

find the following mention of the west face of the Wellhorn: 'In front of us rose the singularly fine peak of the Wellhorn, which is, I think, one of the few summits of the Alps that are totally inaccessible. I never saw rocks so perfectly and hopelessly smooth, and it would be totally impossible for any human being to find hold for hand or foot on them. I have, indeed, seen nothing at all like them in any other part of the Alps.'

A footnote adds, 'The Wellhorn was ascended by Herr von Fellenberg in 1866.' Professor Kennedy says in a further note that the party 'climbed the mountain by its eastern ridge, which was found to be "good going" once the difficulties of reaching it had been surmounted. The actual face referred to by Moore has not, of course, been climbed.'

This last sentence will, I trust, be regarded as sufficient justification for my having written this account of the first passage of the west face of the Wellhorn.

ON MOUNTAINS AND MANKIND.

An Address delivered to the British Association at Cambridge.

By DOUGLAS W. FRESHFIELD,
*President of the Geographical Section.**

WE have all of us seen hills, or what we call hills, from the monstrous protuberances of the Andes and the Himalaya to such puny pimples as lie about the edges of the Cambridge fens. Next to a waterfall, the first natural object (according to my own experience) to impress itself on a child's mind is a hill, some spot from which he can enlarge his horizon. Hills, and still more mountains, attract the human imagination and curiosity. The child soon asks, 'Tell me, how were mountains made?' a question, easier to ask than to answer, which occupied the lifetime of the father of mountain science, De Saussure. But there are mountains and mountains. Of all natural objects the most impressive is a vast snowy peak rising as a white island above the waves of green hills—a fragment of the arctic world left behind to commemorate its past predominance—and bearing on its broad shoulders a garland of the Alpine flora that has been destroyed on the lower ground by the rising tide of heat and drought that succeeded the last glacial epoch. Midsummer

* The preliminary portion of Mr. Freshfield's address, dealing with general geographical progress, is omitted.

snows, whether seen from the slopes of the Jura or the plains of Lombardy, above the waves of the Euxine or through the glades of the tropical forests of Sikhim, stir men's imaginations and rouse their curiosity. Before, however, we turn to consider some of the physical aspects of mountains, I shall venture, speaking as I am here in a university town, and to a more or less literary audience, to dwell for a few minutes on their place in literature—in the mirror that reflects in turn the mind of the passing ages. For geography is concerned with the interaction between man and Nature in its widest sense. There has been recently a good deal of writing on this subject—I cannot say of discussion, for of late years writers have generally taken the same view. That view is that the love of mountains is an invention of the nineteenth century, and that in previous ages they had been generally looked on either with indifference or positive dislike, rising in some instances to abhorrence. Extreme examples have been repeatedly quoted. We have all heard of the bishop who thought the devil was allowed to put in mountains after the fall of man; of the English scribe in the tenth century who invoked 'the bitter blasts of glaciers and the Pennine host of demons' on the violators of the charters he was employed to draft. The examples on the other side have been comparatively neglected. It seems time they were insisted on.

The view I hold firmly, and which I wish to place before you to-day, is that this popular belief that the love of mountains is a taste, or, as some would say, a mania, of advanced civilisation, is erroneous. On the contrary, I allege it to be a healthy, primitive, and almost universal human instinct. I think I can indicate how and why the opposite belief has been fostered by eminent writers. They have taken too narrow a time-limit for their investigation. They have compared the nineteenth century, not with the preceding ages, but with the eighteenth. They have also taken too narrow a space-limit. They have hardly cast their eyes beyond Western Europe. Within their own limits I agree with them. The eighteenth century was, as we all know, an age of formality. It was the age of Palladian porticos, of interminable avenues, of formal gardens and formal style in art, in literature, and in dress. Mountains, which are essentially romantic and Gothic, were naturally distasteful to it. The artist says 'they will not compose,' and they became obnoxious to a generation that adored composition, that thought more of the cleverness of the artist than of the aspects of Nature he used as the material of his work. It

was a contented and material century, little stirred by enthusiasms and aspirations and vague desires. There is a great deal to be said for it; it produced some admirable results. It was a phase in human progress, but in many respects it was rather a reaction than a development from what had gone before. Sentiment and taste have their tides like the sea, or, we may here perhaps more appropriately say, their oscillations like the glaciers. The imagination of primitive man abhors a void; it peoples the regions it finds uninhabitable with æry sprites, with 'Pan and father Sylvanus and the sister nymphs;' it worships on high places and reveres them as the abode of Deity. Christianity came and denounced the vague symbolism and personification of Nature in which the pagan had recognised and worshipped the Unseen. It found the objects of its devotion, not in the external world, but in the highest moral qualities of man. Delphi heard the cry, 'Great Pan is dead!' But the voice was false. Pan is immortal. Every villager justifies etymology by remaining more or less of a pagan. Other than villagers have done the same. The monk driven out of the world by his wickedness fell in love with the wilderness in which he sought refuge, and soon learnt to give practical proof of his love of scenery in his choice of sites for his religious houses. But the literature of the eighteenth century was not written by monks or country folk, or by men of world-wide curiosity and adventure like the Italians of the Renaissance or our Elizabethans. It was the product of a practical common-sense epoch which looked on all waste places, heaths like Hindhead, or hills like the Highlands, as blemishes in the scheme of the universe, not having yet recognised their final purpose as golf-links or gymnasiums. Intellectual life was concentrated in cities and courts; it despised the country. Books were written by townsmen, dwellers in towns which had not grown into vast cities, and whose denizens, therefore, had not the longing to escape from their homes into purer air that we have to-day. They abused the Alps frankly. But all they saw of them was the comparatively dull carriage passes, and these they saw at the worst time of year. Hastening to Rome for Easter, they traversed the Maurienne while the ground was still brown with frost and patched untidily with half-melted snowdrifts. It is no wonder that Gray and Richardson, having left spring in the meadows and orchards of Chambéry, grumbled at the wintry aspect of Lanslebourg.

That at the end of the eighteenth century a literary lady

of Western Europe preferred a Paris gutter to the Lake of Geneva is an amusing caricature of the spirit of the age that was passing away, but it is no proof that the love of mountains is a new mania, and that all earlier ages and peoples looked on them with indifference or dislike. Wordsworth and Byron and Scott in this country, Rousseau and Goethe, De Saussure and his school abroad, broke the ice, but it was the ice of a winter frost, not of a glacial period.*

Consider for a moment the literature of the two peoples who have most influenced European thought—the Jews and the Greeks. I need hardly quote a book that before people quarrelled over education was known to every child—the Bible. I would rather refer you to a delightful poem in rhyming German verse written in the seventeenth century by a Swiss author, Rebman, in which he relates all the great things that happened on mountains in Jewish history; how Solomon appreciated the charms of Lebanon; how Moses and Elias both disappeared on mountain-tops; how kings and prophets found their help among the hills; how closely the heights of Palestine are connected with the story of the Gospels.

Consider, again, Greece, where I have just been wandering. Did the Greeks pay no regard to their mountains? They seized eagerly on any striking piece of hill scenery and connected it with a legend or a shrine. They took their highest mountain, broad-backed Olympus, for the home of the gods; their most conspicuous mountain, Parnassus, for the home of poetry. They found in the cliffs of Delphi a dwelling for their greatest oracle and a centre for their patriotism. One who has lately stood on the top of Parnassus and seen the first rays of the sun as it springs from the waves of the *Ægean* strike its snows, while Attica and Bœotia and Eubœa still lay in deep shadow under his feet, will appreciate the famous lines of Sophocles, which I will not quote, as I am uncertain how you may pronounce Greek in this university. You may remember, too, that Lucian makes Hermes take Charon, when he has a day out from Hell, to the twin-crested summit and show him the panorama of land and sea, of rivers and famous cities. The Vale of Tempe, the deep gap between Olympus and Ossa, beautiful in its great red cliffs, fountains, and spreading plane-trees, was part of a Roman's

* Even in the eighteenth century a great deal of interest was taken in mountain phenomena. M. le Baron de Zurlauben's splendid work, '*Tableaux de la Suisse*,' published in 1781, has numerous plates illustrating glaciers, and its index contains nearly three long columns of references to them.

classical tour. The superb buttresses in which Taygetus breaks down on the valley of the Eurotas were used by the Spartans for other purposes besides the disposal of criminals and weakly babies. The middle regions—the lawns above the Langada Pass, ‘*virginibus bacchata Lacænis Taygeta*’—are frequented to this day as a summer resort by Spartan damsels. The very top, the great rock that from a height of 8,000 ft. looks down through its woods of oaks and Aleppo pines on the twin bays of the southern sea, is a place of immemorial pilgrimage. It is now occupied by a chapel framed in a tiny court, so choked with snow at the beginning of June that I took the ridge of the chapel roof for a dilapidated stoneman. I have no time to-day to look for evidence in classical literature, to refer to the discriminating epithets applied in it to mountain scenes.*

A third race destined apparently to play a great part in the world's history—the Japanese—are ancient mountain lovers. We are all aware that Fujiyama to the Japanese is (as Ararat to the Armenians) a national symbol; that its ascent is constantly made by bands of pilgrims; that it is depicted in every aspect. Those who have read the pleasant book of Mr. Weston, who, as English chaplain at Kobe for some years, had exceptional opportunities of travel in the interior, will remember how often he met with shrines and temples on the summits of the mountains, and how he found pilgrims who frequented them in the belief that they fell there more readily into spiritual trances. The Japanese Minister, when he attended Mr. Weston's lecture at the Alpine Club, told us that his countrymen never climbed mountains without a serious—that is to say, a religious—object.

India and China would add to my evidence had I knowledge and time enough to refer to their literature. I remember Tennyson pointing out to me in a volume of translations from the Chinese a poem, written about the date of King Alfred, in praise of a picture of a mountain landscape. But I must return to the sixteenth and seventeenth centuries in Europe; I may go earlier—even back to Dante. His allusions to mountain scenery are frequent; his Virgil had all the craft of an Alpine rock-climber. Read Leonardo da

* Cicero puts together a list of rural delights (*De Natura Deorum*, ii. 39): ‘*Fontium gelidas perennitates, liquores pellucidos amnium, riparum vestitus viridissimos, speluncarum concavas altitudines, saxorum asperitates, impendentium montium altitudines, immensitatesque camporum.*’ Apuleius, in his treatise *De Mundo*, arguing in favour of physiography, quotes as amongst the common objects of picturesque description in the second century, ‘*Nysæ juga, et penetralia Coryci, et Olympi sacra, et Ossæ ardua, et alia hujuscemodi.*’

Vinci's 'Notes,' Conrad Gesner's ascent of Pilatus; study the narratives of the Alpine precursors Mr. Coolidge has collected and annotated with admirable industry in the prodigious volume he has recently brought out.

It is impossible for me here to multiply proofs of my argument, to quote even a selection from the passages that show an authentic enthusiasm for mountains that may be culled from writers of various nations prior to A.D. 1600. I must content myself with the following specimens, which will probably be new to most of my hearers.

Benedict Marti was a professor of Greek and Hebrew at Bern, and a friend of the great Conrad Gesner (I call him great, for he combined the qualities of a man of science and a man of letters, was one of the fathers of botany as well as of mountaineering, and, in his many-sidedness, a typical figure of the Renaissance). Marti, in the year 1558 or 1559, wrote as follows of the view from his native city:—

'These are the mountains which form our pleasure and delight' (the Latin is better—*delicie nostræ, nostrique amores*) 'when we gaze at them from the higher parts of our city and admire their mighty peaks and broken crags that threaten to fall at any moment. Here we watch the risings and settings of the sun and seek signs of the weather. In them we find food not only for our eyes and our minds, but also for our bellies;' and he goes on to enumerate the dairy products of the Oberland and the happy life of its population. I quote again this good man: 'Who, then, would not admire, love, willingly visit, explore, and climb places of this sort? I assuredly should call those who are not attracted by them dolts, stupid dull fishes, and slow tortoises' (*fungos, stupidos insulsos pisces, lentosque chelones*). 'In truth, I cannot describe the degree of affection and natural love with which I am drawn to mountains, so that I am never happier than on the mountain crests, and there are no wanderings dearer to me than those on the mountains. . . . They are the theatre of the Lord, displaying monuments of past ages, such as precipices, rocks, peaks and chasms and never-melting glaciers;' and so on through many eloquent paragraphs.

I will only add two sentences from the preface to Simler's 'Vallesix et Alpium Descriptio,' first published in 1574, which seem to me a strong piece of evidence in favour of my view: 'In the entire district, and particularly in the very lofty ranges by which the Vallais is on all sides surrounded, wonders of Nature offer themselves to our view and admiration. With my countrymen many of them have through

familiarity lost their attraction; but foreigners are overcome at the mere sight of the Alps, and regard as marvels what we through habit pay no attention to.'

Mr. Coolidge, in his singularly interesting footnotes, goes on to show that the books that remain to us are not isolated instances of a feeling for mountains in the age of the Renaissance. The mountains themselves bear, or once bore, records even more impressive. Most of us have visited the picturesque old castle at Thun and seen beyond the rushing Aar the green heights of the outposts of the Alps, the Stock horn, and the Niesen. Our friend Marti, who climbed the former peak about 1558, records that he found on the summit 'tituli, rythmi, et proverbia saxis inscripta unà cum imaginibus et nominibus auctorum. Inter alia cujusdam docti et montium amœnitate capti observare licebat illud—

'Ο τῶν ὄρων ἔρως ἀριστος.'

'The love of mountains is best.' In those five words some Swiss professor anticipated the doctrine of Ruskin and the creed of Leslie Stephen, and of all men who have found mountains the best companions in life.

In the annals of art it would be easy to find additional proof of the attention paid by men to mountains three to four hundred years ago. The late Josiah Gilbert, in a charming but too little known volume 'Landscape in Art,' has shown how many great painters depicted in their backgrounds their native hills. Titian is the most conspicuous example.

It will perhaps be answered that this love of mountains led to no practical result, bore no visible fruit, and therefore can have been but a sickly plant. Some of my hearers may feel inclined to point out that it was left to the latter half of the nineteenth century to found Climbers' Clubs. It would take too long to adduce all the practical reasons which delayed the appearance of these fine fruits of peace and an advanced civilisation. I am content to remind you that the love of mountains and the desire to climb them are distinct tastes. They are often united, but their union is accidental, not essential. A passion for golf does not necessarily argue a love of levels. And I would suggest that more outward and visible signs than are generally imagined of the familiar relations between men and mountains in early times may be found. The choicest spots in the Alpine region—Chamonix, Engelberg, Disentis, Einsiedlen, Pesio, the Grande Chartreuse—were seized on by recluses; the Alpine Baths were in full swing at quite an early date. I will not count the Swiss

Baden, of which a geographer, who was also a Pope, Æneas Silvius (Pius II.), records the attractions, for it lies under the Jura, not the Alps; but Pfäfers, where wounded warriors went to be healed, was a scene of dissipation, and the waters of St. Moritz were vaunted as superseding wine. I may be excused, since I wrote this particular passage myself a good many years ago, for quoting a few sentences bearing on this point from 'Murray's Handbook to Switzerland.' In the sixteenth century fifty treatises dealing with twenty-one different resorts were published. St. Moritz, which had been brought into notice by Paracelsus (died 1541), was one of the most famous baths. In 1501 Matthew Schiner, the famous prince bishop of Sion, built 'a magnificent hotel' at Leukerbad, to which the wealthy were carried up in panniers on the back of mules. Brieg, Gurnigel, near Bern, the Baths of Masino, Tarasp, and Pfäfers were also popular in early times. Leonardo da Vinci mentions the Baths of Bormio, and Gesner went there.

It is not, however, with the emotional influences or the picturesque aspect of mountains that science concerns itself, but with their physical examination. If I have lingered too long on my preamble, I can only plead as an excuse that a love of one's subject is no bad qualification for dealing with it, and that it has tempted me to endeavour to show you grounds for believing that a love of mountains is no modern affectation, but a feeling as old and as widespread as humanity itself.

Their scientific investigation has naturally been of comparatively modern date. There are a few passages about the effects of altitude, there are orographical descriptions more or less accurate in the authors of antiquity. But for attempts to explain the origin of mountains, to investigate and account for the details of their structure, we shall find little before the notes of Leonardo da Vinci, that marvellous man who combined, perhaps, more than any one who has ever lived the artistic and the scientific mind. His ascent of Monte Boso, about 1511, a mountain which may be recognised under this name on the Italian ordnance map on the spur separating Val Sesia and the Biellese, was the first ascent by a physical observer. Gesner, with all his mountain enthusiasm, found a scientific interest in the Alps mainly, if not solely, in their botany.

The phenomenon which first drew men of science to Switzerland was the Grindelwald glaciers—'miracles of Nature' they called them. Why these glaciers in particular, you may ask, when there are so many in the Alps? The answer is

obvious. Snow and ice on the 'mountain-tops that freeze' are no miracle. But when two great tongues of ice were found thrusting themselves down among meadows and corn and cottages, upsetting barns and covering fields and even the marble quarries from which the citizens of Bern dug their mantelpieces, there was obviously something outside the ordinary processes of Nature, and therefore miraculous.

Swiss correspondents communicated to our own Royal Society the latest news as to the proceedings of these unnatural ice-monsters, while the wise men of Zürich and Bern wrote lectures on them. Glacier theories began. Early in the eighteenth century Hottinger, Cappeller, Scheuchzer, that worthy man who got members of our Royal Society to pay for his pictures of flying dragons, contributed their quota of crude speculation. But it was not till 1741 that Mont Blanc and its glaciers were first brought into notoriety by our countrymen, Poccocke and Windham, and became an attraction to the mind and an object to the ambition of the student whose name was destined to be associated with them. Horacé Benedict de Saussure, born of a scientific family, the nephew of Bonnet, the Genevese botanist and philosopher, who has become known to the world as a mountaineer and a climber of Mont Blanc, came twenty years later. In truth he was far more of a mountain traveller and a scientific observer, a geological student, than a climber. When looking at his purple silk frock-coat (carefully preserved in his family's country home on the shore of the Lake of Geneva), one realises the difference between the man who climbed Mont Blanc in that garment and the modern gymnast who thinks himself *par excellence* the mountaineer.

De Saussure did not confine his travels to Savoy or to one group; he wandered far and wide over the Alpine region, and the four volumes of his 'Voyages' contain, besides the narratives of his sojourn on the Col du Géant and ascent of Mont Blanc, a portion of the fruit of these wanderings.

The reader who would appreciate De Saussure's claim as the founder of the Scientific Exploration of Mountains must, however, be referred to the List of Agenda on questions calling for investigation placed at the end of his last volume. It explains the comparative indifference shown by De Saussure to the problems connected with glacial movement and action. His attention was absorbed in the larger question of earth-structure, of geology, to which the sections exposed by mountains offered, he thought, a key; he was bitten by the contemporary desire for 'A Theory of the Earth,' by the taste

of the time for generalisations for which the facts were not always ready. At the same time, his own intellect was perhaps somewhat deficient in the intuitive faculty: the grasp of the probable or possible bearing of known facts by which the greatest discoverers suggest theories first and prove them afterwards.

The school of De Saussure at Geneva died out after having produced Bourrit, the tourist who gloried in being called the Historian of the Alps, a man of pleasant self-conceit and warm enthusiasm, and De Luc, a mechanical inventor, who ended his life as reader to Queen Charlotte at Windsor, where he flits across Miss Burney's pages as the friend of Herschel at Slough and the jest of tipsy royal dukes. Oddly enough, the first sound guess as to glacier movement was made by one Bordier, who had no scientific pretensions. I reprinted many years ago the singular passage in which he compared glacier ice to 'cire amollie,' soft wax, 'flexible et ductile jusqu'à un certain point,' and described it as flowing in the manner of liquids.* He added this remarkable suggestion foreshadowing the investigations of Prof. Richter and M. Forel: 'It is very desirable that there should be at Chamonix some one capable of observing the glaciers for a series of years and comparing their advance and oscillations with meteorological records.' To the school of Geneva succeeded the school of Neuchatel, Desor, and Agassiz; the feat of De Saussure was rivalled on the Jungfrau and the Finsteraarhorn by the Meyers of Bern. They in turn were succeeded by the British school, Forbes and Tyndall, Reilly and Wills, in 1840-60.

In 1857 the Alpine Club was founded in this country. In the half-century since that date the nations of Western Europe have emulated one another in forming similar bodies, one of the objects of which has been to collect and set in order information as to the mountains, and to further their scientific as well as their geographical exploration.

What boulders, or rather pebbles, may we profitably add to the enormous moraine of modern Alpine literature—a moraine of which it is to be hoped for the sake of posterity that the torrent of time may speedily make away with some of the lighter portions?

For fifty years I have loved and at frequent intervals wandered and climbed in the Alps. I have had something of a grand passion for the Caucasus. I am on terms of visiting

* *Alpine Journal*, ix. 327.

acquaintance with the Pyrenees and the Himalaya, the Apennines and the Algerian Atlas, the mountains of Greece, Syria, Corsica, and Norway. I will try to set in order some observations and comparisons suggested by these various experiences.

As one travels east from the Atlantic through the four great ranges of the Old World the peaks grow not only in absolute height, but also in abruptness of form, and in elevation above the connecting ridges. The snow and ice region increases in a corresponding manner. The Pyrenees have few fine rockpeaks except the Pic du Midi d'Ossau; their chief glacier summits, the Vignemale, Mont Perdu, the Maladetta, correspond to the Titlis or the Buet in the Alps. The peaks of the Alps are infinite in their variety and admirable in their clear-cut outlines and graceful curves. But the central group of the Caucasus, that which culminates in Dykhtau, Koshtantau, and Shkara, 17,000-ft. summits (Koshtantau falls only 120 ft. below this figure), has even more stately peaks than those that cluster round Zermatt.

Seek the far eastern end of the Himalaya, visit Sikhim, and you will find the scale increased; Siniolchum, Jannu, and Kangchenjunga are all portentous giants. To put it at a low average figure, the cliffs of their final peaks are half as high again as those of Monte Rosa and the Matterhorn.

In all these chains you will find the same feature of watersheds or partings lying not in but behind the geological axis. This is the case in the Alps at the St. Gotthard, in the Caucasus for some 40 miles west of the Dariel pass, in the Himalaya, in Sikhim and Nepal, where the waters flowing from the Tibetan plateau slowly eat their way back behind Kangchenjunga and the Nepalese snows. The passes at their sources are found consequently to be of the mildest character: hills 'like Wiltshire downs' is the description given by a military explorer. It needs no great stretch of geological imagination to believe in the cutting back of the southern streams of Sikhim or the Alps, as, for instance, at the Maloya; but I confess that I cannot see how the gorges of Ossetia—clefs cut through the central axis of the Caucasus—can be ascribed mainly to the action of water.

I turn to the snow-and-ice region. Far more snow is deposited on the heights of the Central Caucasus and the Eastern Himalaya than on the Alps. It remains plastered on their precipices, forming hanging glaciers everywhere of the kind found on the northern, the Wengern Alp, face of the Jungfrau. Such a peak as the Weisshorn looks poor and

bare compared with Tetnuld in the Caucasus or Siniolchum in the Himalaya. The plastered sheets of snow between their great bosses of ice are perpetually melting; their surfaces are grooved, so as to suggest fluted armour, by tiny avalanches and runnels.

In the Aletsch glacier the Alps have a champion with which the Caucasus cannot compete; but, apart from this single exception, the Caucasian glaciers are superior to the Alpine in extent and picturesqueness. Their surfaces present the features familiar to us in the Alps—icefalls, moulins, and earthcones.

In Sikhim, on the contrary, the glaciers exhibit many novel features, due no doubt mainly to the great sun-heat. In the lower portion their surface is apt to be covered with the *débris* that has fallen from the impending cliffs, so that little or no ice is visible from a distance. In the region below the *névé* there are very few crevasses; the ice heaves itself along in huge and rude undulations, high gritty mounds, separated by hollows often occupied by yellow pools which are connected by streams running in little icy ravines—a region exceptionally tiresome, but in no way dangerous to the explorer. In steep places the Alpine icefall is replaced by a feature I may best compare with a series of earth-pillars such as are found near Evolena and elsewhere, and are figured in most textbooks. The ice is shaped into a multitude of thin ridges and spires, resembling somewhat the Nieves Penitentes of the Andes—though formed in a different material.

Great sun-heat acting on surfaces unequally protected, combined in the latter case with the strain of sudden descent, is no doubt the cause of these phenomena. Generally the peculiarities of the great glaciers of Kangchenjunga may be attributed to a fiercer sun, which renders the frozen material less liable to crack, less rigid, and more plastic.

A glacier, as a rule, involves a moraine. Now, moraines are largely formed from the material contributed by sub-aërial denudation—in plain words, by the action of heat and cold and moisture on the cliffs that border them. It is what falls on a glacier, not that which it falls over, that mainly makes a moraine. The proof is that the moraines of a great glacier which flows under no impending cliffs are puny compared with those of a little one that lies beneath great rockwalls.

Take, for example, the Norwegian glaciers of the Jostedal's Brae and compare them with the Swiss. The former, falling from a great *névé* plain or snowfield, from which hardly a crag protrudes, are models of cleanliness. I may cite as

examples the three fascinating glaciers of the Olden valley. The Rosenlauri glacier in Switzerland owed the purity which gave it a reputation fifty years ago, before its retirement from tourists' tracks, to a similar cause—its source in a vast snow-plateau, the Wetterkessel.

One peculiarity very noticeable both in the Himalaya and the Caucasus I have never found satisfactorily accounted for. I refer to the long grassy trenches lying between the lateral moraine and the mountain-slope, which often seem to the explorer to have been intended by Providence to form grass paths for his benefit. They may possibly be due to the action of torrents falling from the hillside, which, meeting the moraine and constantly sweeping along its base, undermine it and keep a passage open for themselves. There are remarkable specimens of this formation on both sides of the Bezingi glacier, in the Caucasus, and on the north side of the Zemu glacier in Sikhim.

Water is one of the greatest features in mountain scenery. In Norway it is omnipresent. In this respect Scandinavia is a region apart; the streams of the more southern ranges are scanty compared with those of a region where the snowfall of two-thirds of the year is discharged in a few weeks. Greece stands at the opposite pole. By what seems a strange perversity of Nature, its slender streams are apt to disappear underground, to reissue miles away in the great fountains that gave rise to so many legends. Arcadia is, for the most part, a dry upland, sadly wanting in the two elements of pastoral scenery, shady groves and running brooks.

The Alps are distinguished by their sub-alpine lakes—

‘Anne lacus tantos; te, Lari maxime, teque
Fluctibus et fremitu assurgens, Benace, marino?’

of Virgil. But perhaps even more interesting to the student are the lake-basins that have been filled up, and thus suggest how similar lakes may have vanished at the feet of other ranges.

I know no more striking walk to any one interested in the past doings of glaciers than that along the ridge of the mighty moraine of the old glacier of Val d'Aosta, which sweeps out, a hill 500 feet high, known as ‘La Serra,’ from the base of the Alps near Ivrea into the plain of Piedmont. Enclosed in its folds still lies the Lago di Viverone; but the Dora has long ago cut a gap in the rampart and drained the rest of the enclosed space, filling it up with the fluvial deposit of centuries.

It is, however, the tarns rather than the great lakes of the Alps which have been the chief subjects of scientific disputation. Their distribution is curious. They are found in great quantity in the Alps and Pyrenees, hardly at all in the Caucasus, and comparatively rarely in the part of the Himalaya I am acquainted with.

A large-scale map will show that where tarns are most thickly dotted over the uplands the peaks rise to no great height above the ridges that connect them. This would seem to indicate that there has been comparatively little sub-aërial denudation in these districts, and consequently less material has been brought down to fill the hollows. Again, it is in gneiss and granitic regions that we find tarns most abundant—that is, where the harder and more compact rocks make the work of streams in tapping the basins more lengthy. The rarity of tarns in the highlands behind Kangchenjunga, perhaps, calls for explanation. We came upon many basins, but, whether formed by moraines or true rock-basins, they had for the most part been filled up by alluvial deposits.

In my opinion, the presence of tarns must be taken as an indication that the portion of the range where they are found has until a comparatively recent date been under snow or ice. The former theory, still held, was that the ice scooped out their basins from the solid rock. I believe that it has simply kept scoured pre-existing basins. The ice removed and the surrounding slopes left bare, streams on the one hand have filled the basins with sediment, or, on the other, tapped them by cutting clefts in their rims. This theory meets, at any rate, all the facts I have observed, and I may point out that the actual process of the destruction of tarns by such action may be seen going on under our eyes in many places, notably in the glens of the Adamello group. Professor Garwood has lately employed his holidays in sounding many of the tarns of the St. Gotthard group, and his results, I understand, tend to corroborate the conclusions just stated.

I desire here to reaffirm my conviction that snow and ice in the High Alps are conservative agents; that they arrest the natural processes of sub-aërial denudation; that the scouring work done by the glacier is insignificant compared with the hewing and hacking of frost and running water on slopes exposed to the open sky without a roof of névé or glacier.

The contrast between the work of these two agents was forced upon me many years ago while looking at the ground from which the Eiger glacier had then recently retreated.

The rocks, it is true, had had their angles rubbed off by the glacier, but through their midst, cut as by a knife, was the deep slit or gash made by the sub-glacial torrent. There is in the Alps a particular type of gorge, found at Rosenlauri, at the Lower Grindelwald glacier, at the Kirchet above Meiringen, and also in the Caucasus, within the curves of old terminal moraines. It is obviously due to the action of the sub-glacial torrent, which cuts deeper and deeper, while the ice above protects the sides of the cutting from the action of the atmosphere.

One more note I have to make about glaciers. It has been stated that glaciers go on melting in winter. Water, no doubt, flows from under some of them, but that is not the same thing. In January the end of the Rosenlauri glacier is dry; you can jump across the clear stream that flows from the Lower Grindelwald glacier. That stream is not melting, but the issue of a spring which rises under the glacier and does not freeze. There is another such stream on the way to the Great Scheideck, which remains free when frost has fettered all its neighbours.

I should like to draw your attention before we leave glaciers to the systematic efforts that are being made on the Continent to extend our knowledge of their peculiarities. The subject has a literature of its own, and two societies—one in France, one in other countries—have been constituted to promote and systematise further investigations, especially with regard to the secular and annual oscillations of the ice. These were initiated by the English Alpine Club in 1893, while I was its president. Subsequently, through the exertions of the late Marshall Hall, an enthusiast on the subject, an International Commission of Glaciers was founded, which has been presided over by Dr. Richter, M. Forel, and others; and more recently a French Commission has been created with the object of studying in detail the glaciers of the French Alps. A number of excellent reports have been published, embodying information from all parts of the globe. There has been, and is, I regret to say, very great difficulty in obtaining any methodical reports from the British possessions oversea. The subject does not commend itself to the departmental mind. Let us hope for improvement: I signalise the need for it. Of course, it is by no means always an easy matter to get the required measurements of retreat or advance in the glacial snout, when the glacier is situated in a remote and only casually visited region. Still, with good will more might be done than has been. The periods of advance and retreat of glaciers appear

to correspond to a certain extent throughout the globe. The middle of the last century was the culmination of the last great advance. The general estimate of their duration appears to be half a century. The ice is now retreating in the Alps, the Caucasus, and the Himalaya, and I believe in North America. We live in a retrogressive period. The minor oscillation of advance which a few years ago gave hopes to those who, like myself, had as children seen the glaciers of Grindelwald and Chamonix at their greatest, has not been continued.

Attempts are made to connect the oscillations of glaciers with periods of sunspots. They are, of course, connected with the rain or snowfall in past seasons. But the difficulty of working out the connection is obvious.

The advance of the glacier will not begin until the snows falling in its upper basin have had time to descend as ice and become its snout; in each glacier this period will vary according to its length, bulk, and steepness, and the longer the glacier is, the slower its lower extremity will be to respond. Deficiency in snowfall will take effect after the same period. It will be necessary, therefore, to ascertain (as has been done in a tragic manner on Mont Blanc by the recovery in the lowest portion of the Glacier des Bossons of the bodies of those lost in its highest snow) the time each glacier takes to travel, and to apply this interval to the date of the year with which the statistics of deposition of moisture are to be compared. If the glacier shows anything about weather and climate, it is past, not contemporary, weather it indicates.

Another point in which the Asiatic ranges, and particularly the Himalaya, differ from the Alps is in the frequency of snow avalanches, earthfalls, and mud-slides. These are caused by the greater deposition of snow and the more sudden and violent alternations of heat and cold, which lead to the splitting of the hanging ice and snows by the freezing of the water in their pores. I have noticed at bivouacs that the moment of greatest cold—about the rising of the morning star—is often hailed by the reports of a volley of avalanches.

The botanist may find much to do in working out a comparison of the flora of my four ranges. I am no botanist: I value flowers according, not to their rarity, but to their abundance, from the artist's, not the collector's, point of view. But it is impossible not to take interest in such matters as the variations of the gentian in different regions, or the behaviour of such a plant as the little Edelweiss (once

the token of the Tyrolese lover, now the badge and bane of the Alp-trotter), which frequents the Alps, despises the Caucasus, reappears in masses in the Himalaya, and then, leaping all the isles of the tropics, turns up again under the snows of New Zealand. I may mention that it is a superstition that it grows only in dangerous places. I have often found it where cows can crop it; it covers acres in the Himalaya, and I believe it has been driven by cows off the Alpine pastures, as it is being driven by tourists out of the Alps altogether.

The Italian botanists, MM. Levier and Sommier, have given a vivid account of what they call the Makroflora of the Central Caucasus—those wild-flower beds, the product of sudden heat on a rich and sodden soil composed of the vegetable mould of ages, in which a man and horse may literally be lost to sight. Has any competent hand celebrated the Mikroflora of the highest ridges, those tiny, vivid forget-me-nots and gentians and ranunculuses that flourish on rock-island 'Jardins' like that of Mont Blanc, among the eternal snows, and enamel the highest rocks of the Basôdino and the Lombard Alps? A comprehensive work on a comparison of mountain flora and the distribution of Alpine plants throughout the ranges of the Old World would be welcome. We want another John Ball. Allied to botany is forestry, and the influence of trees on rainfall, and consequently the face of the mountains, a matter of great importance, which in this country has hardly had the attention it deserves.

From these brief suggestions as to some of the physical features of mountains I would ask you to turn your attention to the points in which mankind come in contact with them, and first of all to history.

I fancy that the general impression that they have served as efficient barriers is hardly in accordance with facts, at any rate from the military point of view. Many great captains—Hannibal, Hasdrubal, Cæsar, Charles the Great, and Napoleon—passed the Alps successfully. Hannibal, it is true, had some difficulty, but then he was handicapped with elephants. Many years ago I showed that Servius, the greatest authority in Rome in the days of Augustus, had no doubt as to where Hannibal crossed the Alps, and proved that it was not by any Aostan pass.* The Holy Roman emperors constantly moved forwards and backwards. Burgundy, as the late Mr. Freeman was never weary of insisting,

* See *Alpine Journal*, Nos. 81, 89; *P.R.G.S.*, October, 1886, and May, 1899.

lay across the Alps. So till our own day did the dominions of the House of Savoy. North Italy has been in frequent connection with Germany; it is only in my own time that the Alps have become a frontier between France and Italy. But questions of this kind might lead us too far. Let me suggest that some competent hand should compose a history of the Alpine passes and their famous passages, more complete than the treatises that have appeared in Germany. Mr. Coolidge, to whom we owe so much, has, in his monumental collection and reprint of early Alpine writers, just published, thrown great light on the extensive use of what I may call the by-passes of the Alps in early times. Will he not follow up his work by treating of the Great Passes? I may note that the result of the construction of carriage roads over some of them was to concentrate traffic; thus the Saas passes and the Gries were practically deserted for commercial purposes when Napoleon opened the Simplon. The roads over the Julier and Maloya ruined the Septimer. Another hint to those engaged in tracing ancient lines of communication. In primitive times, in the Caucasus to-day, the tendency of paths is to follow ridges, not valleys. The motives are on the spot obvious—to avoid torrents, swamps, ravines, earth-falls, and to get out of the thickets and above the timber-line. The most striking example is the entrance to the great basin of Suanetia, which runs not up its river, the Ingur, but across a ridge of over 9,000 feet, closed for eight months in the year to animals.

From the military point of view mountains are now receiving great attention in Central Europe. The French, the Italians, the Swiss, the Austrians have extensive Alpine manœuvres every summer, in which men, mules, and light artillery are conveyed or carried over rocks and snow. Officers are taught to use maps on the spot; the defects in the official surveys are brought to light. It is not likely, perhaps, except on the Indian frontier, that British troops will have to fight among high snowy ranges. But I feel sure that any intelligent officer who is allowed to attend such manœuvres might pick up valuable hints as to the best equipment for use in steep places. Probably the Japanese have already sent such an envoy and profited by his experience.

A word as to maps, in which I have taken great interest, may be allowed me. The ordnance maps of Europe have been made by soldiers, or under the supervision of soldiers. At home when I was young, it was dangerous to hint at any

defects in our ordnance sheets, for surveyors in this country are a somewhat sensitive class. Times have altered, and they are no longer averse from receiving hints and even help from unofficial quarters. Since the great surveys of Europe were executed, knowledge has increased, so that every country has had to revise or re-execute its surveys. In three points that concern us there was great room for improvement—the delineation of the upper region as a whole, and the definition of snow and glaciers in particular, and in the selection of local names. In the two former the Federal Staff at Bern has provided us with an incomparable model. The number of local names known to each peasant is small, his pronunciation is often obscure, and each valley is apt to have its own set of names for the ridges and gaps that form its skyline. Set a stranger, speaking another tongue than the local *patois*, to question a herdsman, and the result is likely to be unsatisfactory. It has often proved so. The Zardezan is an odd transcription of the Gias del Cian of *patois*, the Gite du Champ in French. Grand Paradis is probably a corruption of Granta Parei, an apt description of the great screen of rock and ice of the highest mountain in Italy, though that name is now given to a neighbouring peak. The Pointe de Rosablanc was formerly the Roesa Bianca, or white glacier. Monte Rosa herself, though the poet sees a reference to the rose of dawn, and the German professor detects ‘the Keltic *ros*, a promontory,’ is a simple translation of the Gletscher Mons of Simler, or rather Simler’s hybrid term is a translation of Monte della Roesa. Roesa, or Ruize, is the Val d’Aostan word for glacier, and may be found in De Saussure’s ‘Voyages.’

An important case in this matter of mountain nomenclature has recently come under discussion—that of the highest mountain in the world. Most, if not all, mountaineers regret that the name of a Surveyor-General, however eminent, was fifty years ago affixed to Mount Everest. The ground for this action on the part of the Survey was the lack of any native name. Some years ago I ventured to suggest that the 29,002-foot peak (No. XV. of the Survey) was probably visible from the neighbourhood of Katmandu, even though the identifications of it by Schlagintweit and others might be incorrect, and that since some at least of the summits of the snowy group east of that city are apparently known in Nepal as Gaurisankar, that name might, following the practice which gave its name to Monte Rosa in the Alps, legitimately be applied to the loftiest crest of the mountain group of which the Nepalese Gaurisankar formed a part.

Recently by the kindness of Lord Curzon, acting on a suggestion of my own, Captain Wood, a Survey officer, has been deputed to visit Katmandu and ascertain the facts. He has found that, contrary to the opinion of the late General Walker and the assertion of Major Waddell, Peak XV. is visible from the hills round the capital, and that the two highest snow-peaks visible from the city itself in the same direction are known to the Nepalese 'nobles' as Gaurisankar.*

These latter peaks or peak are about 36 miles distant from Peak XV., but are connected with it by a continuous line of glaciers. According to the principles that have prevailed in the division of the Alps, they would undoubtedly be considered as part of the same group, and the name, which, according to Captain Wood, is applied to a portion of the group, might legitimately be adopted for its loftiest peak.

But the chiefs of the Indian Survey take, as they are entitled to, a different view. They have decided to confine the name Gaurisankar to one of the peaks seen from Katmandu itself. I do not desire to raise any further protest against this decision. For since, in 1886, I first raised the question, its interest has become mainly academical. A local Tibetan name for Peak XV., Chomo-Kankar, the Lord of Snows, has been provided on excellent native authority, confirmed by that competent Tibetan scholar, Major (now Colonel) Waddell, and I trust this name may in the future be used for the highest mountain in the world. The point at issue is mainly one of taste. Indian surveyors may see no incongruity in naming after one of their own late chiefs the highest mountain in the world. But in this view they are, I believe, in a small minority.†

I would urge mountain explorers to attempt in more distant lands what the late Messrs. Adams-Reilly and Nichols, Mr. Tuckett, and Lieut. Payer (of Arctic fame) did forty years ago with so much success in the Alps, what the Swiss Alpine Club have done lately—to take a district, and working from the trigonometrically fixed points of a survey, where one exists,

* See 'Report on the Identification and Nomenclature of the Himalayan Peaks as seen from Katmandu, Nepal.' By Captain H. Wood, R.E., with Preface by Colonel St. G. Gore, C.S.I., R.E. Calcutta: 1904. 3s.

† See, for more recent discussions of this question in periodicals, *Proceedings of the Royal Geographical Society*, N.S., 1885, vii. 753; 1886, viii. 88, 176, 257; 1891, xiii. 108; *Geographical Journal*, 1903, xxi. 294; 1904, xxiii. 89; xxiv. 356; *Alpine Journal*, 1886, xii. 438; 1902-3, xxi. 33, 317; 1904, xxii. 56; *Petermann's Mitteilungen*, 1888, xxxiv. 338; 1890, xxxvi. 251; 1901, xlvii. 40, 289; 1902, xlviii. 14.

fill it in by plane-tabling with the help of the instruments for photographic and telephotographic surveying, in the use of which Mr. Reeves, the map curator to the R.G.S., is happy to give instruction. An excellent piece of work of this kind has recently been done by Mr. Stein in Central Asia.

There are, I know, some old-fashioned persons in this country who dispute the use of photography in mountain work. It can only be because they have never given it a full and fair trial with proper instruments.

Lastly, I come to a matter on which we may hope before long to have the advantage of medical opinion, based for the first time on a large number of cases. I refer to the effects of high altitudes on the human frame and the extent of the normal diminution in force as men ascend. The advance to Lhasa ought to do much to throw light on this interesting subject. I trust the Indian Government has taken care that the subject shall be carefully investigated by experts. The experience of most mountaineers (including my own) in the last few years has tended to modify our previous belief that bodily weakness increases more or less regularly with increasing altitude. Mr. White, the Resident in Sikhim, and my party both found on the borders of Tibet that the feelings of fatigue and discomfort that manifested themselves at about 14,000 to 16,000 ft. tended to diminish as we climbed to 20,000 or 21,000 ft. I shall always regret that when I was travelling in 1899 on the shoulders of Kangchenjunga the exceptional snowfall altogether prevented me from testing the point at which any of our ascents were stopped by discomforts due to the atmosphere. Owing to the nature of the footing, soft snow lying on hard, it was more difficult to walk uphill than on a shingly beach; and it was impossible for us to discriminate between the causes of exhaustion.

Here I must bring this, I fear, desultory address to an end. I might easily have made it more purely geographical, if it is geography to furnish a mass of statistics that are better and more intelligibly given by a map. I might have dwelt on my own explorations in greater detail, or have summarised those of my friends of the Alpine Club. But I have done all this elsewhere in books or reviews, and I was unwilling to inflict it for a second time on any of my hearers who may have done me the honour to read what I have written. Looking back, I find I have been able to communicate very little of value, yet I trust I may have suggested to some of my audience what opportunities mountains offer for scientific observations to mountaineers better qualified in science than the present

speaker, and how far we scouts or pioneers are from having exhausted even our Alpine playground as a field for intelligent and systematic research.

And even if the value to others of his travels may be doubtful, the Alpine explorer is sure of his reward. What has been said of books is true also of mountains—they are the best of friends. Poets and geologists may proclaim—

‘The hills are shadows, and they flow
From form to form, and nothing stands.’

But for us creatures of a day the great mountains stand fast, the Jungfrau and Mont Blanc do not change. Through all the vicissitudes of life we find them sure and sympathetic companions. Let me conclude with two lines which I copied from a tomb in Santa Croce at Florence—

‘Huc properate, viri, salebrosum scandite montem,
Pulchra laboris erunt præmia, palma, quies.’

A PILGRIMAGE TO MONTE VISO.

By WM. ANDERTON BRIGG.

NO mountain in the Alps is more happily named than Monte Viso, for none is better seen of all men, whether they be climbers of the high peaks or dwellers in the plain. It stands so near the great valley of the Po and so far from any rivals that it is clearly visible from all sides, and is a striking feature in the view, not only from the plains, but also from almost every peak in the Western and Central Alps.

The late Mr. Wm. Mathews was the first to climb the Viso,* and Mr. Coolidge contributed an exhaustive article to the ‘Journal’ in 1881.† These and a note on its recent history‡ render any further description of the peak, on my part, unnecessary. And if English climbers had visited and described it as often and as well as our French and Italian climbers—I refer especially to Sig. Guido Rey’s paper in the ‘Bollettino’ (vol. xx. No. 54), M. de Cessole’s in the ‘Revue Alpine’ (vol. x. p. 33), and Sig. Valbusa’s exhaustive monograph in a recent issue of the ‘Bollettino’ (vol. xxxvi. No. 69)—I should have had no excuse for this article. But the Viso lies so far south of the ordinary track that few English climbers seem to visit it, and none, so far as I know, have written

* *Peaks Passes and Glaciers*, 2nd series, vol. ii.

† *Alpine Journal*, x. 458.

‡ *Ibid.* xxii. 186.