about to explore the great *terra incognita* which the Burhampooter is supposed to traverse in the upper part of its course, and we may confidently hope that, at no distant day, this energetic young officer will ultimately obtain the highest honours of this Society.

In the discussion which followed the reading of the memoir of Captain Godwin Austen, Dr. Falconer grappled most ably with the novel theory that the lakes of the Alps owe their origin to the erosive action of ice, which, descending from former great glaciers, has excavated or scooped out the cavities now filled with water. Being one of the few men who have personally examined the glaciers both of the Himalayas and the Alps, his reasoning from observed facts is most valuable. Believing, with the vast majority of practical geologists, that the irregularities of the surface of the Alps have been primarily caused by dislocations and denudations, he gave it as his opinion that the Alpine cavities, having been filled with ice during the glacial period, were thereby protected from the influx of the vast masses of the detritus hurled down in the moraines of gigantic glaciers that passed over these countries on solid ice, which, on melting, left the depressions in the condition of lakes. On the southern flank of the Himalayan mountains, on the contrary, where ice has not acted as a conservative agent, the valleys have been choked up with *débris*, but no great lakes exist. Dr. Falconer expressed the same views at an evening meeting of the Geological Society, on the 5th March, 1862, but it is not the practice of that body to record the opinions of speakers.

In alluding to this original view of Dr. Falconer, and to the able illustration of the whole subject, as detailed in our Proceedings,* I am bound, as a geologist, not to shrink from stating that I agree with him. I beg also to take this opportunity of recording my own opinion of the effects which glaciers have produced in those tracts where they formerly existed, or where they now prevail, as founded on the observations of many good observers, as well as on my own researches. Until lately most geologists seemed to be agreed that the numerous deep openings and depressions which exist in all lofty mountains were primarily due to cracks, rents, and denudations, which took place during the various movements which each chain had undergone at various periods. These apertures, it was supposed, were necessarily enlarged by long diurnal atmospheric agency and the action of torrents carrying down boulders and detritus; such action being most intense in those mountains where snows and glaciers prevailed, the melting of which necessarily produced great débâcles. In the place of this *modus operandi*, another theory has been applied to all those mountains, which, like the Alps, have been for long periods the seat of glaciers.

Before I enter on the consideration of the new theory of the power of moving ice, let us take a review of the progress recently made in pointing out the extent to which ancient glaciers and their moraines have ranged within or on the flanks of the Alps. In the northern portions of the chain these phenomena long ago attracted the attention of some admirable observers. Originating with Venetz and Charpentier, the true active powers of glaciers were defined by Rendu, Agassiz, and Forbes, and subsequently by the other explorers. In short, no doubt any longer obtains, that such was the powerful agency of the grand ancient glaciers, that blocks of crystalline rock were transported by them from the central Alps of Mont Blanc to the slopes of the Jura Mountains. When, however, we begin to seek for satisfactory explanations of the method of transport of these huge erratics, geologists (who are only geographers of another order) entertained different opinions. For my own part, I have had strong doubts as to whether the great blocks derived from Mont Blanc, and which lie on the slopes of the Jura, were ever borne thither by a vast solid glacier which advanced from the Lake of Geneva over the Cantons of Vaud and Neuchâtel. Whilst fully believing in the great power of glaciers and their

* 'Proceedings of Royal Geographical Society,' vol. viii. p. 38.

agency, my opinion was that these blocks were rather transported to their present habitats on the Jura on ice-rafts, which were floated away in water to the N.N.W., when the great glaciers melted, and the low countries were flooded. I founded this opinion on the fact, that in examining the Canton de Vaud, and particularly the tracts near Lausanne and the north side of the Lake of Geneva, I never could detect the trace of true moraines. In that detritus I saw merely accumulations of loose materials, which had all the aspect of having been accumulated under running waters. But, even granting to the land-glacialists their full demand, and supposing that a gigantic glacier was formerly spread out in fan shape, as laid down by several geologists and recently in the little map of Sir Charles Lyell, in his work on the Antiquity of Man, and that it became eventually of such enormous thickness as to have carried up the great blocks on its surface, to lodge them on the Jura Mountains; there is still in it nothing which supports the opinion, as indeed Sir Charles has himself observed,* that the deep cavity in which the lake lies was *excavated* by ice.

The geologists who first embraced the view of the transport of the huge blocks on the Jura by a solid glacier, were of opinion, that the great depressions and irregularities of the surface which we now see between the Alps and the Jura, including the Lakes of Geneva and Neufchatel, were so filled up with snow and ice, that the advancing glaciers travelled on them as bridges of ice, the foundations of which occupied the cavities.

Let us now turn to the south side of the Alps, where a long incline accounts for the enormous extension of glaciers into the plains of Italy. Thus, in examining the remains of the old glaciers which once advanced into the valley of the Po, MM. Martins and Gastaldi show us, that one of those bodies extended from Mount Tabor to Rivoli, a length of 50 miles; and, therefore, was longer than any existing glacier described on the flanks of the Himalayas; † whilst those to the south of the Lago di Garda are shown to have had a much greater length. Demonstrating, along with many other authors, how these old glaciers had striated and polished the hard rocks through or on which they had advanced, these authors also clearly pointed out how the course of the glaciers had been deflected, so as to take a new direction, when they met with the obstruction of any promontory of hard rock. Further, M. Martins, being well

* See 'Antiquity of Man,' p. 312.

† Bull. Soc. Géol. de France. 1850.

acquainted with Norway, indicated that, just as in that country, the face of each rock in a valley was rounded off, polished, and striated where it had been opposed to the advancing mass of ice, and that its opposite or downward face, over which the ice had cascaded or tumbled, was left in a rough state; thus exhibiting the worn or "stoss-seite," and lee, or protected side, of the Scandinavian geologists. The subsequent works of M. Gastaldi on the geology of Piedmont, in 1853 and in 1861, bring within well-defined limits the phenomena of old moraines and ancient drift, and prove that the débris carried over each gorge and valley has been derived from the rocks which specially encase such depressions. He also clearly demonstrated that in many of these cases the gigantic boulders, which are piled together and present the character of a cataclysmal origin, can all be accounted for simply by the power of advancing ancient glaciers. In these works M. Gastaldi very properly distinguishes between the erratic blocks which were evidently parts of old terrestrial moraines, and those which, associated with tertiary strata, are found in deposits with marine shells—the larger erratics in the latter, as in the Superga, having been transported in masses of ice which floated on the then sea.

Various other Italian authors have occupied themselves with glacial phenomena (particularly Omboni, Villa, Stoppani, Cornalia, Paglia, Parolini, &c.): the conclusion at which they have all arrived is, that there existed an enormous extension of the moraines sent forth by the ancient Alpine glaciers into the great valley of the Po. Geographers who have not studied the phenomena may well indeed be surprised when they learn, that the hills to the south of the Lago di Garda, and extending by Pozzolengo and Solferino to Cavriano,* or the very ground where the great battles of the year 1859 were fought (the hill of Solferino being 657 English feet above the sea), are simply great moraines of blocks and gravel, produced by the advance of former glaciers which issued from the southern slopes of the Alps.

Combining these observations with others of his own on the lake of Annecy, M. Mortillet suggested in 1862 a new theory, in attributing to the descent of the glaciers a great excavating power. Believing, with all those who have been named, as well as the most eminent of the Swiss and French geologists, that the last great upheavals and denudations of the Alps had produced the irregularities

* See Paglia—'Sulle Colline del Terreno Erratico all' estremità meridionale del Lago di Garda' (with map).

of their surface, he inferred that before the glacial period began, the débris derived from the wear and tear of the mountains by watery action had, to a great extent, choked up the valleys and filled the rock-basins. He further believed that, in the cold period which followed, great glaciers, descending with enormous power, forced all such débris out of the original rock-basins, and left them to be occupied by the present lakes. It is proper here to state that M. Gastaldi was right, as well as M. Mortillet, who followed him, in presuming that great deposits of old water-worn alluvium or loose drift were accumulated before the formation of glaciers, inasmuch as the oldest moraines are seen to repose in many places on the former. It will presently be shown that this fact contains within it the proof that the glaciers were not and are not in themselves excavating bodies.

Preceding M. Mortillet, however, in reasoning upon the excavating power of former glaciers, my eminent associate Professor Ramsay had broached a much bolder theory. In his essay entitled 'The Old Glaciers of Switzerland and North Wales,' published in 1859, and re-published with additions in 1860, he expressed the opinion that the excavation of deep hollows in solid rocks was due to a weight of superincumbent ice pressing and grinding *downwards and outwards*, over high, flat, and sometimes broad watersheds and table-lands, during that period of intense cold which produced the old glaciers.* In 1862 he went still further; and whilst M. Mortillet was communicating his views on the Continent, Ramsay, wholly unconscious of what M. Mortillet was doing, read a memoir to the Geological Society of London, showing that all the cavities occupied by lakes in Switzerland and the North of Italy had been excavated originally by the action of glacier ice. Whatever, therefore, be the fate of this ingenious view, Professor Ramsay has our thanks for having excited much useful inquiry, and for having compelled old geologists like myself to reconsider our conclusions.

If the view of M. Mortillet has been met with objections, still more is the theory of Ramsay opposed, and particularly in foreign lands. In this country it has indeed met with the most vigorous opposition on the part of Dr. Falconer, as recorded in our Proceedings; and even Sir Charles Lyell, the great advocate of the power of existing causes, has stoutly opposed this

* See 'Peaks, Passes,' &c. (Alpine Journal, 1859), and 'The Old Glaciers of Switzerland and North Wales,' London, 1860, p. 110.

bold extension of a most powerful *vera causa*.* Having explored the Alps, at various intervals, for upwards of forty years, I long ago came to the conclusion that their chief cavities, vertical precipices, and subtending, deep, narrow gorges, have been *originally* determined by movements and openings of the crust, whether arranged in anticlinal or synclinal lines, or not less frequently modified by great transversal or lateral breaks, at right angles to the longitudinal or main folds of elevation and depression. Explorations of other mountainous regions, in various parts of Europe, have strengthened this conviction. I rejoice, therefore, to find that those geologists of Switzerland, who justly stand at the head of their profession, Professor Studer and M. Escher von der Linth, have sustained, by numerous appeals to nature, the views I hold in common with the great majority of geologists. Those Swiss explorers, who have laboured for many years in their native Alps, and have constructed admirable geological maps of them, must surely be well acquainted with the ruptures of the various rocks, the outlines of which they have sedulously followed. Now, they attribute most of those deep cavities in which the rivers and lakes occur either to dislocations producing abrupt fissures, or to great foldings of the strata leaving openings upwards where the tension has been the greatest—openings which were enlarged by powerful denudations. Numerous geologists have recently expressed their concurrence in the generally-adopted view, that the Alpine lakes occupy such orographic depressions; and, by close researches, my accomplished friend Mr. John Ball † has ably sustained this view, and has further shown how slight is the erosive power of a glacier even when issuing from its main source. No one of them, in short, any more than Professor Studer and myself, doubts that the origin of these lakes is primarily due to other causes. Nor am I aware that any geologists of France and Germany, much as many of them have examined the Alps, have deviated from the opinion that the main diversity of outline in that chain was due to ruptures and denudations that occurred during the upheavals of the chain.

On the other hand, I am bound to state that, although the new theory has met with little or no favour on the continent of Europe, it is supported by our able geologists, Jukes and Geikie. Again, whilst Ramsay extended his view to the great lakes of the Alps, the eminent physicist Tyndall speculated even upon all the Alpine

* See 'Antiquity of Man,' pp. 316 *et seq.*

† See 'Phil. Mag.' 1863.

valleys having been formed by the long processes of the melting of snows and the erosion of ice.* With every respect for the reasoning of my distinguished countrymen, I rely upon my long acquaintance with the structure of the Alpine chain; and now that I see sound practical geologists, who have passed their lives in examining every recess of those mountains, rejecting this new theory, and pointing out, in place of it, the proofs of ruptures and denudations in the chain, I adhere firmly to the view I have long entertained.†

Those who wish to analyse this matter, must consult the admirable essay of Professor Studer on the origin of the Swiss lakes.‡ They will find numerous proofs of the views sustained by the leader of Alpine geologists. He shows you, indeed, how many of the rivers now flow in fissures or deep chasms in very hard rocks of different composition; chasms which water alone could never have opened out, particularly in those cases where the river has left a softer rock, and, with very slight obstacles to its straight course, has availed itself of one of these deep transverse natural gorges, which have evidently been produced by a great former rent. My personal observations in the Alps, Carpathians, and Ural mountains enable me to confirm this view. As regards the continent of Europe, I should transport you to the Rhine, the Danube, and other great streams, which, flowing through flat countries, with little declivity, never could have eroded those deep, abrupt gorges through which they here and there flow, and which are manifestly due to original ruptures of the rocks.§

* See Tyndall on the Conformation of the Alps, 'Phil. Mag.' vol. xiv., 1862, p. 169, and also Ramsay on the Excavations of the Alps, xvi. p. 377.

† Some remarkable facts have been mentioned to me in a letter by M. Escher von der Linth, as proving the inapplicability of the ice erosion theory to the Swiss lakes. 1st. That the glacier of Rosenlauri, which descends from a great altitude, does not enter a low deep narrow gorge of the valley, but forms a bridge over it; and so it is to be inferred, that, as the ancient glacier did not excavate this gorge, still less did it excavate the great valley in which the present glacier is embosomed. Again, he points out that, as the bottoms of many of the Swiss lakes are below the level of the sea, the glacier which is supposed to have excavated the hollow would have to ascend considerable heights to emerge from the depression which it had excavated—an impossible movement, and contradicted by the existing operations of all glaciers.

‡ 'Origine des Lacs Suisses,' Biblio. Univ. et Revue Suisse (Arch. des Sci. Phys. et Nat.) t. xix. liv. de Février, 1864; also Phil. Mag. vol. xxvii. p. 481.

§ The recent Russian exploration of Eastern Siberia has shown how the grand river Amur deflects suddenly at nearly right angles from its course in a comparatively low country, to take advantage of a deep natural rent in the mountains through which it escapes to the seaboard (see p. 201 of the Address).

In holding these opinions as to the small power of watery or glacial action, when not acting on an adequate incline, I do not doubt that glaciers have been, and still are, most important agents in modifying the outlines of mountains. Their summits are, we know, continually degraded by rains and melted snows; and torrents flowing down from them and carrying much detritus, are, doubtless, deepening their channels wherever sufficient slopes occur. But to whatever extent this agency has been and is at work, and to however great a degree a descending glacier may scratch and round off the rocky bottom on which it advances, I coincide with Professor Studer, and many other observers, that the amount of erosion produced by these icy masses, particularly when they have advanced into valleys where there is only a slight inclination, must be exceedingly small. In valleys with a very slight descent it will presently be shown that, even in the Alps, no erosion whatever takes place, particularly as the bottom of the glacier is usually separated from the subjacent rock or vegetable soil by water arising from the melting of the ice. Again, in all the steeper valleys down which ancient glaciers have formerly descended, we do not find that either the sides or bottoms of the upper gorges afford any proof of wide erosion, but only exhibit the peculiar fashioning of the flanking surfaces of the rocks, or that rounding off and polishing, called *moutonné*, accompanied with striations. On the contrary, in gorges whence the largest glaciers have advanced for ages, we meet with islands of solid rock and little bosses still standing out, even in the midst of valleys down which the icy stream has swept.

With such proofs before us of what the frozen rivers called glaciers have done and are doing in the high valleys, how can we imagine, as Dr. Falconer has forcibly put it, that the glacier which is supposed to have occupied the Lago Maggiore, for example, and had advanced its moraines into the plains of the Po, should have had the power to plough its way down to a depth of 2000 feet below the Mediterranean, and then to rise up along an incline at the rate of 180 feet per mile? Nor can I admit the possible application of this ice-excavating theory wherever I see that a depression in which a lake occurs is at right angles to the discharge of an old main glacier. This is remarkably to be noticed in the case of the Lake of Geneva, which trends from E. to W., whilst the detritus and blocks sent forth by the old glacier of the Rhone have all proceeded to the N. and N.W.; or in direct continuation of the line of march of the glacier which issued from the narrow gorge of the Rhone. By what

momentum, then, was the glacier to be so deflected to the west that it could channel or scoop out, on flat ground, the great hollow now occupied by the Lake of Geneva? And, after effecting this wonderful operation, how was it to be propelled upwards from this cavity on the ascent, to great heights on the slopes of the Jura mountains?

Still stronger objections exist to the application of the excavation theory to the Lake of Constance. There I have never been able to see on the northern flank of the Hohe Sentis, which presents its abrupt, precipitous, and highly dislocated and contorted jurassic and cretaceous rocks to the lake, with terraces of miocene deposits, at various heights,—there I have been unable, when with my indefatigable friend and companion M. Escher von der Linth, who knows every inch of the ground, to trace the signs of the action of a great glacier, which could, in its descent, have so plunged into the flat region on the east and north, as to have scooped out the cavity in which the Lake of Constance lies. In this case, indeed, there are no traces whatever of those great old moraines from the relics of which we infer that glaciers have formerly advanced; the level country to the north of the lake being entirely free from them.

Great orographic depressions and deep cavities, sometimes dry, sometimes filled with water, occur in numberless countries where no glaciers ever existed. Thus, in Spain, as my colleague M. de Verneuil assures me, the large depressions on either side of the granite mountains of the Guadarrama present exactly the appearance which a theorist might attribute to excavation by ice, and yet, however these cavities were formed, it is certain that no glacier has ever existed there. Nor, again, has ice ever acted on the sides of the steep mountains of Murcia, where deep excavations and denudations are seen upon the grandest Alpine scale.

If we transport ourselves from those southern climes to the northern latitudes of the Ural mountains, where doubtless ice and snow formerly prevailed to a greater extent than now, we do not there find any proof whatever of the action of glaciers; for the hills are much too low to have given propulsion to such masses. On the contrary, we know that great blocks of hard rocks have been transported to the foot of these hills from Lapland and Scandinavia, when, during the glacial period, a vast Arctic Sea watered the flanks of the Ural mountains, and when most parts of that low chain could then have been only slightly elevated above

the waters. And yet on the sides of this chain, where no glaciers have ever so acted as to have produced erosion, we meet with both longitudinal and transverse deep fissures in some of which lakes, and in others rivers, occur. Thus, all along the eastern flank of the Ural mountains we find a succession of depressions filled with water without a trace, on the sides of the bare and hard rocks which subtend these lakes, of any former action of glaciers. Then, as to deep valleys in which rivers flow, let us take two out of the examples along the western flank of this chain, on which my companions De Verneuil, Keyserling, and myself have specially dwelt in our work on Russia. The Serebrianka river, as it issues from a network of metamorphic schists, quartz rocks, and marbles of Silurian age, exhibits on its rugged banks the extrusion of much igneous matter. This agency has split up the stratified deposits; and the necessarily accompanying movements have caused great openings, including the cavity in which the river flows. Or, when the geological traveller passes from the valley of the Serebrianka to that of its recipient, the Tchussovaya, still more is he struck with wonderment at the unquestionable evidences, amidst intensely dislocated rocks, of the ruptures by which the deep narrow chasm has been formed in hard crystalline rocks, in which a lazy stream flows, which, not descending from any altitude, has had no excavating power whatever, and, like our own meandering Wye, has flowed on through clefts in limestone during the whole historic and prehistoric period, without deepening its bed.*

But if rivers which are not torrential, and do not descend from heights, cannot possibly have produced, nor even have deepened, the natural hollows or chasms in which they flow, still it might be contended, that, what water has not effected, may have been done by a river, when, in the compacter form of ice, it descended and advanced across the lower country. Unluckily for the supporters of the ice-excavating theory, the data which existing nature presents to us, as before said, are decisively opposed to their view. The examination of those tracts over which glaciers have advanced, and from which they have retreated, shows, in the most convincing manner, that ice has so much plasticity that it has always moulded itself upon the inequalities of hard rocks over which it passed, and, merely pushing on the

* For a full description of the abrupt gorge of the Tchussovaya, see 'Russia and the Ural Mountains,' vol. i. p. 352 *et seq.*

loose detritus which it meets with, or carries along with it from the sides of the upper mountains, has never excavated the lateral valleys, nor even cleared out their old alluvia. This fact was well noticed by the Swiss naturalists, as evidenced by present operations, at their last meeting in the Upper Engadine, and has been well recorded by that experienced and sagacious observer of glacial phenomena, M. Martins.*

Since that time the able French geologist, M. Collomb, who was associated with Agassiz in his earliest researches on glaciers, and has been the companion, in Spain, of my colleague M. de Verneuil, has recently put into my hands the results of his own observation upon the present and former agency of the glaciers of the Alps, which decisively show that ice, *per se*, neither has nor has had any excavating power.† None of the glaciers of the Alps cited by M. Collomb, viz. those of the Rhone, the Aar, the Valley of Chamounix, the Allée Blanche, and the Valley of Zermatt, produce any excavation in the lower grounds over which they pass. That of Görner, which, among others, is advancing, affects very slightly the surface of the meadows on which it proceeds, and does not penetrate into the soil. Again, where the glacier of the lower Aar pushes, on its front, upon accumulations of the débris of old moraines and gravel, it scarcely deranges these materials, but slides over them, leaving them covered with mud and sand, but not excavating them. Also, the glacier of the Rhone, the principal part of which can be so conveniently studied, advances on a gravelly substratum, in which it does not form a channel. Such being the facts as regards glaciers now advancing, M. Collomb cites equally strong, if not still stronger, cases, in support of his view, as derived from the observation of retiring or shrinking glaciers in the valleys of the Alps. Examining last year with M. Daubrée the glaciers of the Valley of Chamounix, he was attracted to that named Bossons, which he had not seen for five years. During that time the glacier had shrunk very considerably, both in altitude and length, and yet upon the surface of the ground from which it had retired there was not the smallest sign of excavation.

Viewing a glacier as a plastic body, we know that it is pressed onwards by gravitation from the increasing and descending masses

* See 'Revue des Deux Mondes,' Mars, 1864. The former observations of M. Martins on Norway and on the Alps are of the highest importance.

† I may add that M. de Collomb expresses that which I believe to be the opinion of Elie de Beaumont, d'Archiac, de Verneuil, Daubrée, and all the leading French geologists.

of snow and ice behind it in the loftier mountains, and being forced to descend through narrow gorges, it naturally acts with the greater energy on the precipitous rocky flanks of these openings; striating and polishing them with the sand, blocks, and pebbles which it holds in its grasp. But, as before touched upon, the narrowness of many of those channels through which glaciers have been thrust for countless ages, is in itself a demonstration that the ice can have done very little in widening the gorge through which it has been forced, and where, of necessity, it exerted by far its greatest power. In other words, the flanking rocks of each gorge have proved infinitely more stubborn than the ice and its embedded stones, which have merely served as graters and polishers of the granites, quartz rocks, porphyries, slates, marbles, or other hard rocks, among which the frozen river has descended. And, if such has been the amount of influence of advancing glaciers in the higher region, where the body descends with the greatest power, how are we to believe that when this creeping mass of ice arrived in low countries (as for instance in the depressions occupied by the Lakes of Geneva and Constance) it could have exerted a power infinitely greater than that which it possessed in the higher regions?

When we turn from modern glaciers to the remains of those of ancient date, the proofs are equally decisive, that, whatever might be their extent, those gigantic bodies exercised no excavating power. I am reminded by M. Collomb, as well as by M. Escher von der Linth, that in many parts of the Alps, vast old moraines repose directly on incoherent and loose materials of quaternary age; the old drift of the Alps, containing *Elephas primigenius* and *Rhinoceros tichorhinus*. Well may we then ask, how is it that the ancient and larger glaciers, which were supposed to have had such enormous excavating power as to have scooped out deep valleys in hard rocks, should not have entirely destroyed the loose accumulation of gravel over which they have been spread? Or, if glaciers excavated the Lago di Garda and Lago Maggiore, why did they not produce any such effect at Ivrea, in the Valley of Aosta, down which we know that enormous masses of ice travelled; or at Rivoli, in their march from Mount Cenis towards Turin?

Leaving it to physical philosophers, such as Forbes, Faraday, Hopkins, and Tyndall, to show what is the real measure of the abrading power of masses of moving ice, I simply form my opinion from what glaciers are accomplishing, or have accomplished. Judging from positive data, I infer that if, as agents, they have been wholly

incapable of removing even the old and loose alluvial drift which encumbered the valleys, infinitely less had they the power of excavating hard rocks. At the same time I know that, in every mountain tract which I have examined, there have been quite a sufficient number of rents and denudations to account for all inequalities. These openings have doubtless been greatly increased by the atmospheric agencies of ages, and particularly in all those situations where water has acted with great power, during the melting of glaciers.

I have made these observations (which I could largely extend) to show the intimate connection which exists between the science of geology, to which I have been so long devoted, and physical geography. Let me explain, however, that I do not doubt that glaciers have, in certain regions, caused the formation of lakes, though by a very different agency from that of the excavation of rocks. The great glaciers of former times have unquestionably sent forth and discharged still larger accumulations of débris than those of our day, which, in the form of high terminal moraines, barred up water-channels, and the result in some mountainous tracts has inevitably been the production of lakes. Among examples of such in Europe, M. Collomb directs my attention to the Gérard-meer, on the western flanks of the Vosges mountains. This lake has been formed by an ancient moraine, which, descending from the Vosges mountains, has been accumulated on old drifted loose materials, which it has not excavated, whilst it has served as a permanent dam to sustain the waters at a height of 1400 feet above the plain of the Rhine, to the east of the Vosges, and nearly 2000 English feet above the level of the sea.

In the grand and loftier cases, however, of Western Tibet, before alluded to, it is scarcely conceivable that icy barriers or moraines in the valleys could have risen to sufficient height to pond back the waters to many thousands of feet above the low country on the south. The bursting of those old vast and lofty mountain lakes was probably, as suggested by Dr. Falconer, determined by the last great upheaval of the Himalayas, which, judging from the very modern character of the organic remains in the upheaved deposits, must have taken place during one of the most recent of geological epochs.

In referring you to my observations of last year on the marvellous effects of those aqueous currents which have transported erratic blocks of stone during the former glacial period, I must attract your notice to a remarkable and faithfully executed new map of Finland by

Professor Nils Nördenskiöld, of Helsingfors, which illustrates an able memoir by that author on the scratched and polished surfaces of the rocks of his native country.* Carefully taking the direction of every one of the innumerable sets of parallel scratches over a region larger than Great Britain, he shows, that everywhere the direction of these groovings and scratches is from north-west to south-east, with slight local deviations only. Again, the worn sides (*stoss-seiten*) of each hard rock which has been scratched, worn down, and polished, are presented to the north-west, the point from which the force proceeded; and every *lee*, or protected and rough side, lies to the south-east. On the coast of Finland these groovings are even observed to extend in one place from many feet under the surface of the sea. Seeing that the force which produced these groovings and scratches came from beyond the Gulf of Bothnia and the low country of Sweden, and has operated with such uniformity over a vast region, parts of which rose to about 1000 feet above the Bothnian Gulf, he necessarily refers the phenomena to powerful marine currents. These took place when Finland, as well as all Northern Russia and Germany, lay under the sea, and when the chief groovings were made by stones and blocks, which were held fast in the bottom of floating icebergs, when they were arrested on submarine banks or points of rock. He also indicates how the erratic blocks dropped by these icebergs are found to be more and more rounded as they have receded from the source of their origin, or how, in drifting to the south-east, they have consequently been more exposed to wear and tear. The quantities of sea-sand which abound, and the accompanying small and waterworn pebbles and gravel, have, of course, assisted in the polishing of the rocks. The sand-ridges and pebble-beds which abound in Finland are, in fact, nothing different from the *Ösar* of the Swedish geologists; and thus the drift phenomena on either side of the Gulf of Bothnia are shown to be identical sub-aqueous deposits.

Here, then, we have a vast region of Europe in which it is manifest that no land-ice or glacier could ever have acted, inasmuch as the area from whence the force was directed was manifestly far to the north-west of the Gulf of Bothnia, and the low countries of Sweden, which, equally with Finland, are covered with erratic blocks and aqueously transported drift. Neither in the south of Sweden nor in Finland are there any moraines, all the detritus

* 'Beitrag zur Kenntniss der Schrammen in Finland.' Von N. Nördenskiöld, Helsingfors, 1863.

around the great erratics being water-worn; and yet the scratched and polished surfaces, the worn and abrupt sides of the hillocks, in both these countries, resemble precisely the *roches moutonnées* seen in the march of every existing glacier. Agreeing, as I do entirely, with Professor Nördenskiöld (for in my published works I have maintained the same view as regards the southern parts of Sweden, and all Northern Russia, Prussia, and Germany),* I also agree with him in the conclusion that the depressions in the surface of Finland, which are now occupied by innumerable lakes, are those which existed when the country was a sea-bottom, and that the present lakes simply occupy the hollows which existed when Finland was raised from beneath the waters. In a table giving the lithological structure of each rock *in situ* which has been grooved, it is shown that the depth of the scratches bears an exact relation to the hardness and resisting nature of the rock. The map—on which every lake and the numerous scratched surfaces are marked, as well as all the altitudes—is a work which must elicit the admiration of every geographer and geologist, and does such honour to Professor Nördenskiöld, that our Council has justly placed him in the list of our Honorary Members.

The lines of striation, so carefully laid down by Nördenskiöld in Finland, I have myself found extending in the adjacent low regions of Russia, and notably upon the hard quartzose rocks forming the sides of the lake Onega, at a distance of 500 miles from the Bothnian Gulf. There, also, they are seen to be continuous from the shore under the water of the lake, being visible at some feet below the surface. In this flat or slightly undulating country we have all the same proofs as in Finland, that these scratches, groovings, and polishings could only have been produced by stones carried in icebergs; and there, as in Finland, the great erratics, referable to the north-western parts of Norway, have been dropped at numerous intervals, some of them from Lapland, extending to the western flank of the Ural mountains. In the work and map of "Russia and the Ural Mountains," published by myself and companions De Verneuil and Keyserling, the enormous area over which these erratics were transported during the period when the glacial sea covered Russia in Europe and Northern Germany was defined. It was then for the first time made manifest that the currents which transported these blocks had eccentric directions. Thus, whilst the blocks in Finland

* See 'Russia in Europe and the Ural Mountains,' vol. i. chapters 20 and 21. Also, 'Quart. Jour. Geol. Soc.,' vol. ii. p. 349.

and Northern Russia had proceeded from N.W. to S.E. (having been derived from the old north Norwegian ice-fields), the blocks which covered the plains of Prussia, and extended over Poland up the great valleys, on to the foot of the Carpathians, being also of Scandinavian origin, must have been brought from north to south when all those lands were under the sea. On the east of England the great Scandinavian erratics came from the west coast of Norway, whilst in Lapland, M. Böhlingk had shown that the blocks were diverted northwards into the icy sea.

These facts of the divergence of the distribution of the erratics, as due to divergent currents, are quite in harmony with what would be found at the present day, if the bottom of the sea could be so laid bare as to enable us to refer to the various north or south polar glaciers, or to those of Greenland, the devious lines of deposit of the blocks derived from each of these regions, as determined by different prevailing currents.

If we refer to what glaciers have effected upon land, and to those phenomena which could only have been produced when the rocks so affected were submarine, we must admit that two distinct modifications of the same great agency have produced similar results. The great mass of low country in North America, the surface of which has been striated in like manner from north to south, seemed to me long ago to fall into the category of subaqueous striation by floating icebergs, which were here and there arrested in their progress by sunken rocks. When presiding over the Geological Society of London, in 1842, I gave all credit to Mr. Peter Dobson, a citizen of the United States, for the adoption of that view in reference to his native land,—a previous acquaintance with whose writings, I then said, might have saved volumes of disputation on both sides of the Atlantic.* And now, after a lapse of 22 years, I hold to the same belief.

In the admirable work of Sir W. Logan on the 'Geology of Canada,' my eminent friend expresses the opinion, "that the grooves on the surfaces of the rocks which descend under the water appear to point to glacial action as one of the great causes which have produced these depressions."† Not having visited the region myself, I should have no right to oppose my opinion to that of such weighty authority,

* See 'Anniversary Address, Proc. Geol. Soc.,' vol. iii. pp. 686 *et ante*.

† 'Report of Geological Survey of Canada, 1863,' p. 889 and note *ib.* Montreal.

were it not that the grounds assigned for believing in the excavating power of glaciers in North America are the same striations on the sides of the lakes, and beneath the water, as those which I have cited from the shores of the Bothnian Gulf and the lake of Onega in Northern Russia. Now, as regards the latter countries, I have shown that land glaciers could never have passed over them; for surely no terrestrial glacier in advancing to Finland and Northern Russia can have scooped out the Bothnian Gulf by the way! Instead of such striation on the sides of rock-basins, now filled with water, being proofs of the grinding and excavating action of former glaciers, particularly in the cases of Finland and North America, where no lofty mountains, as in the Alps, are at hand to give great power to descending masses of ice, I conceive that such phenomena can only be explained by appealing to the grating action of the bottom of former floating icebergs. My belief is, that the great North American lakes were cavities originally due to a combination of ruptures and denudations of the rocks, and that the whole surface of the lower country thus prepared, was under the sea when icebergs coming from Arctic glaciers floated over it.

We can thus well imagine how countless icebergs were here and there arrested on those submarine rocks which now form the sides of the lakes, and how each icy mass, forced on by a powerful current, after producing the well-known striation on the points of stoppage, would necessarily, when set free, float rapidly across the deep sea cavity, until the base of the iceberg was again arrested by the prominences on the opposite side of the depression, there again to make striations with the stones held fast in its bottom. In this way we can just as easily account for the transport of the numerous great erratics which are spread over North America up to 38° N. latitude, as we have explained the transport of the Scandinavian blocks up to the foot of the Carpathian Mountains.

Whilst, therefore, I fully recognise the stupendous spread and influence of former land-glaciers over extensive regions, I at the same time affirm, that as regards the striation and polishing, the worn side and the abrupt side of the rocks affected, floating icebergs, when impeded by submarine obstacles, have also produced those results. The true and independent test of the action of terrestrial glaciers is the existence of moraines. Now, there is no

trace of these peculiar accumulations in the South of Sweden and Finland, all the detritus of those regions, as well as of the North of Russia and Germany, being waterworn; and I have yet to learn that there are any evidences of true moraines in the low countries of Canada and the United States.*

[Whilst I was reading this Address to the Geographers in London, that sound practical geologist, Principal Dawson, was performing a similar duty at the Annual Meeting of the Natural History Society of Montreal. Having received a copy of his Address in time for insertion of a Postscript here, I rejoice to have the opportunity of stating that he also is a vigorous opponent of the theory which refers the striation of the North American rocks, and the excavation of the great lake basins of that country, to the action of terrestrial glaciers. He shows indeed that the great striation of a large portion of the continent from N. E. to S. W. was from the ocean to the interior, against the slope of the St. Lawrence valley, thus disposing at once of the glacier theory; for it is impossible to imagine that a glacier travelled from the Atlantic up into the interior. Admitting that in limited tracts of Eastern America there may have been local glaciers, Mr. Dawson believes, as I do, that the chief countries in question were striated when the land lay beneath the sea.]

AFRICA.

North-western Africa.—Senegal and its Dependencies.—Looking to the well-digested and clear accounts of the progress of geographical research in Northern or North-western Africa, which have been embodied in the Reports of the Geographical Society of France, by M. Malte Brun, I have only to refer you to those works, and not detain you on this subject by any observations of my own. I am, however, impelled to call your notice to a work of this year 1864, the ‘*Annuaire de Sénégal*,’† as followed by a *résumé* of the explo-

* For a full explanation of my views respecting the manner in which former floating icebergs transported blocks, and spread out submarine detritus, I must refer the reader to the 21st and 22nd chapters of the work ‘*Russia and the Ural Mountains*,’ pp. 507 to 556. Since that time (1845) I have indeed seen reason to admit a much greater extension of former land-glaciers than my colleagues and myself then believed in, and this I explained in my last Address to the Royal Geographical Society.

† Printed at St. Louis, Senegal, 1864. Paris, chez Challamel aîné, Rue des Boulangers, 30.

rations of the interior, made by order of the Government, in the years 1859, 1860, and 1861, and which has just fallen into my hands. Whenever our allies the French describe any one of their possessions, it is invariably done with method, order, and a lucid condensation of details; and such qualities are particularly observable in this little volume. Discovered in 1460 by some bold navigators of Dieppe, Senegal was soon after colonised by the same Normans. In succeeding centuries the Portuguese and Dutch warred for the occupation of these tracts, until 1758, when the English took the country, including Goree, but ceded it again to France by treaty. Again, in 1800, Goree fell into our hands, and in 1809 we added to it St. Louis; but, at the conclusion of the last great war in 1814, the whole territory was rightly given back to France, its original occupant. Holding possession of this territory for the last fifty years, the French have striven energetically to improve it, by a vast enlargement of boundary, the construction of forts, strict military tenure, and by carrying on a commerce with the adjoining native tribes; so that they reckon upon having 200,000 subjects, and, after several years of war, they are now in relation with about a million of natives.

In the long list of annexations of native districts, it is gratifying to read, as a sequence of the last treaty of peace, that a telegraphic communication is now established between St. Louis and Goree, and that in 1863 the new port of Dakar was formed. Recently the quiet state of the political horizon has enabled the Governor, Colonel Faidherbe, who has been the mainspring of French progress in Senegal, and who has recently been named one of our Honorary Foreign Members, to send various exploratory parties along the north coast and into the interior of the country. These have added much important information to the sketches of tracts formerly visited by the Père Labat, Mungo Park, Caillé, Mollien, and Panet. The French colonists, since their occupation of Algeria, have sagaciously sought for original knowledge in the native recitals of Arabs, and the inhabitants of Soudan and Berber. With these data, and in acquiring the language of the natives, several travellers,—such as Captain Vincent; MM. Bournel and Mage, young Naval officers; Pascal and Lambert, Infantry officers; with Alioun Sal and Bough-el-Moghdad, intelligent Native officers in the French service,—have, in the years 1859, 1860, and 1864, made most successful journeys. Thus, the portion of Soudan adjacent to Senegal is now nearly as well known as the more central

regions, which have been already developed by British explorations, including those of Denham, Clapperton, and W. Lander,* and the works of our honoured Associate Barth. One of these parties, Alioun Sal, reached Timbuctoo; and the death of this young and intelligent Mohammedan, who unfortunately fell a prey to the fever of the country, has been deeply lamented by the authorities of Senegal.

Before quitting the subject of North-western Africa, I am unwilling to pass unnoticed the services of the enterprising young German traveller Gerhard Rohlfs, who, having made a successful journey through Southern Morocco by Tafilet to Gerysville in Algeria, is now on his route to Timbuctu under the auspices of the Royal Geographical Society.

Northern Abyssinia.—The efforts of our German contemporaries to complete our acquaintance with Northern Abyssinia and the adjacent countries (of which mention was made in a note to my last year's Address), have been most successful; and every geographer must have heartily commended the researches of Von Heuglin, Kinzelbach, Munzinger, and Steudner. Whilst these travellers have prepared an excellent detailed map of the districts of Bogos, Manesa, and Murea, with the surrounding tracts, a more extended map, ranging from the Red Sea on the east to $34^{\circ} 45'$ E. longitude, which has resulted from their surveys, is a work of great and general interest. For, in it, we find the routes laid down of all the travellers of various countries during the last quarter of a century, who have examined the regions between Massáwa and the coast of the Red Sea on the east, and the river Atbara, that great affluent of the Nile, on the west. This sheet, as published in the 'Mittheilungen' of Petermann, is an excellent example of the amount of knowledge which can be conveyed on a map alone; the successive journeys of the different travellers being laid down in different colours with border profiles showing the relative heights of the different countries traversed.

* I have just had the gratification to learn that, with a due appreciation of the devoted and zealous researches in Central Africa of that accomplished young traveller Edward Vogel, who was barbarously beheaded by the King of Wadai, Earl Russell has granted the sum of 500*l.* to Miss Julia Vogel, the sister of the deceased. In thanking me warmly for supporting her cause, this lady assures me that, by this generous act, all her prospects in life are brightened, and that her heart's desire will now be fulfilled in being enabled to do honour to the memory of her lamented brother, as well as, she says, "to assist a younger brother in those studies which may enable him to serve a country to which she will ever cling with the deepest gratitude."—24 June, R. I. M.

The Niger.—The last accounts I have seen of the labours of Dr. Baikie are contained in a private letter to a relative, dated at Lukoja, on the 9th October, 1863. This persevering and praiseworthy envoy of our Government, who has been seven years in Africa and in whose appointment I took much interest, had, it appears, made up his mind to come home last year, when he received instructions to remain at his post till further orders.* In braving the dangers of the climate, Dr. Baikie has shown how a British settlement can be made a centre of civilization. Alone, and almost without means, he has contracted friendships with all the leading chiefs of Soudan, and has awed tribes merely by the exercise of moral influence, whilst his messengers can now travel securely from his station to Bonny.

It is by such an example and such persevering conduct that Africa can be best civilized; and we must earnestly hope that whoever may succeed Dr. Baikie, will follow the same kind, judicious, and forbearing conduct which has endeared him to the natives, and has enabled him to make his little station, so far up the Niger, a centre of commerce and friendly intercourse with them.

The Gaboon Country.—Although the progress of the recent expedition of M. du Chaillu to the scene of his former explorations has been unluckily checked by the loss of his scientific instruments, I trust that when he receives the fresh supply sent out to him by us, he will make a successful examination of the interior in those latitudes. He has, indeed, already sent home instruments, including the native harp with strings of vegetable fibre, which prove the truthfulness of some of his descriptions which had been unjustly discredited. As regards his previous accounts of the geography of the Gaboon country, M. du Chaillu's accuracy, in the main, has been amply confirmed by Lieuts. Serval and Du Bellay, who have since made surveys in the interior.†

South Africa.—*Explorations of the Baron C. von der Decken.*—*The unchanged terrestrial condition of the ancient Surface of the Interior of South Africa.*—*Project of rendering the White Nile the highway of intercourse between Central Africa and Europe.*—*Petherick's Journal.*—Whilst our last Session closed with the striking results of the journey of Speke and Grant, and our warm welcome of the undaunted travellers, who, for

* As this Address is printing, Mr. Layard informs me that the *Investigator* steamer has been ordered to bring Dr. Baikie down the Niger, and that he may be expected home this year.

† Vide Petermann's 'Mittheilungen,' December, 1863. Messrs. Serval and Du Bellay have discovered a new and broad river, the Ogowai, flowing from the interior, about 20 leagues to the south of the Gaboon.

the first time in history, had crossed Equatorial Africa and had also descended along the course of the great White Nile from its water-basin to its mouth, the opening of this Session was marked by the interesting and detailed description of the snow-clad mountain Kilimandjaro, the issue of two expeditions conducted entirely at his own cost by Baron C. von der Decken.

In the first of these, he was accompanied by my clever and lamented young friend, the late Mr. Richard Thornton, who drew the first contoured map of that wild and lofty country, took many observations of latitude and longitude, and kept an accurate diary. Copies of all his writings, as well as his original map, have now been sent by his family to the Royal Geographical Society.* In the second expedition, Baron von der Decken had for his scientific companion a German astronomer, Dr. Kärsten.

I have already adverted at some length to the importance of this enterprise, as recorded in our 'Proceedings,' and also in the award of the Medal. I have informed you that, in reference to the prosecution of other enterprises by the same distinguished person, the First Lord of the Admiralty had given directions that Her Majesty's vessels on the coast of Africa should assist the Baron in passing his own steamer into one of the rivers of Formosa Bay; and I have now to state that Her Majesty's Secretary for Foreign Affairs has strongly recommended this enterprising traveller to the good-will of the Sultan of Zanzibar, through the British Consul at that place. Seeing that Baron von der Decken, who has already done so much, is organising at considerable expense another expedition, in which, providing himself with an iron river-steamer, he will be attended by competent observers, we naturally wish him all the success which his zeal and devotion to our cause merit.

If, after ascending one of the rivers which fall into the Bay of Formosa, he should reach Mount Kenia or any part of that mountainous region of Eastern Africa, north of the Kilimandjaro, probably a great watershed, and should thence descend by any eastern affluent of the White Nile, or should reach Egypt by the Blue Nile, in either case he will have performed a most essential service to geography. In the mean time, both for the great and good duties he has already performed, and for the extensive and vigorous preparations he is now making to enlarge our acquaintance with the geography of Africa, the Council has in my opinion wisely adjudicated a Gold Medal to Baron C. von der Decken.

* See my observations on the late Richard Thornton in the Obituary, p. 184.

Our Victoria Medal has, with great propriety, been awarded to the gallant Captain Grant,* the companion of Speke, to mark, as I have said, emphatically and once more, our sense of the vast importance of their journey across Equatorial Eastern Africa, and the region of the head waters of the Nile. By their researches the watershed between North and South Africa was first established in respect to the Eastern Equatorial region. The results which ought to follow from these discoveries will be further considered in the sequel.

In former Addresses I suggested that the interior mass and central portions of Africa constituting a great plateau occupied by lakes and marshes, from which the waters escaped by cracks or depressions in the subtending older rocks, had been in that condition during an enormously long period. I have recently been enabled, through the apposite discovery of Dr. Kirk, the companion of Livingstone, not only to fortify my conjecture of 1852, but greatly to extend the inferences concerning the long period of time during which the central parts of Africa have remained in their present condition, save their degradation by ordinary atmospheric agencies. My view, as given to this Society in 1852, was mainly founded on the original and admirable geological researches of Mr. Bain in the colony of the Cape of Good Hope. It was, that, inasmuch as in the secondary or mesozoic age of geologists, the northern interior of that country was occupied by great lakes and marshes, as proved by the fossil reptile discovered by Bain, and named *Dicynodon* by Owen, such it has remained for countless ages, even up to the present day. The succeeding journeys into the interior, of Livingstone, Thornton, and Kirk, Burton and Speke, and Speke and Grant, have all tended to strengthen me in the belief that Southern Africa has not undergone any of those great submarine depressions which have so largely affected Europe, Asia, and America, during the secondary, tertiary, and *quasi* modern periods.

The discovery of Dr. Kirk has confirmed my conclusion. On the banks of an affluent of the Zambesi, that gentleman collected certain bones, apparently carried down in watery drifts from inland positions, which remains have been so fossilized as to have all the appearance of antiquity which fossils of a tertiary or older age usually present. One of these is a portion of the vertebral column and sacrum of a buffalo, undistinguishable from that of the Cape buffalo; another is a fragment of a crocodile, and another of a

* See 'Presentation of Royal Awards,' *ante*.

water-tortoise, both undistinguishable from the forms of those animals now living. Together with these, Dr. Kirk found numerous bones of antelopes and other animals, which, though in a fossil condition, all belonged, as he assured me, to species now living in South Africa.

On the other hand, none of our explorers, including M. Bain, who has diligently worked as a geologist, have detected in the interior any limestones containing marine fossil remains, which would have proved that South Africa had, like other regions, been depressed into oceanic conditions, and re-elevated. On the contrary, in addition to old granitic and other igneous rocks, all explorers find only either innumerable undulations of sandstones, schistose, and quartzose rocks, or such tufaceous and ferruginous deposits as would naturally occur in countries long occupied by lakes and exuberant jungles, separated from each other by sandy hills,—scarcely any other calcareous rocks being found except tufas formed by the deposition of land-springs. It is true that there are marine tertiary formations on the coasts (around the Cape Colony, near the mouth of the Zambesi opposite Mozambique, and again on the coasts of Mombas opposite Zanzibar), and that these have been raised up into low-coast ranges, followed by rocks of igneous origin. But in penetrating into the true interior, the traveller takes a final leave of all such formations; and in advancing to the heart of the continent, he traverses a vast region which, to all appearance, has ever been under terrestrial and lacustrine conditions only. Judging, indeed, from all the evidences as yet collected, the interior of South Africa has remained in that condition since the period of the secondary rocks of geologists! Yet, whilst none of our countrymen found any evidences of old marine remains, Captain Speke brought from one of the ridges which lay between the coast and the lake Victoria Nyanza a fossil shell, which, though larger in size, is undistinguishable from the *Achatina perdix* now flourishing in South Africa. Again, whilst Bain found fossil plants in his reptiliferous strata north of the Cape, and Livingstone and Thornton discovered coal in sandstone, with fossil plants, like those of our old coal of Europe and America,—yet both these mesozoic and palæozoic remains are terrestrial, and are not associated with marine limestones, indicative of those oscillations of the land which are so common in other countries.

It is further to be observed that the surface of this vast interior is entirely exempt from the coarse superficial drift that encumbers

so many countries, as derived from lofty mountain-chains from which either glaciers or great torrential streams have descended. In this respect it is also equally unlike those plains of Germany, Poland, and Northern Russia, which were sea-bottoms when floating icebergs melted and dropped the loads of stone which they were transporting from Scandinavia and Lapland.

In truth, therefore, the inner portion of Southern Africa is, in this respect, as far as I know, geologically unique in the long conservation of ancient terrestrial conditions. This inference is further supported by the concomitant absence, throughout the larger portion of all this vast area, *i.e.* south of the Equator, of any of those volcanic rocks which are so often associated with oscillations of the *terra firma*.*

With the exception of the true volcanic hills of the Cameroons recently described by Burton, on the west coast, a little to the north of the Equator, and which possibly may advance southwards towards the Gaboon country, nothing is known of the presence of any similar foci of sub-aërial eruption all round the coasts of Africa south of the Equator. If the elements for the production of them had existed, the coast-line is precisely that on which we should expect to find such volcanic vents, if we judge by the analogy of all volcanic regions where the habitual igneous eruptions are not distant from the sea or from great internal masses of water. The absence, then, both on the coasts and in the interior, of any eruptive rocks which can have been thrown up under the atmosphere since the period when the tertiary rocks began to be accumulated, is in concurrence with all the physical data as yet got together. These demonstrate that, although the geologist finds here none of those characters of lithological structure and curiously diversified organic remains, which enable him to fix the epochs of succession in the crust of the earth in other quarters of the globe, the interior of South Africa is unquestionably a grand type of a region which has preserved its ancient terrestrial conditions during a very long period, unaffected by any changes except those which are dependent on atmospheric and meteoric influences.

If, then, the lower animals and plants of this vast country have gone on unchanged for a very long period, may we infer that its human inhabitants are of like antiquity? If so, the Negro may claim as old a lineage as the Caucasian or Mongolian races. In the absence of any decisive fact, I forbear at present to speculate on

* Although Kilimandjaro is to a great extent igneous and volcanic, there is nothing to prove that it has been in activity during the historic era.

this point; but as, amid the fossil specimens procured by Livingstone and Kirk, there are fragments of pottery made by human hands, we must wait until some zealous explorer of Southern Africa shall distinctly bring forward proofs that the manufactured articles are of the same age as the fossil bones. In other words, we still require from Africa the same proofs of the existence of links which bind together the sciences of Geology and Archæology which have recently been developed in Europe. Now, if the unquestioned works of man should be found to be coeval with the remains of fossilized existing animals in Southern Africa, the travelled geographer, who has convinced himself of the ancient condition of its surface, must admit, however unwillingly, that although the black man is of such very remote antiquity, he has been very stationary in civilization and in attaining the arts of life, if he be compared with the Caucasian, the Mongolian, the Red Indian of America, or even with the aborigines of Polynesia.*

The discovery of that vast water-basin, the Victoria Nyanza, in the heart of Equatorial Africa, and the proof that a great stream flowed out from its northern extremity, which Speke and Grant followed, and showed almost conclusively to be the White Nile, was truly, as I said last year, a grand feat, of which all our countrymen had reason to be proud. But, in warmly praising and honouring the men who accomplished it, we are not yet satisfied, as geographers, with this their single line of march, and the valuable data which they fixed. We look naturally to other efforts which must be made to dispel scepticism regarding the upper waters of the Nile, including that raised by the claim of the Venetian traveller Miani, as to his having continuously ascended a river to $2\frac{1}{2}^{\circ}$ to the s.s.w. of Gondokoro, the rocky banks of which he has laid upon a sketch-map, and which he contends does not flow from the Victoria Nyanza. But irrespective of such a claim, the Council of our Society have, on general grounds, come to the conclusion that the physical geography of all the region, together with the shores of the Victoria Nyanza (a lake laid down by Speke as larger than Scotland), should be further explored, and the nature and extent of the various affluents of that vast body of water determined. They further wish to see examined the region lying between the great lake Luta-Nzige, north of the Equator, and the lake Tanganyika, south of it, in order to deter-

* The most remarkable proof of the inferiority of the negro, when compared with the Asiatic, is, that whilst the latter has domesticated the elephant for ages and rendered it highly useful to man, the negro has only slaughtered the animal to obtain food or ivory.

mine if there be not there (as some geographers think possible) other sources of supply for the White Nile, coming from the region to the west of the Victoria Nyanza; and finally, that, if possible, the Upper White Nile of Speke and Grant should be traced continuously from the lake to that point, where, according to their map, it is made to join the end of the lake Luta-Nzige.

Having considered this subject, the Council has adopted my proposal, to assist in fitting out an expedition to clear away all such obscurities, by ascending the White Nile, and not, as previously, by any efforts from Zanzibar and the eastern coast of Africa. The difficulties encountered by Speke and Grant in passing through that tract, and the apparent impossibility of establishing any regular traffic between the east coast and the central kingdoms, have induced us to prefer to any other line of research an effort to render the Great White Nile a channel of intercourse and commerce between the prolific interior and the traders of the Mediterranean Sea. One serious difficulty only exists in bringing about this desirable consummation. Between Khartûm, the present southern boundary of Egypt, and Gondokoro no obstacle on the river-navigation exists, as recently proved, indeed, by the voyage of the enterprising and intelligent Dutch ladies, though the natives in the interior have, it appears, been to a great extent demoralised by the conduct of the traders in ivory, who, arming one set of villagers against another, are said to plunder tribes, and carry away the women and children as slaves. Now, these horrible practices having been still more ruthlessly carried into effect above or south of Gondokoro, as we learn from the testimony of Speke and Grant, a belt of country, from 100 to 200 miles in breadth, inhabited by the Bari, has been rendered so lawless and savage, that it was with the utmost difficulty our medallists traversed it in their way northwards from the fertile kingdoms of Karagwe, Uganda, and Unyoro.

On the part of the Society, therefore, the Council have drawn up a memorandum, in which, after enumerating the desiderata, commercial, philanthropical, and geographical, involved in our project, we express the hope, that, as we are ready to embark 1000*l.* in such an expedition, some means may be found to put a stop to this demoralising trade in slaves, which, as our Consul-General in Cairo, Mr. Colquhoun, writes to me, is accompanied by horrors of which no one can form an idea. We believe that this can best be accomplished by the exertions of the Pasha of Egypt, and by the extension of his influence southwards from Khartûm to Gondokoro: The in-

termediate country is a sort of No-man's-land, in which numerous warring small tribes are kept in an excited and barbarous state by an extensive importation of firearms. Now, if the miserable natives were rescued from disorders occasioned by such enormities, legitimate commerce would eventually arise between the Equatorial kings and the merchants of Cairo and the Mediterranean; and the Great Nile, which for thousands of years has alone served to enrich the soil of Lower Egypt, would eventually become a highway of intercourse with Europe, which might largely tend to the civilisation of Central Africa. To have made the first proposal in a matter of such permanent interest will, I trust, be always counted a proof of the lofty as well as useful efforts of this Society, to bring about a state of things which will prove the real importance of the discovery recently made in Inner Africa by British geographers, and may render the White Nile, for the first time in history, of real use to commerce and civilisation.

The practical geographer will, I trust, find in the observations made by Mr. Petherick and his associate, Dr. Murie, which have at length reached the Society, some materials for the construction of improved maps of the large region on that portion of the west bank of the White Nile which is watered by the Bahr-el-Ghazal. We are also indebted to Mr. Petherick for a measurement of the comparative volume of water discharged by the Nile and its affluents, the Bahr el Ghazal and the Sobat. When measurements such as these shall have been repeated at different periods of the year, we shall be in a far better position to estimate the relative importance of the tributaries and parent stream of the Nile.

In the commencement of this Session I adverted to a feeling letter written to me by Mrs. Petherick, the wife of the traveller, and explaining how he had been cast down by misfortunes and severe illness, and was unable then to send home the accounts of his expedition. These documents having arrived, will soon be printed and circulated among the Fellows, who, seeing the amount of work accomplished by Mr. Petherick, will be able to estimate to what extent the disasters he encountered prevented his fulfilling the engagements he had entered into with the view of succouring Speke and Grant.

We now wait with deep anxiety for accounts of the ultimate issue of the journey made by the adventurous Dutch ladies and their scientific companion Baron von Heuglin, and their exploration

of the great western affluents of the White Nile.* We are also equally anxious to have some account of the travels of that undaunted, generous, and self-sacrificing explorer, Mr. Samuel Baker, of whom we have heard no tidings for a year.

Conclusion.—In terminating these observations on the results of geographical explorations in various countries, I must, on the grand subject of African geography, as on the previous occasion, decline to enter upon an analysis of the respective writings, of great value in critical geography, which have in past years been contributed by our own countrymen, by continental writers, as well as by the Portuguese authorities who preceded them. An analytical sketch, which would do justice to the scholars who have from time to time set forth the results of their researches, is much wanted. In this way, for example, we might trace the amount and increase of information published by Cooley, first anonymously, in articles of the ‘Edinburgh Review,’ commencing in 1835, and followed up by him in the construction of a map delineating his view of a line of lakes and rivers proceeding from N.N.W. to S.S.E. through Southern Africa.

In like manner I have not, in anything I said last year, done the justice I wished to our Abyssinian Medallist, Dr. Beke, for his ingenious suggestion as to the region wherein the head-waters of the Nile would be found, and his bold hypothesis, of 1848, respecting the mountain-chains of Africa, which opened out an original view of the physical geography of Africa north of the Equator. The analyses of such subjects as these, and of all the labours of Macqueen, Arrow-smith, Petermann,† and other practical geographers, require much more time and power of research than I possess. Unable to cope with them myself, I hoped that, in taking leave of you at this Anniversary, I might be succeeded by one whose scholarship and powers as a comparative geographer would enable him to describe the

* Since this Address was read, I learn with deep sorrow that Madame Tinné and two of her European attendants have died. Her enterprising daughter, Baron von Heuglin, and Baron D'Ablaing, had, however, reached Khartûm. As Baron von Heuglin is in regular correspondence with M. Petermann, we may look to the ‘Mittheilungen’ of our correspondent for much interesting matter respecting the exploration of the region of the Bahr-el-Ghazal. In a letter to Capt. Speke, which I have read, Baron von Heuglin speaks of the ivory and slave dealing merchants, and, in addition to much important knowledge respecting the fauna and flora of the Bahr-el-Ghazal, informs us that he has prepared a map of that region, as also of the country of Nyam Nyam.

† The various researches of late years in Africa are admirably illustrated by the series of maps and accompanying descriptions in the ‘Mittheilungen’ of Petermann, of which I gave an account in my last year's Address, and which have since been completed.

successive steps made by all contributors to our science, and, by a comparison of their labours with those of their predecessors, to trace down throughout the long current of ages the additions which have been made, in Asiatic as well as African geography, by various men, to that vast emporium of geographical knowledge which we now enjoy.

As on this head, doubtless, there have been many omissions on my part, I beseech my friends to be assured that such omissions have not been caused by any want of good will, but simply from an inability to do justice to the theme amidst the many other avocations which occupy my time.*

One task, however, I will try to accomplish, to the best of my ability, if my tenure of life be prolonged, and that you should place me for the current year in this Chair. I will endeavour at our next Anniversary to draw a parallel between the general state of geography when this Society was founded, in 1830, and the condition which it has reached in the present day; and, in doing this, I hope to demonstrate that my countrymen have borne no small share in this progress, and that the Royal Geographical Society has taken the lead in efficiently promoting this great work of advancement,—not merely by the publication of the volumes of our Journal and our Proceedings, but by zealously encouraging explorations, and by rewarding those persons, to whatever nation they belonged, who have thrown light on the geography of the world.

P.S.—Whilst this Address is going through the press, letters from Dr. Livingstone have reached me, giving an account of his journey into the interior, on the west bank of the Shiré, and for nearly 700 English miles to the N.N.W. of that river. Owing to his being obliged to return to settle the affairs of his Consulate and to convey H.M. *Pioneer* steamer down the Zambesi, he was unable personally to determine the question whether any waters flow into the head of the great Lake Nyassa (coming, as had been suggested, from Lake Tanganyika).† The natives, however, one and all, denied that any waters entered the lake from the north, and Livingstone seems

* Some of the discussions which have been going on between Mr. Cooley and Capt. Burton, and others, can only be correctly understood by etymologists who have studied the African languages and dialects.

† As far as it was examined and laid down on a map by Dr. Kirk, the Lake Nyassa trends due South and North.

to think that the lateral affluents which he saw are sufficient to account for the infilling of the lake and the supply of the Shiré.

The one point on which Livingstone and all African travellers are agreed is, that where no traders in slaves and ivory are met with, there no difficulty occurs in passing through the country; the inhabitants willingly serving as porters. In a recent letter to Captain Speke, which I have already mentioned, Baron von Heuglin, after affirming that the ivory dealers in the Bahr-el-Ghazal are barbarising all that fine region, and have rendered it impassable, exclaims that it is a disgrace to civilised governments not to endeavour to put an end to these horrors. Let us hope that the aspirations of our Council, in unison with the prayers of all travellers, may have a due influence on the governments of Europe and Egypt, and thus eventually render the White Nile useful as a highway of commerce.

June 10th, 1864.
