XI.—*On the Geognosy and Mineralogy of Scotland.*

By Professor Heddle.

SUTHERLAND.

EVERY writer has his moods. It may be thought that the present writer was cynical and severe in his remarks on the geognostic features of Caithness. With a view to remove any such impression, Dr. Maculloch's opinion of that country is quoted; specially in order that it may be used as a foil to what has to be said concerning the geognosy of Sutherland.

Hear then Macculloch. "On entering into Caithness all the pleasures of travelling are gone and past, for an uglier country from one end to the other would not easily be found. In the usual sweeping manner of those who love to generalise, like Humboldt, it is level, or, at least, not hilly, without trees, without enclosures, as black and as flat as Bagshot Heath; as flat as a pancake! Nature has provided no monuments, and has refused to be its poet. I saw a Caithness forest. It was of mixed wood, of about fifty or sixty years growth, and was precisely five feet two inches and a half high. The surface was so neatly cut and so compact and flat that I might have walked on it. I thought it must have required a large pair of sheers; but the north wind and the east have long arms, and nature was the artist, while the dyke was the scale, and the limit—beyond which the winds had said it should not rise. Such a forest, potted, would have been a fortune to a Chinese.

Liberty is a fine thing, and I do not know that I ever enjoyed it more than here, where I could see the horizon, and felt that I might walk and run and ride in any direction.

The physiology of the country is quite unlike that of Scotland in general. A land scarcely elevated above the sea, a long surf on a smooth flat beach, great pools in the middle of close nibbled grass, sand, and the white tall steeple of Cannisbay like a pillar in the desert, not directing the people the way to heaven, but teaching mariners to shun the land.

The headland of Dunnet Bay is an ugly square mass of red sandstone. Duncanstry Head which rises to a considerable height, is red, square, and ugly.

The lofty pass over the Ord becomes entertaining in descending into Sutherland. Hence, the country begins to look like what it actually is,—*a new creation.*"

All this monotony has been said to result from the nature of the *one* rock which Caithness contains.

Five rocks, of a facies each differing from the others as much at least in the fashion of their sculpture, as it is conceivable that any stony bodies could differ, are to be seen in the adjacent county—which Macculloch declares to have the features of *a new creation*. Nor does this include the whole;—these five lie on but one side of the country,—the western; passing to the eastern, two others appear; while igneous rocks of three very different natures still further diversify the whole.

There is no county in Britain which contains within it so many formations; hence there is none which can lay claim to so many of the essentials of geologic interest, and none in which there is *a priori* to be expected so great an amount of diversified scenery.

Whatever extent of such expectations may have been indulged in, the reality will here be found to exceed it. *Hills* of all fashions and forms and tints:—*Mountains* which rear their heads like waves which are curling aloft to break, and have been petrified in the poise:—*Rocks* of which the contours are here graceful, there grand; here chaste, there grotesque; but which ever differ each from the other:—*Water* disposed now in deep trenches, and slumbering between gloomy rifts, now sprinkled in innumerable lakelets to the open eye of day, but each standing separate with strangely formed contours, like rain-drops reposing on a polished slab:—*Ocean* thrusting its tongues far in among the sombre hills in shade-loving meanderings; so tortuous, so lost among the land as to accomplish its backwards escape only at the cost of having become half freshened by the long embrace.

What a contrast to Caithness! Here nature has made her mightiest effort as the grand and wonderful; there, exhausted, she slumbrously drew over her the Old Red blanket of actionless repose.

There are many counties which may rival this one in this effect or that grand combination:—there is none which for an instant can compare with with it in a diversity which ceases only when the ocean's verge is reached. Here Old Scotland is in very truth, "the land of brown heath and shaggy wood, the land of the mountain and the flood;" and here, if anywhere, we learn that she is indeed *Old* Scotland; not a recently-created flat-featured parvenu, like others to which she has given a foundation; these dark-green rocks were laid bare, as ocean's deserted bed, ere ever the mountains were brought forth; they have resisted the billow's might during the many successive stages of the world's formation, and have yielded the materials of its after growth.

If anyone could wander amidst the convoluted mazes of its hills without feeling his heart burning within him, it could only be from an utter

want of sympathy with nature. The lungs play more freely, the stride gets longer, gravitation is an insignificant retardation, the big hammer's weight is scarce perceived; the whole man is improved in tone; even in the midst of nature's warfare, one feels altogether benignant,—so long at least as she refrains from wrapping those grand hills in gloom.

Every geologist must be more or less of an artist; he is none the worse if he be a little of a poet also. And every artist should be more or less of a geologist,—so far at least as to understand the nature of that which he is depicting. And every true lover of scenery should get up his geology well, learning it in the class-room which has an azure dome, or his enjoyment is only that of the moment or of the memory; for the intellect has otherwise nought to grasp; the heart may burn as the footsteps are turned hither or thither, but the cup of rational and reflective enjoyment can only be filled to the brim, while the silent record is being unfolded, the deeper lesson of the rocks being read,—the majestic mystery which is half seen, whole felt.

"It is thus that geology when it quits the trammels of its disputes and its theories, and puts aside its jargon and its trifling, illustrates even the pursuits of the artist. As far as landscape depends on forms, it will be found that it is very often essentially regulated, as to its beauty or deformity as well as its character, by the nature of the rocks of which a country consists. And this is often true, even when the rocks are not visible; as the character of the surface, the outlines of the hills, the forms of the shores, and many other circumstances, depend on the geological nature and disposition of the rocks beneath. Nor is even the aspect of a cultivated country, where all form is either originally absent, or obscured by vegetation and improvement, so independent of the nature of the subjacent rocks as might be imagined. So far from it, many districts have a character in their vegetating surface, if it may so be called, so marked, as not only to indicate the nature of the rocks beneath, but to enable a practical eye to decide where one kind terminates and another begins.

But where the rocks are exposed, the characters of the landscape, as these are affected by their differences, are still more marked; and it is then also more easy to trace the connection between the causes and the effects. In the district which has given rise to these remarks this is very conspicuous; an entire and sudden change of character always occurring whenever gneiss succeeds to sandstone, or the reverse.

I cannot part with this subject without suggesting how necessary the knowledge of rocks is to the landscape painter; not only that he may preserve character and truth in his representations of mere rocks, but that he may avoid those incongruities of general aspect, which do not interfere with the truth of portraiture, or the consistency of style alone, but which

offend the eye. Nor is it only the eye of the geologist which is thus offended; for in almost every representation of nature the uneducated and the unscientific detect, by something like instinct, faults and inconsistencies the nature of which they cannot explain; or rather perhaps they merely feel that something is wrong, while they know not what that something is. When indeed landscape painters have been faultless in this particular it has arisen rather from what may be called the accident of their having painted from nature carefully, and in the open air, than from correct general knowledge of the natural history or anatomy of their landscape. That perfection in this department of landscape painting is rare, is a proof of the necessity which a landscape painter is under of knowing the anatomy, if I may again use such a term, of his rocks, as well as of his trees, his plants, his shipping, his architecture, and his animals. I do not say that landscape painters ought to study the Huttonian theory, or learn to distinguish between greenstone and basalt; but I must maintain that until they are familiar with the leading rocks of the earth and their characteristic differences, their works will be imperfect. To represent her earnestly, Nature must be known, "*iutus et in cute*;" and it is as vain to hope for truth in this department of art, without knowledge, as to expect to paint a horse or a man justly without being acquainted with their anatomy.

But I have done; satisfied, not with having given landscape painters a wipe with my pen, but with reflecting, that if they will take these things to heart, they will profit by them. All the arts and sciences materially aid each other; to a painter's necessary knowledge I know of no limits; and even geology, I trust, may be rescued from some portion of the contempt which the crowd of its miserable cultivators has brought on it, when it shall have been raised to the dignity of a handmaid to the arts of design."

The caustic writer of the above was a skilful surgeon, whose caustic appeared only when the application was called for. In the belief that it is called for here, no apology is offered for transcribing his words of wisdom.

Looking at the extraordinary attempts to depict rocks which are to be seen upon the walls of our Academys, the writer has often felt that, inasmuch as five years of silent listening was a prominent feature of Pythagorian instruction, so five years of wandering paintless and palletless among corrys and cliffs, should be a *sine qua non* before the landscape painter attempts to depict their forms and physiognomy.

These remarks find a place here most fittingly, because *here*, that is in Sutherland, the student of Nature's lineaments will find them assuming the most marked versatility of expression; and here, as it is well in this as in all things to begin at the very beginning, the artist will be able to study the first foundation-stones of all.

In the midst of that diversity, moreover, he may imbibe of that inner essence of poetic feeling, without some trace of which, transferred to his portraiture, no painting can image forth nature's face at all. Unless the meaning of nature's imagery be understood, he had best go back to sign-boards and portraits.

Sutherland is a school-room teeming with studies for both painter and poet. The almost endless diversity of its scenery gives amplest scope for the unfolding of the sympathy which exists between the inner being of man, and the outer face of nature, and the idealism of the expression of its features.

The ghastly cheek of Arkle is that of one who knows his next step—the grave. The terrific peak of Coul Beg was surely so *cast* as a conductor to break that livid vapour, and draw the lightning's flash.

The lurid gloom which hangs under the lowering crests of Foinaven, and rolls steaming up that grim trench of Dionard, must surely only lead to the "cold swellings of the dark valley's waters." The tremendous gash, cinctured by Craig Riavach's cliffs, which trends visibly to *nowhere*, can scarce be ought else than one of the Gates of Hades.

Suilven "heaves high his summit bare," the perfect model of a light-house,—for a "Sugar loaf" is never made of *brown* sugar.

Stack Polly is a porcupine in a condition of extreme irascibility; and Coul More, quietly reposing upon her back, teaches Jura a lesson in depicting lines of female loveliness.

It is a most impressive scene to stand on the lonely moor of Lewis, and look eastward across the Minch at those diverse-tinted and wierd mountains of Sutherland. They are wierd and wondrous from afar, but it requires no distance to lend enchantment here. They are wierd and wonderful when they are melting away in blue haze; they are weird and wonderful at every forward surge of the vessel as we approach them—there is no need to place oneself in this position or in that, they are graceful and grand from every side; and they are most wierd and wonderful of all when, twining among their splintered pinnacles, we gaze beneath us into a gulf of mist, and have come to learn that that gulf was once filled with solid stone, and that the great mass up whose slopes we lately toiled, is but a crumbling relic of a vastly greater mass,—one indeed which once stretched both hitherward and thitherward for well-nigh a hundred miles.

The impression conveyed by their aspect from the Lewis is that we are contemplating a sepulchre;—the strip of water lies before us like the wall of a churchyard;—it is just as if we were looking over the wall of a churchyard into a burial-place of the dead. These diverse-tinted cones stand erect like tombstones from a dead level, for all the lower land is sunk. They function as tombstones moreover, for nought but themselves

is left to vouch for the previous existence, and tell the life-history of tha which they represent. Nature sometimes *raises* a tombstone, rearing one aloft by a convulsive effort. In Scotland, in the old days, the rule seemed to be to do everything by *digging downward*. And so these great monoliths were not set up, but the earth around was cut away from them, after the manner of the Sphinx, and not a few of the heirogliphics which are to tell their story were scratched upon them in the digging.

The fashion of the heirogliphics moreover is very different upon each—we can see that as we are getting across the wall; in the deciphering we are helped if we regard them from all distances, and it is not good to come too near. They run in gently waving bands vertically up the face of that dark tombstone; when we get to the back of it we find them coming equally directly down it; while if we climb to the top, we discover the two sets of lines to be continuous, for they strike right across the summit. That great red mass is barred from side to side, and from base to its acuminated peak with deeply chiselled horizontal streaks, now bold, now faint, now close, now far apart. These are not written upon its face alone, but pass in almost level course across its sides to meet upon the back,—each with the self-same stroke again.

On that opposing shaft, again, the writing of the finger is more faint, because the pale stone is very hard, and the writer sloped the lines always to one side of the pillar.

Three different styles of writing are palpable to us, before we are close enough to study the characters themselves. This study requires a correct reading of the legend, and a no less correct interpretation. There has been not a little differing as to the first, and squabbling as to the second; there has been even but little agreement as to the nature of the stones themselves; and then came the usual result,—individuals carrying big hammers got into the burial-place, and made use of the same in feats of sacriligious muscularity.

It is not, however, the whole expanse of Sutherland, which possesses this plenitude of scenic wealth: the tetter of Caithness' hideousness has crept across the border and far into its centre To anyone who wishes to get himself into good condition for appreciating scenery, we would recommend a walk from Arscaig, on the south shore of Loch Shin, in the direction of Loch Ailsh. There are here, certainly, no grand combinations of serrated peak, with finely-contoured slope, with gloomy tarn, or bright-green sea-loch with golden edging:—of bosky dell with glancing river glinting through birken tracery:—or of ocean's foam, with verdant isle and beetling cliff. It may be said of Sutherland *scenically* what has been said of Fife *agriculturally*, that it is "a serge mantle with a golden fringe;" and here we are in the midst of the serge. Roll after roll of

shapeless humps of heath-clad rock—at least we suppose it to be rock, for it is so enveloped that the hammer's occupation is gone. The very heather is featureless and meaningless:—the short-cropped ling, with scarce a single bell. The ear does not listen to even the companionship of a raven's croak. The pained eye turns in vain for relief, and turning falls, almost with a shudder, upon the vast, Acheron-looking, Loch Shin;—a great gutter, whose waters resemble flat-porter in shade, and molten-lead in sunshine. Sentinelled, and even they stand far off in repugnance, by the only two ugly hills in Sutherland,—Ben Klibrick and Ben Hee,—it resembles a great junk of a mighty river which has been dammed off at both ends, and left to stagnate;—an incubus upon nature,—a huge smear upon the face of beauty.

This central district of Sutherland, may be left to the coleopterist, as the only species of naturalist who never lifts his eyes from the ground; botanist, mineralogist, and artist alike would flee from it, and make for the golden fringe. Bursting southward, he would light upon the greenery of Rosehall, and the sylvan softness of the lower Oikel; northward, he he would pivot among the beauties of the hundred-pictured Tongue, as oft as he could snatch his gaze from the queenly Loyal: or westward, traversing the great gash of the mountains, he would pass between the grand portals of Arkle and of Stack, and enter upon that weird tract, which, stretching from Applecross to Cape Rath, appears to have been the workshop of the Titans, and which presents so marked a contrast to the deadness and drearyness which he has left behind, that he cannot but speculate upon, and search into the causes of so strange and so stupendous a dissimilarity.

By almost all who have written upon the geognosy of Sutherland has the wondrous diversity and the striking features of its scenery been noticed, though no one of the writers has gone very far in attempting to show how it comes that this diversity has been so concentrated in space.

Cunningham says that in the county "every variety of alpine and cliff scenery may be found," and that "it affords, in its undisturbed solitudes, all which constitutes the sublime in nature." Without going so far as to say that every variety of *cliff* scenery occurs in it, the correctness of the statement as regards its *mountains* may be maintained, and it is the ever-varying features which these present, which has impressed the most.

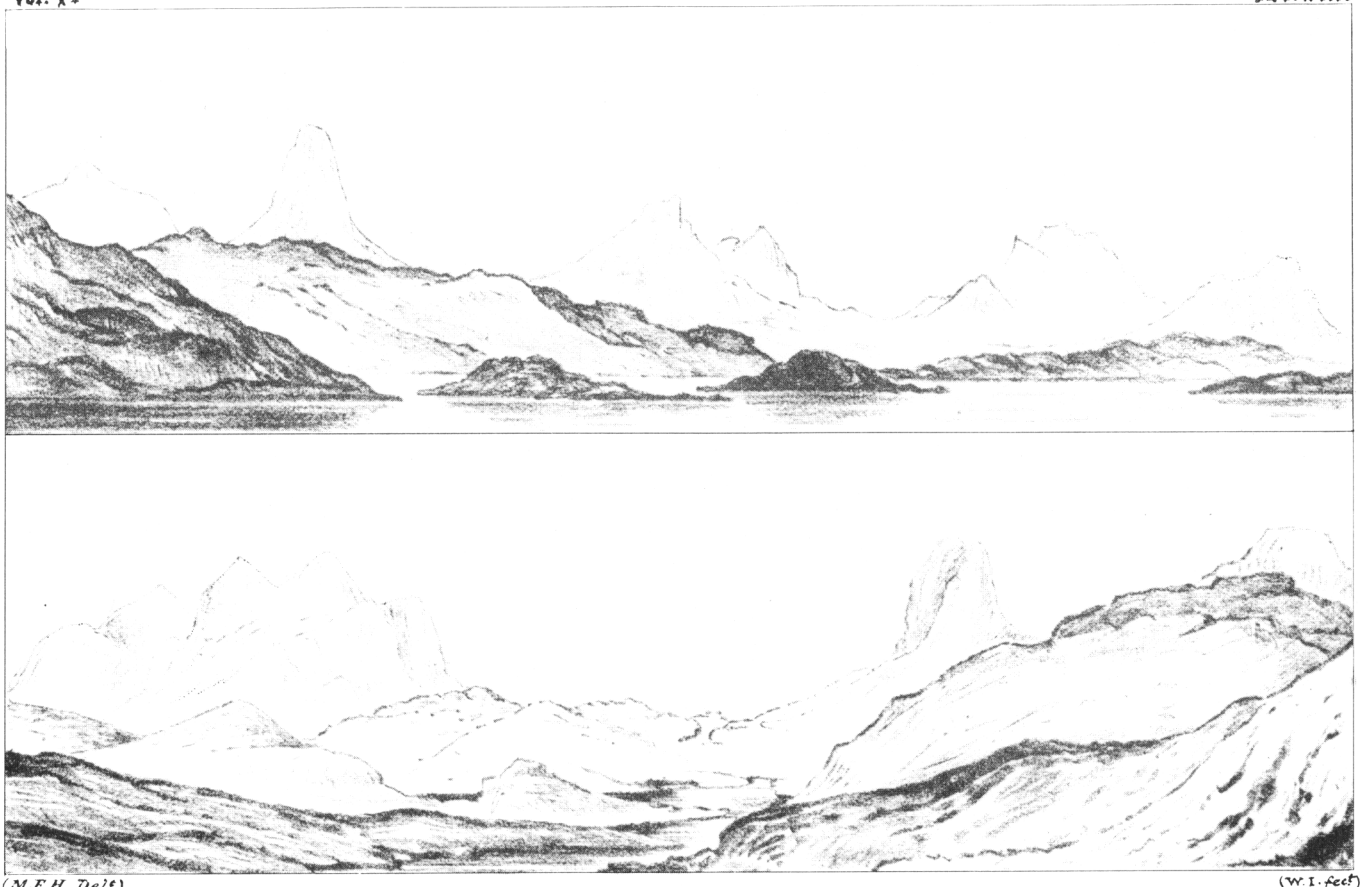
Nicol remarks—"The mountains, rising abruptly from the great table land of lower hills in smooth-rounded cones, spiry peaks, or long serrated ridges, their hoary summits shining in the sun like new-fallen snow, and sending down streams of rugged fragments to the deep sea-lochs that, running far up into the interior, wash their bases, present scenes of wild

and varied grandeur unknown in other parts of the island. Nor does a closer examination lessen the wonder with which we regard these mountains. They are then found to consist, not of granite or igneous rocks, nor of the older so-called primary strata, crushed up and broken by some great convulsion, as their singular outlines might have led us to expect, but of stratified rocks of no great hardness, lying almost horizontally in thin even beds, and moulded into these strange forms by the slow agency of natural causes."

Speaking of but one type of these alone, Hugh Miller describes them thus:—"Rising over a basement of rugged gneiss-hills that present the appearance of a dark tumbling sea, we descry a line of stupendous pyramids from 2000 to 3000 feet in height, which, though several miles distant in the back ground, dwarf by their great size the nearer eminences into the mere protuberances of an uneven plain. Their mural character has the effect of adding to their apparent magnitude. Almost devoid of vegetation, we see them barred by the line of the nearly horizontal strata, as edifices of man's erection are barred by their courses of dressed stone. Their colours, too, lend to the illusion. Of a deep red hue, which in the light of the setting sun brightens into a glowing purple, they contrast as strongly with the cold grey stone of the gneiss tract beneath, as a warm-coloured building contrasts with the earth-tinted street or roadway over which it rises."

While again, even while confining himself to a small cluster which circles Loch Inver to the eastward, Dr. Macculloch has an ample field for his grotesqueness.—"Round about, there are four mountains, which seem as if they had tumbled down from the clouds; having nothing to do with the country or each other, either in shape, materials, position or character, and which look very much as if they were wondering how they got there. Which of them all is the most rocky and useless, is probably known to to the sheep; human organs distinguish little but stone: black precipices when the storm and rain are drifting by, and when the sun shines, cold bright summits that seem to rival the snow.

"Suil Veinn loses no part of its strangely incongruous character on a near approach. It remains as lofty, as independent, and as much like a sugar loaf (really, not metaphorically) when at its foot as when far off at sea. In one respect it gains, or rather the spectator does, by a more intimate acquaintance. It might have been covered with grass, to the imagination; but the eye sees and the hand feels that it is rock, above, below, and round about. The narrow front, that which possesses the conical outline, has the air of a precipice, although not rigidly so; since it consists of a series of rocky cliffs piled in terraced succession above each other; the grassy surfaces of which being invisible from beneath, the whole seems



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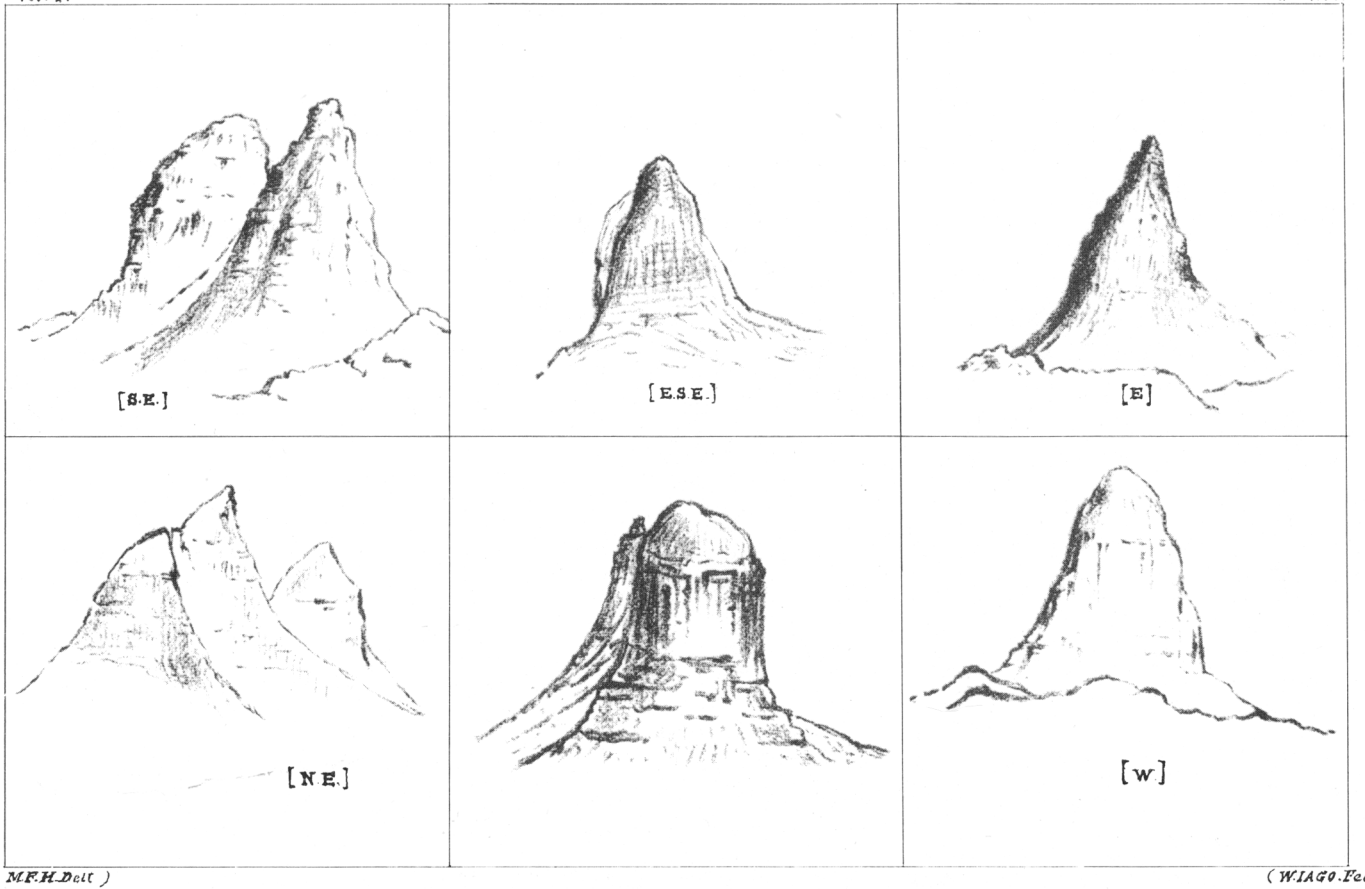
"Hills which look as if they had tumbled out of the Clouds."



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Hill Sculpture.— Gables of Suilven.

one rude and broken cliff, rising suddenly and abruptly from the irregular table land below, to the height of a thousand feet. The effect of a mountain thus seen, is always striking; because, towering aloft into the sky, it fills the eye and the imagination. Here, it is doubly impressive, from the wide and open range around, in the midst of which this gigantic mass stands alone and unrivalled—a solitary and enormous beacon, rising to the clouds from the far-extended ocean-like waste of rocks and rudeness.

The conical appearance of Suil Veinn vanishes on a side view. Thus seen, it displays a prolonged ridge with an irregular summit: but the sides all around are precipitous, like the western extremity; and, at the east end, it terminates in a similar manner; looking wide over an open rocky country, and thus preserving its independence in every part. The lateral outline is varied and graceful, the whole mountain, in every direction, presenting an object no less picturesque than it is uncommon and striking in effect." *(See Plates, Gables and Flanks of Suilven.)*

In these descriptions we find one writer startled by the close association of such distinctive forms as "smooth rounded cones, spiry peaks, and long serrated ridges," which alike "rise abruptly from a great table-land." These forms being stated by him to be *quite unusual to the material* which has been fashioned into them; while the agent which has accomplished a work apparently calling for violent effort—"crushing, breaking, and convulsion,"—declares itself as the "slow agency of natural causes."

Another writer gazes with wonder upon a superior quiescence which was unaffected by an inferior turmoil,—a quiescence of deposition so marked that he is carried back to his memories of "dressed courses," rectilinear streets and roadways, and the molecular regularity of "edifices of man's erection;"—"horizontally barred pyramids of mural character" which are based on "rugged hills which present the appearance of a dark tumbling sea."

The last writer makes the assertion that these strange masses have "*nothing to do* with the country or with each other, either in shape, material, position, or character;" while he adds that they "look very much as if they were wondering how they got there."

It is quite possible that *they* know more about that than many of those who have undertaken to tell it us; and it might be as shrewd a surmise to say that they look as if they were wondering how they were *left* there.

The three geologists from whom the above quotations have been made, had, we make bold to say, walked more over Scotland than any three men living,—their remarks show clearly enough that *they* wondered how these hills *got there*, and they may therefore be worthy of the regard of others who may not have seen so much, and thought so much, and taught so much as James Nicol, Hugh Miller, and John Macculloch.

It certainly would seem to be very specially the function of the geologist or at least of the petrologist to give the earliest lessons in the study of hill and rock sculpture; and certain we are that if such a function were accorded to him, he would select Sutherland as his class-room.

Here he would find the greatest *variety of material* for the operations of nature's chiscllings, and here he would be presented with the most ample series of illustrations of *diverse result*. From among these, without difficulty, might he select well-defined types of the various forms of Scotland's hills, which he would broadly classify into her *domes*, her *peaks*, her *ridges*, and her *cliff-fringed slopes*. He would learn with which of these her *buttresses*, her *aiguilles*, her *seridans*, and her *scalps* were most closely associated; be able to perceive how it comes that here a rock-mass lies supine in a massiveness which appears capable of defying even the earthquake throw; while there, "worn and wasted to the bones," in splintered pinnacles of precarious poise, its yearly topplings are battering its pediments into shifting sand.

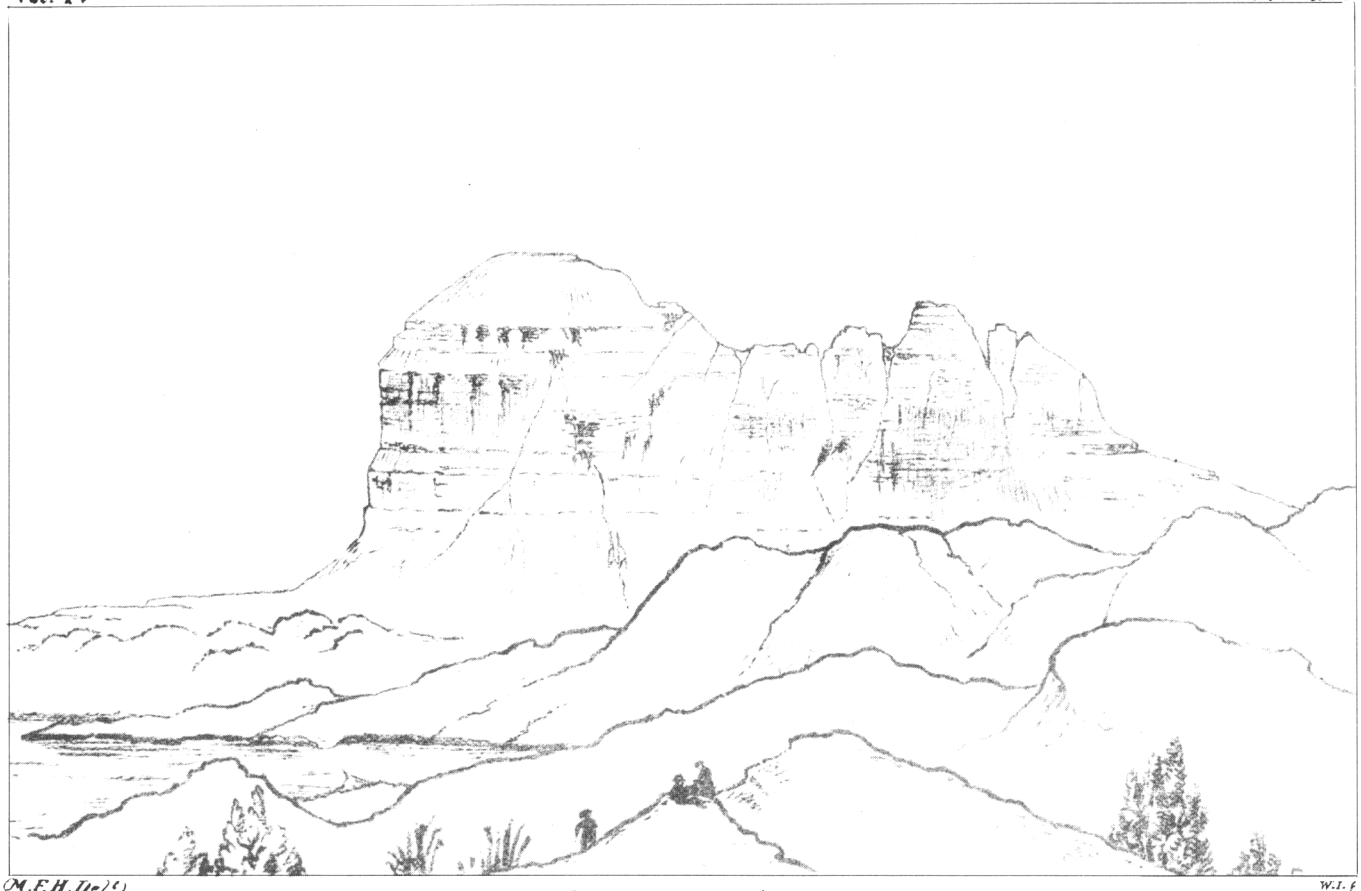
How it comes that upon this hill the mantling sward seems lovingly to shield its rock from the gnawing tooth of the atmosphere; while in that hollow, it palpably is living upon that which it embraces, and eating into it with most insatiate craving.

Perchance he would here, though not so much as in other parts of Scotland, be impressed forcibly with the empty assertiveness, the *pretention* of most of the so-called great hills; especially of those of the ridge and spur type; see how little there is in them after all; what mere skeletons they are—bared of every lineament of life; and as he passed,—balancing himself rope-dancer fashion, along their back-bone ridges, with loose stone slopes, hardly at the angle of rest, which start from his very feet on either hand,—smile at the vanity of the patriotic poet who speaks of the "*everlasting*"—the "*unchanging* hills."

But not in one county, or on one formation, or at one side of a country, can its hill-forms, and their sculpture be learnt;—this can only be attained to—the power of grasping the salient features of any one, can only come from an ever-widening fellowship with all; from winding among their slopes, and scrambling among their corries, till they become almost unto him as familiar friends—ready to picture themselves upon the retina of his memory with easily recognisable sharpness, from every point of view.

A very singular fact, but perchance an easily to be explained one, if we only had the perfectly-fitting key, would then arrest the attention. This is, that very much the greater number of the ridged-hills of Scotland stretch their length from W.N.W. to E.S.E., while their steeper slopes or their cliffs, as the case may be, face the N.E., more or less directly.

From certain geological facts to be alluded to below, this does not apply



(M.F.H. Del.ᵗ) W.I. f

Flanks of Suilven.

to Sutherland to so full an extent as to Scotland generally,—yet it will be seen that—if we except cliff-faces which front the west (and this exception holds in many districts) on account of the rock-escarpments demanding such a frontage,—it does obtain even there.

This singular fact will be fully stated and considered in treating of the Counties in which it is best seen.

The close concentration in space, of Sutherland's *many-faced* scenery has to be accounted for, first, as regards its great diversity in form, and secondly, as concerns its colouration.

In form, it is the resultant of the meeting, almost along one line, of three, it might almost be said of four great formations:—of the rock-masses which form these being acted upon by the agencies of degradation in very diverse manners:—and of that line having been rent and dislocated by a great longitudinal fault,—by a system of nearly parallel transverse faults, and also by occasional divergent rents, which let-in wedge-shaped fragments, in positions which produce extremely contrasted effects among the diverse-tinted rocks. So dislocated, rent, and fragmentary a series of rocks, afforded on account of their opened joints, a comparatively feeble resistence to the assaults of the many agencies, each of which, by its biting tooth is potent as a fashioner of the surface-contour of the land. Assaults of such agencies as the battering of waves, and the scour of whirling tides; of toppling blasts, of the rending expansion of freezing water, of abrading and polishing sand-scourgings, of cannon-cutting rivers, of plowing and rounding ice, of the loosening and gravitating transport of soaking rains,—of all the agencies which hurry the dry land into the great sink of the Ocean,—even as they do at present.

There is abundant evidence that all acted then as now,—then as now leaving upon the frontlets of each rock-mass a tracery of decay, characteristic and diverse as the diversity in substance and in colour of the rock material themselves.

The hills differ also in their forms *on account of the amount of action upon each having necessarily been very unequal*; for the most ancient of these formations has been modelled and remodelled many times, till it is perchance but its wasted pediments which, in low rounded hummocks, alone remain; while, of the more recent, the massive thickness has in many places been but little cut in upon, and still reposes in long stretches of unbroken solidity.

The district to which the above applies has an average width of ten miles, measured from the western shore; and the same general feature of scenery extends as far south as Torridon, though hardly to Applecross.

The rock-pabulum out of which this diverse scenery has been sculptured is highly complex.

Commencing at the sea-margin, and extending as a pediment beneath all the other rocks, almost to the eastern verge of the district named, there is found the wasted remains of what was formerly, unquestionably, a once great land. At that eastern verge it either sinks beneath the ocean,—is entirely swaddled and concealed by the overlying rocks,—or is cut off from the younger eastern formation by the great fault.

Taking the sea level as its limiting cincture, and stripping from off its surface the overlying masses which now conceal it, its geographical chart presents us with a number of low islets clustering closely, and a single range of peaked hills. These alike stretch from N.E. to S.W; and they present the counter-part of the extended and dissevered tract, which, under the name of The Long Island, lies parallel to them westward of the Minch. A geographical chart of this Eastern Hebrida with its range of great hills is given. Its eastern coast-line is, at its south-eastern extremity, somewhat problematical.

Formed of the same rock, with identical strike of rock-layer, this *Eastern* and *Western Hebridia* unquestionably present themselves as the remnants of a country, the great thickness of whose deposits, as evinced by the almost unvarying continuance of one dip, entitled it almost to lay claim to the dignity of *Continent*.

Out of the sorely-wasted remnants of this ancient land, probably when sinking beneath the waters,—rung-out to give place to the new,—the chisels which sculptured the features of the old-earth crust, trenched a a deep north and south valley, now termed the Minch. This, forthwith submerged, received into its quiet and many-shored waters, layer after layer of comminuted debris, which, consolidated by accumulation of pressure, and agglutinated by metamorphic change, presented themselves upon the returning cycle of elevation, as the many-bedded trough of the Conglomerates. These, from their great dominance in that district, have fittingly received the name of *Torridon standstones*.

It has been said that the vast thickness of strata of the basement rock, vouches for its great extent as a formation. A common profundity of position and similiarity of structure has induced speculative geologists to link it, under the Atlantic floor, with rocks of the Western World, and correlate it with the *Laurentian* of that Continent. It is a more temperate speculation which links it with the Long Island, and rests satisfied with asserting that it is the oldest rock in Britain, and probably in Europe.

The general character of its scenery is most peculiar. Looked at from a distance, its appearance is simply repulsive,—a low table-land formed of insignificant hummocks of bared and barren rock.* Considered in detail, it

* This feature will be seen in the sketch of "The flank of Suilven," and also in the foreground of *one*—the upper—of the sketches of "The hills which look as if they had tumbled out of the clouds." The foreground of the lower, with its gently sweeping curves, consists of the "Upper gneiss."

EASTERN HEBRIDES.

M. F. H. Del.

presents itself as a labyrinth of beauty. Viewed from an elevation and at a distance of several miles, the myriad lakelets which stud its surface confer upon it the appearance of a swamped bog seem from the top of a hill. Fairly judged, as with ever-doubling course we wander amidst the mazes of its lakelets and boskey knolls, we find each one to be an exquisite picture of craggy outline and winding shore, of rockey islet, and rich brown water-tints, and boulder-beach confusion;—of never-ceasing changes of form, and of endless surprises.

It all depends upon time being given to do it justice. Hugh Miller could not see its beauty in presence of the wondrous hills which tower above it; though he happily compares it to "a dark tumbling sea."

Dr. Macculloch, who was as just in his criticisms of scenery as Ruskin is grand, writes of it: "The surrounding country is a melancholy mixture of lakes, rocks, and bays; the general effect of which is as disagreeable as can be well imagined. And yet this air of desolation is to be sought for in the sky rather than on the earth; it is all the effect of climate. When we fairly examine these little lakes, and all those minute details of rock, and bank, and stream, there is not one that is not beautiful, or which at least does not contain the fundamentals of beauty. Were there trees to dispose of as we pleased, I know not of such a collection of little paradises as might be made out of this very country. Nature, I know not why, seems to have reserved her chief beauties for places where she is quite sure they can never be improved or enjoyed."

A walk of three miles—which will take two hours to accomplish—due east of Rhiconich in the direction of Loch Garbat More and Garbat Beg, is a typical one; it will leave upon the pedestrian (if that can be fairly called pedestrianism in which jumping bears to stepping the ratio of 2 to 1,) the impression that in this "melancholy mixture of lakes, rocks, and bays" he has somehow been surfeited with beauty.* The absence of trees, which Macculloch deplores, is not morover, invariable. There are, localities where the rounded swellings of this so called table-land, are amplified into hills of considerable altitude; as in the case of Craig Tolly, at the lower end of Loch Marce, and the grandly opposing pine-clad frontlet of Ben Arrihaar. Here the scenery assumes much of the features which prevail at the Trossachs, being however incomparably grander, and

* At Loch Garbat More the scenery is very grand,—the angling is however poor. Loch Garbat Beg is somewhat tame, scenically, but the angling is super-excellent. In the Visitors' Book at the Inn of Rhiconich there has been written:

Loch Garbat More, I beg you see.
Artist.

Loch Garbat Beg is *more* to me.
Angler.

Those who are "*Heelan*" enough to be able to translate *more* and *beg* will see the point.

less confined. The birken-clad slopes of Stack, also, are altogether perfect.

Throughout the whole of this "table land" the same feature of rounded knoll-like hummocks obtains; hummocks which in their bared surfaces exhibit the denuded edges of high-tilted strata, while their curvilinear outlines vouch for the fact that, whatever combination of agencies had effected the enormous amount of denudation which such an extent of shorn-off outcrop vouches for, polishing ice had been the agent which ultimately had conferred upon them their characteristic forms.

That the ice sheet which had effected this was of no great thickness is disclosed by the multiplicity and abruptness of the curvatures; there palpably had not been weight sufficient to grind all down to anything of a uniform level; rending and regelation of the sheet must have been incessant.

So much for the *subærial* scenery of this wasted formation;—a troubled sea of heaving but *not curling* billows;—sombre coloured, lake besprinkled, ice worn;—weather-wasted when it lifted its head above the waters; swaddled in shingles, and over and above these swathed in sands and silts, when it was depressed beneath them. Re-elevated and again depressed, but with each subærial exposure subject again and yet again to the many biting teeth of atmospheric gnawings, as each superincumbent and protecting belt was cut through, in that unceasing process which abstracts from the pre-existent, materials for the construction of the new.

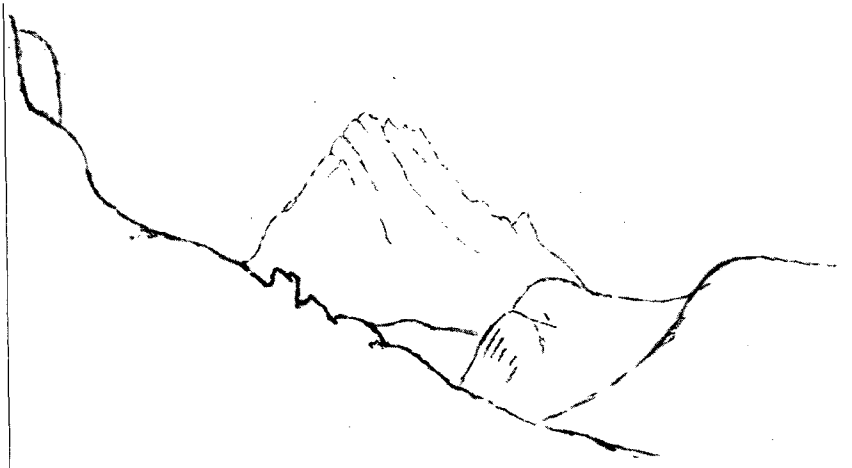
But the formation has a *subterranean* scenery, as well as a subærial.

Murchison, while denying that the formation anywhere showed itself to the eastward of the over-lying quartzite, admitted that it might in some undiscovered locality be "brought up,"—that is, *eruptively* brought up—even far inland to the east.

But it *is* "up"; that is, it is *surface-exposed* to the east of the quartzite, without having been "brought up." "Up" even in cliffs of over 1000 feet in height, and *so* up because *there* it was never ground down; remaining still as a range of lofty hills, the highest peaks of all the old islands of either Eastern or Western Hebridia.

There they remain, because they were swaddled up during one of the dips which Old Scotland took beneath the waves; and they are seen only where the swaddlings have been much thinned off, or altogether removed. A dome-shaped eminence which now forms the main bulk of Fashven protruded in the N.W.; and a range of peaked summits extended from Kean-na-bin to Ben Stack in the east, when the formation stood with bare head beneath the aerial dome. Of this range what is now the western peak of Foinaven forms at present the culminating point; this has an attitude of 2952 feet; but, as two outliers of quartzite of about 25 feet in

BEN GRIAM BEG. OLD RED SANDSTONE.



BEN STACK. HEBRIDIAN GNEISS.

M.F.H Del.

thickness repose upon the highest point, 2930 feet (Keanngarbh) is now he highest elevated point of Hebridia which remains.*

Of the features of this alpine range of the old continent, the thinness of the cover which inwrapps it, permits it to be disclosed that the summits were of peaked form. From one indeed,—Ben Stack, of which an outline sketch is given,—the cover has been totally denuded, at least at its highest or western summit; and it towers in isolated pre-eminence over the plain,—a haystack-gabled hill.

We may not do more than suggest that even this old formation had its N.E. cliffs; for, though it is probable that great part of the stupendous precipice which, from the N.E. front of Keanngarbh, depends over Corry-Dual, had been formed in that ancient day, and had posteriorly been sheathed in the more recent deposits, still it is possible that it may have been partly cut-out by more recent denudation.

It is a strange history which this mountain range of Eastern Hebridia aids in unfolding. An almost continuous line of peaks dominates nigh 3000 feet above a table-land; peak and table-land alike being carved out of the high-tilted edges of the strata; and, as the range of hills runs across the strike, these peaks owe their existence to no folding of the crust; and there is on neither side of the range the smallest evidence of local fault,—of either upheaval or depression.

The table land must have been formed by the cutting away of the rocks westward of the range.

What cut it? and when was it cut? It has been already shown that ice was its *most recent* cutting tool,—ice which simultaneously had cut-in upon the more recent of the local rocks;—but it was also pointed out that the hummocky feature of the plateaux indicates but a *small thickness* of ice. This *recent* cutting then could not have effected the great and general abrasion; and that it did not do so, but that the great table-land was formed when Hebridia stood *a formation by itself*, is proved by the fact that the succeeding formation *lies upon*, and rears its sculptured hills *from that levelled but gently undulating table-land.*

What then had shorn away the land, so as to form the great flat plateaux?

Not atmospheric agencies,—the rock everywhere still shows itself as a most unalterable one. Not breaching waves,—sea cliffs are nowhere visible

* Our fellow member, Mr. Colin Phillip, tells me that, from the altitude which he attained upon its western slopes, he was able to see that the summit of The Maiden,—a hill which lies north of Slioch, consisted apparently of the "old gneiss," and was either that rock or the "igneous rock" of the great fault,—(afterwards to be noticed).

If this be so,—and I have great confidence in his experienced eye—then, as the Maiden is about the height of Slioch, and certainly over 3200 feet, *it* must be the highest peak of the old gneiss. Cleesham, in Harris is, by the author's measurement, 2,785 feet.

upon the flanks of the range, which are of curvilinear outline. Not the scour of waters; no river trenches, with sloping banks which eat back into the land, are anywhere to be seen,—the plain is a great flat, and the lake-hollows are all primarily occasioned by *recent faults*,—as will be afterwards shown.

Ice, alone of nature's agencies, remains to accomplish it; ice, engendered among the lofty eastern peaks. The presumptive evidence is strong; actual evidence is in several localities available. Upon precisely the same grounds that we assign the rounded forms and curvilinear outlines of the rocks in the throat of a pent-up mountain-gorge to the grinding passage of ice, are we entitled to hold that ice cut away *at least the surface* of the low land from which the great landmark hills of the Torridon Conglomerates rear their banded cliffs. For beneath the pediment-strata of these towering masses, do the sweep of curvilinear outlines and broadly-rounded forms pass.

It is true that the sweep of these is more gentle and less abrupt than that of the more recent graving, but the character is the same. Nor is it the very lowest land alone which would appear to have thus been subject to the sway of this old ice; for one of the localities where *ice-sign* is best seen is upon the outlying hill of Fashven; where, *upon every side* upon which the junctions can be seen, sweeps, which would give the lower rock a dome-like form, seem to glide under the mantling-cap of Conglomerate.

The same is to be observed upon the north side of the gneissic islet at Sandwood,—east of the lighthouse at Cape Wrath,—the south-eastern foot of Suilven,—the head of Loch Veyatie,—and, in a most suggestive form, to be afterwards considered, at what I will call the *south terrace* of Arkle.*

This range of hills then, among whose peaks was cradled the *nevé* of an ice-sheet which swept westward, lay some ten miles from the present western shore. There is evidence to be seen upon the western shore of Loch Erribol, that the old land did not extend much further eastward, unless it so extended at a great depth. In this direction it may, for purposes of a newer formation, have been all used up; but close to this the great fault comes in, and no portion of the old formation has been found as yet (even "*brought up*") to the east of that. Be this as it may, the summits of these dark-tinted hills, with grizzly cliffs, vertically seamed by the junction-lines of the contact-beds, protrude themselves, in conse-

* Since the above was in print, I have read a report of Professor Ramsay's address to The British Association, on the occasion of its Meeting at Swansea. In this he says, —"I received a letter from Professor Geikie, in which he informed me that he had discovered mammillated moutonnée surfaces of Laurentian rocks, passing underneath the Cambrian Sandstones of the north-west of Scotland, at intervals, all the way from Cape Wrath to Loch Torridon, a distance of about 90 miles."

quence of the action of degradation, through the thinned-off beds of an overlying rock. One which, in the case of the loftiest summit, is as remarkable for the lightness of its tint, as is the protruding mass for its sombre tone.

This great hill of Foinaven, though seemingly of quartzite, is in its bulk formed of the old gneiss;—thinly in its western, thickly in its eastern portions mantled by quartz rock. Formed of a narrow west and east ridge, which extends for some miles, it to the northward throws out several spurs. Over both slopes of these, the many-jointed enveloping rock throws down myriad fragments, which in white streams streak the darker gneiss. The hill seems to be perpetually swathed in snow, and, as it dominates with strangely serrated ridges over the sun-forsaken valley of the Dionard, this composite mountain, the loftiest peak of the oldest world in Britain, may be aptly termed the Grizzly King.

Being a composite mountain, we are not entitled to say more of the form which atmospheric sculpturing would confer upon the material of which it is most largely composed, than that its western peak, with uniformly steep slopes on three sides and a rough precipice upon the other, warrants the conclusion that, at least with high-tilted strata, *acutely conoid forms* would prevail.

We do not even in the isolated mountain of Stack, obtain conclusive information on the point, for this pyramidal hill unquestionably owes its form primarily to faults. One of these can be seen from Loch More, running directly up the eastern gable; and it will be found upon the summit, cutting the hill longitudinally in two, almost along its narrow ridge; while its grandly-precipitous northern face,—than which nothing in the way of rock-belted hill-side can possibly be finer,—is evidently the south flank of the fault which formed Loch Stack.

Though, from the encumbered state of the hills of this range, we learn little of their sculpture-forms, still the limits and the nature of the encumbering rocks disclose something of their history.

The sadly-worn and shrivelled bulk of the first firmament sank beneath the waters. We now enquire how deep did it sink?—and did it descend horizontally, or turn upon an axis? as Norway is known to be doing at present, and as there is good reason to believe is Scotland likewise.

The mode of swathing of the table-land, and mantling of the hills, may answer these questions.

The lower flats of the table-land were all covered up; bed after bed of coarse-grained grits were showered down upon the bottom, till they attained a thickness which in Teallich attains an altitude of 3486 feet; and, judging from the continuence of the same dip westward, a probable thickness of over 6000; they welled up over the higher hunches till

they capped Fashven, but their thinned-out edges nowhere reached even to the foot of the great eastern chain.

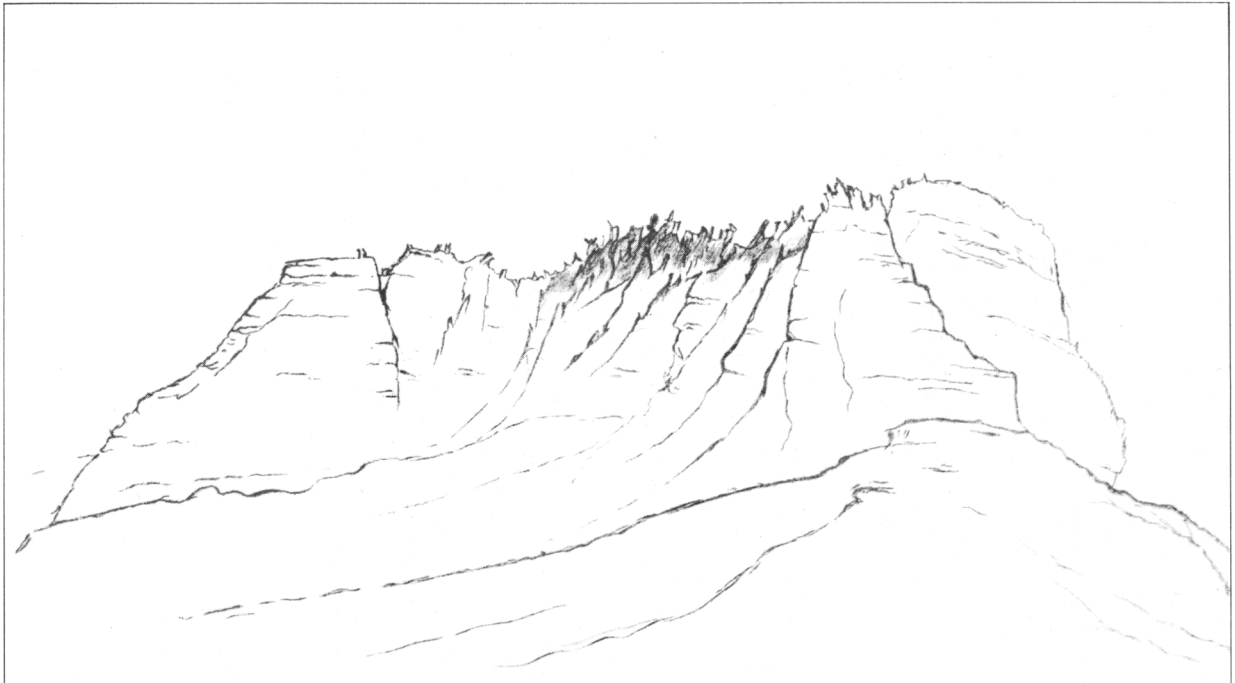
An after denudation, and a still posterior mantling, renders the point somewhat obsure,—but, *somewhere a little to the west of the foot of the mountain range*, would seem to have stretched the eastern shore-line of the Torridon Sea. By a bit of its western, its deposits hang on to the Eye Penninsula of Lewis;—denudation would seem a second time to have cleaned out the scoop of the Minch.*

But the pebbly deposits do not now lie parallel with the present horizon floor; in Sutherland for the most part they dip some 5° to the E.S.E. There is evidence neither of fracture with elevation on the westward, or of fracture with depression to the eastward. The purely local evidence would indicate that Eastern Hebridia had turned upon the axis of its eastern shore, and in sinking beneath the waters had "taken a header" to the west. It is much more probable however that lateral pressure had depressed the trough of the Minch at its centre, and that this had been succeeded by undue local elevation. One thing is evident, namely, that when the old land was again elevated above the waters, burdened by the eastern shore-belt of the Torridon deposit, its great range of mountains had still no covering; and that these, with an altitude more elevated than their present, had for a second epoch to submit, and partially to succumb to the assaults of wasting rains and warring elements.

Were the *Torridon sandstones*,—the formation which had been laid down in this old ocean bed,—now presented to our contemplation in the unbroken and rectilinear bands in which they were originally deposited,—nay, were they even seen either in transverse fissure, or longitudinal escarpment, it is questionable if anything would be considered more tame, and scenically repulsive. What we do see of the formation, as the remaining fragments of a once vast deposit, is very different:—it is as enthralling as a spectacle of scenic magnificence, as it is overwhelming to the intellect as an example of stupendous denudation.

The bands of barred stone which are seen passing from north to south across the terminal faces of each individual fragment of the formation, stop abruptly on their shorn-off cliffs, to be taken up again at the self-same altitude by the face of the next fragment, standing as it does even miles apart. Nothing could vouch more imperatively for these miles of empty air having once been filled up with linking stone. It appears as if a mighty ploughshare had been dragged from east to west across the huge belt of rock, and had hurried all but a few fragments into the waters.

*The Minch is in the direct line of the Antrim,—Shiant,—Farö, volcanic outburst. It may be a fall-in.



CREST OF STACK POLLY.- CONGLOMERATE.

M. F. H. Del.

Carved out of a mass above all others formless and void, these fragments stand isolated,—fantastic beyond measure. Scenery hunters have been said to "*rave*" about the splintered pinnacles of Coruisk, but these monolithic hills of Coigach have ever struck the beholder dumb.*

Fashioned from a material as unvarying in its mass as clay, they confront one another, no two the same; differing so absolutely in their every feature, that as another and another is seen to separate itself from the line, wonder at the endless diversity of form usurps the place of admiration. (*See the sketch from Handa.*)

And when the nature of the chiseling is examined, that wonder culminates.

There are but two stages of the process;—the opening of rectilinear jointings in the rock-wall, and the falling asunder into sand of the constituent granules.

That the ploughshare found a ready entrance is palpable; for a series of great transverse faults, with occasional uphevals and subsidences, rent the great belt of rock into isolated fragments; the looser or the softer portions of which have been swept into the ocean.

It would seem to be a common opinion that ice had been the agent of transport here; but the sea-cliff aspect of many of the rock-fronts, indicates wave-action.

The most isolated of these hills, that called Suilven or the "Sugar-loaf," is usually regarded as pre-eminent in peculiarity; but, as illustrating the modes of their sculpture, that is, the processes of degradation of the rock-mass itself, and indeed even for its general form, the rocky shaft called Stack Polly must take precedence.

Dr. Macculloch is of the same opinion, (he errs in calling it *Coul Beg* however.) He says "It is even more remarkable than Suilven, while its form is more elegant and versatile. In every view it is as graceful and majestic as it is singular; and like the other mountains of this extraordinary shore, it has every advantage that can arise from independence of position; rising a huge and solitary cone, from the high-land beneath, and lifting its dark precipice in unattended majesty to the clouds."

Certainty the most marked feature of these mountains of Torridon sandstone is the vastness and truly *mural* character of the precipices which girdle them, frequently upon several of their sides; this feature has been accounted for by Nicol, who writes,—"The beds have been vertically divided by a rude prismatic structure, and the projecting

* "The other side of Chaos," was the expression of one upon his return, *solemnised* by an early morn's first inspection of them.

butresses resemble the fluted pillars of some gigantic Cathedral, carved and fretted by the genii of the rain and storm."

In the south-western ridge of Teallich and on Stack Polly, the endless diversity in form of the pinnacles into which a flat-bedded and sand-grained rock can be air-wasted, is a scarce less wonderful feature.

The ridge of Stack Polly connects, if it can be called connecting, two terminal massive bastions, square as if rule and angle had been laid to them, and cleft as clean downward as if the Axe of Omnipotence had dealt the blow. The hill thus presents both features.

Its bastions stand as inaccessible to climber, as they seem regardless of winter blast and rending ice; the Bolts of Heaven alone could affect them. But the ridge which stretches between, is actually being blown away in sandy dust, by the wind. The more enduring portions have been left however in the form of spiracles; these are disposed not on the actual ridge alone, but protrude from both its slopes, standing erect or toppling; and they are of extreme tenuity. The hill in fact seems to bristle with divergent spikes; so that we are forcibly reminded of the "fretful porcupine."

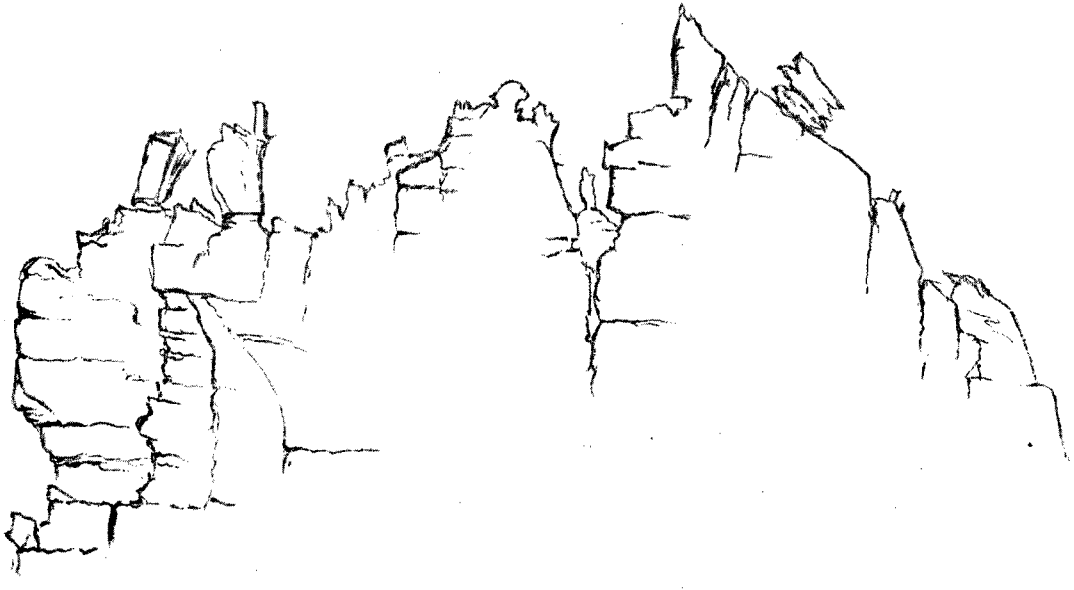
From a distance, however, and when merely the sky-line of the hill is thrown across a blaze of mid-day splendour, these pinnacles project against the sky in a wondrously-felicitous similitude of human forms;—or that of gnomes, intent upon some work of piling up, or tearing down. Here, figures with out-stretched arms, direct; there, they bend prone under heavy weights; and there again, seated, they seem to stoop to chronicle the progress of the enterprise.

And, when the gloaming throws its glamour over the scene, and we approach to note more closely this strange fantasy of nature, and the shadows of evening close round us,—or the mantling nightcap of the mountains sinks from the zenith, heralding the sweep of the tempest, these strange forms assume even more of the shape of man. The great heart of Burns thrilled to the storm-scourged malefactor; but *there* was still humanity; and though these air-hewn images are only in its form, still the sensibilities are stirred, and our sympathies aroused, that anything, even though it be only in the *form* of man, should stand exposed, as do these, to the wild warfare of Atlantic ragings. Here there is not even "looped and windowed raggedness," to sheathe them from the blast;—naked as from the earth they came, must they endure the pelting of every pitiless storm.

The wierd spectacle is now seen only in fitful glimpses;—as we grope among the spectral shapes, the *eerieness* is almost overpowering. Starting forth from out the whirling scud, now distant and now near, their shadows bulk gigantic on the gloom cast from the great square

ROCK SCULPTURE ON STACK POLLY.

M. F. H. Del



ROCK SCULPTURE ON STACK POLLY.

M. F. H. Del.

towers. Soaked by condensing fogs, and chilled by eddying blasts, we feel as if it needed but one touch of those grim gaunt forms to root us in their midst. (*See sketches of "Rock Sculpture on Stack Polly."*)

We are presented here with an illustration, perhaps the most striking in Scotland, of the extreme diversity in external modelling which may, in the different stages of their operation, result from the action of the same agents upon the same rock.

The opposing massive western dome of Suilven, and the ridge of Stack Polly, are altogether as far apart, as types of rock sculpture, as can be conceived. But "even to this favour,"—in similar fashion, must Suilven rot at last. It is the destiny of the everlasting mountains to "change their shapes and flow from form to form," being mere ephemeral embodiments of substances of many destinies,—a pabulum for the operation of unseen forces moving in ceaseless cycles.

Perchance it is through the very intensity of the impression of the *finite side of nature*, as here evidenced, that we are, by a kind of revulsion—when we consider it in relation to the register of time—overpowered with the sense of what has been called its *infinite side*;—"that side which yields no response to man's yearnings, and refuses to make itself plastic under even the strongest powers of emotion. For outside of and beyond man, aloof from his warm hopes and fears, his joy and sorrow, his strivings and aspirations, there is the vast immensity of nature's forces, which pays him no homage, and yields him no sympathy.

This aspect of nature is nowhere borne in upon man as in the presence of the great mountains, which seem so impassive and unchangeable. Their strength and permanence so contrast with man, of few years and full of trouble—they are altogether heedless of his feelings or his destiny. He may smile or weep, he may live or die; they care not. They are the same in all their on-goings, come what may to him. They respond to the sun-rises and the sunsets, but not to his emotions. All the same they perform their mighty functions, careless though no human eye should ever look on them,"—caring nothing, what strange story he may tell about their birth. Suilven will never bow his head to listen, nor Quinaig shake his sides in mirth, or Coul Mohr shed a tear.

They keep their own secrets and drop no hint to him; his grand co-ordinations, his miserable squabblings, his pettiness and his pettishness are to them less substantial than a wreath of vapour, and affect them not at all.

Considered as individual *monolithic hills*—and there are none in Scotland to which the term so fittingly applies—their character is that of an extended narrow cliff-faced ridge with gable ends.

They are occasionally precipitous upon every side.

Sketches have been given to show the changing features of gable and of flank. (*See "Gables," and "Flank of Suilven."*)

Sprinkled at somewhat irregular distances in straight line, at but a short distance from the shore, they stand like a line of sentinels to guard the land: and when we place ourselves, as at the Island of Handa, in such a position as takes in an extended sweep of the line, we perceive that they must be but the fragments of a continuous belt of escarpment, or perchance shore-cliff.

The western frontlet of Quinaig almost proves this. That cliff-face has nearly, but not entirely, been cut up, and still remains continuous as a far-extending rampart. The second sketch of Quinaig from the south, shows the diversity of outline which even one and the same hill can exhibit. Its north-eastern frontlet displays a precipice so intricate in detail and magnificent in form, as to be beyond the powers of an ordinary pencil to depict. Of Coul Mohr, the grandest and most versatile of the whole, it can only be said that it would take many wanderings before we could "tell of its high towers."

Perhaps their versatility is nowhere better seen than in Suilven, when viewed from the north; whence the thinned off ridge has assumed a skyline which is closely imitative of that of the rough lower rock,—as shown in the sketch.

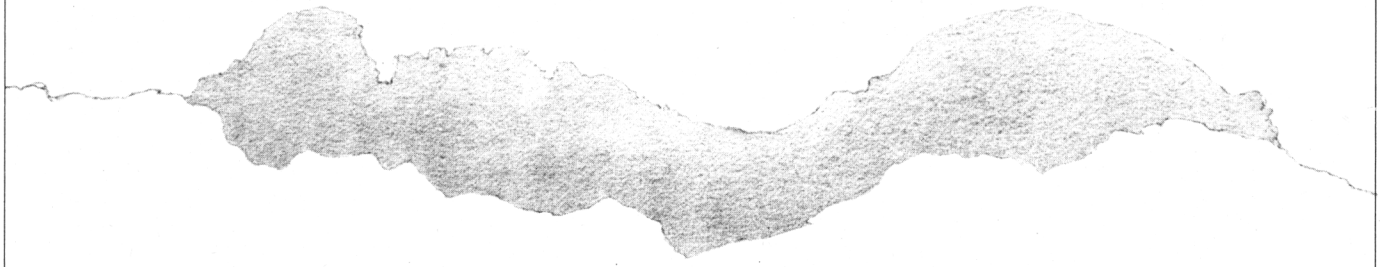
The isolation of these fantastic hills—their standing so far apart from the high ground of the interior—the strange toning of their purple colour—and the marked contrast between their rectilinear courses and the fretwork roughness of the pediment upon which they stand, form the *first element* of the *diversity of the scenery* of the hills of the district.

In order to be in a position to speak to the *period* when the gateways were cut through the Torridon formation, and the pediment of older rock laid bare betwixt them, we must question the next formation.

What it cost to cut Suilven.

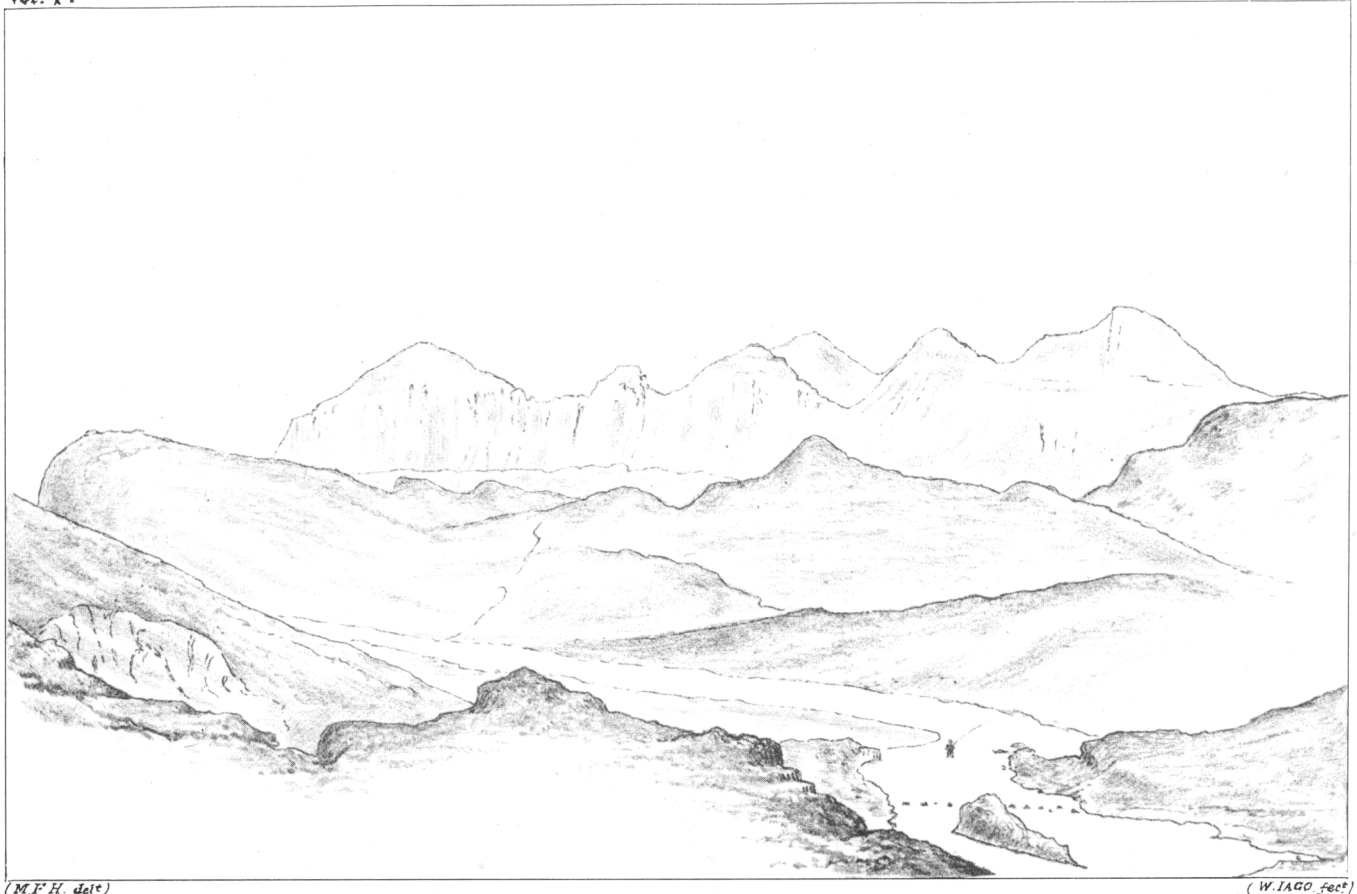
Reference has been made above to the finite side of nature, considered in relation to the register of time; and we have in this district, indeed in this formation, a more palpable record of the *first*, than in any other part of Scotland. We have now to see if we can in any way, or in any degree, definitely consider it in its relation to the second,—the register of time.

The ridge of Stack Polly was selected as exhibiting the greatest amount of ruin; and, as the accuminating processes of decay have cut



TOP OF SUILVEN FROM N.

M. F. H. Del.



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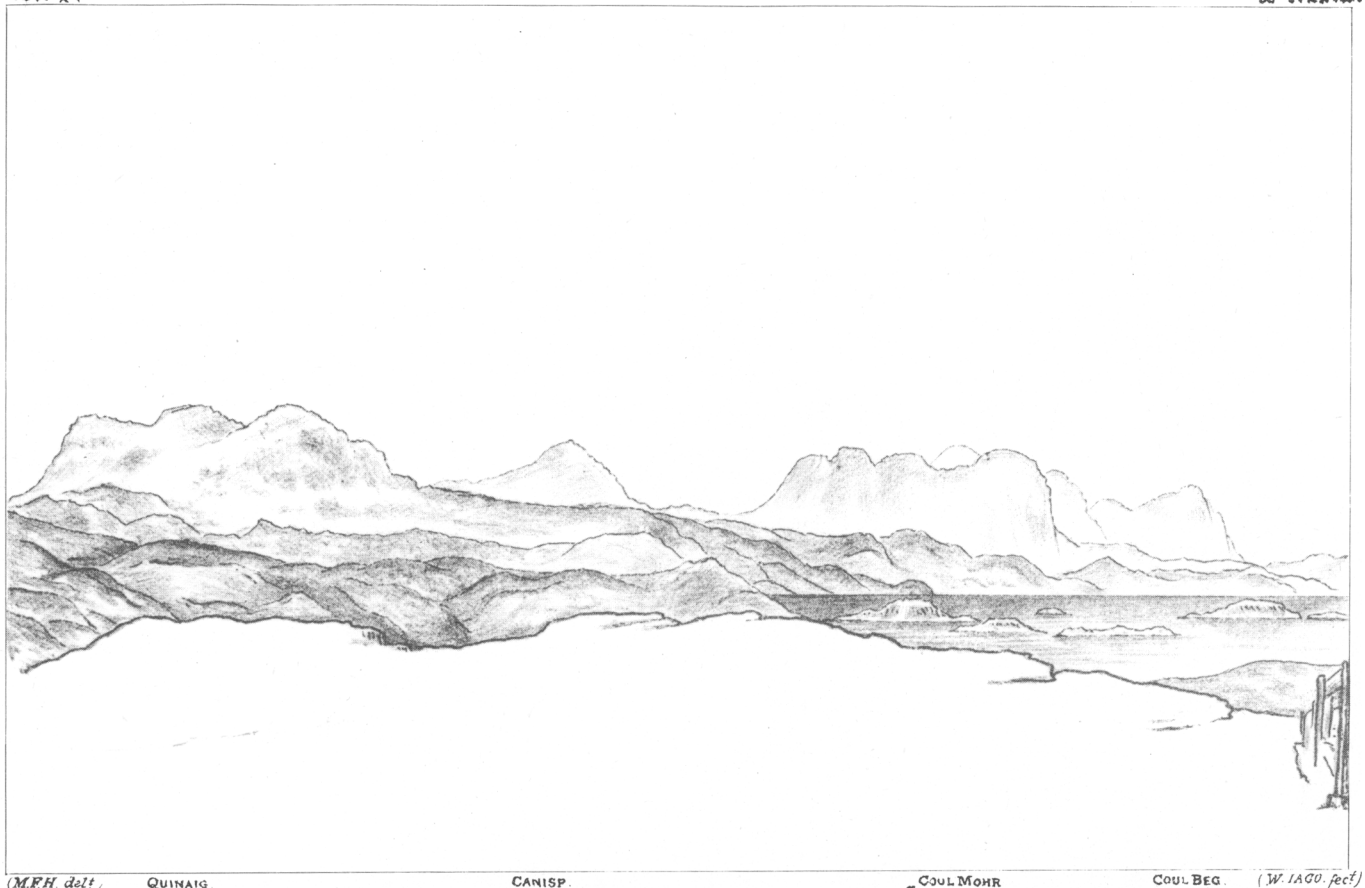
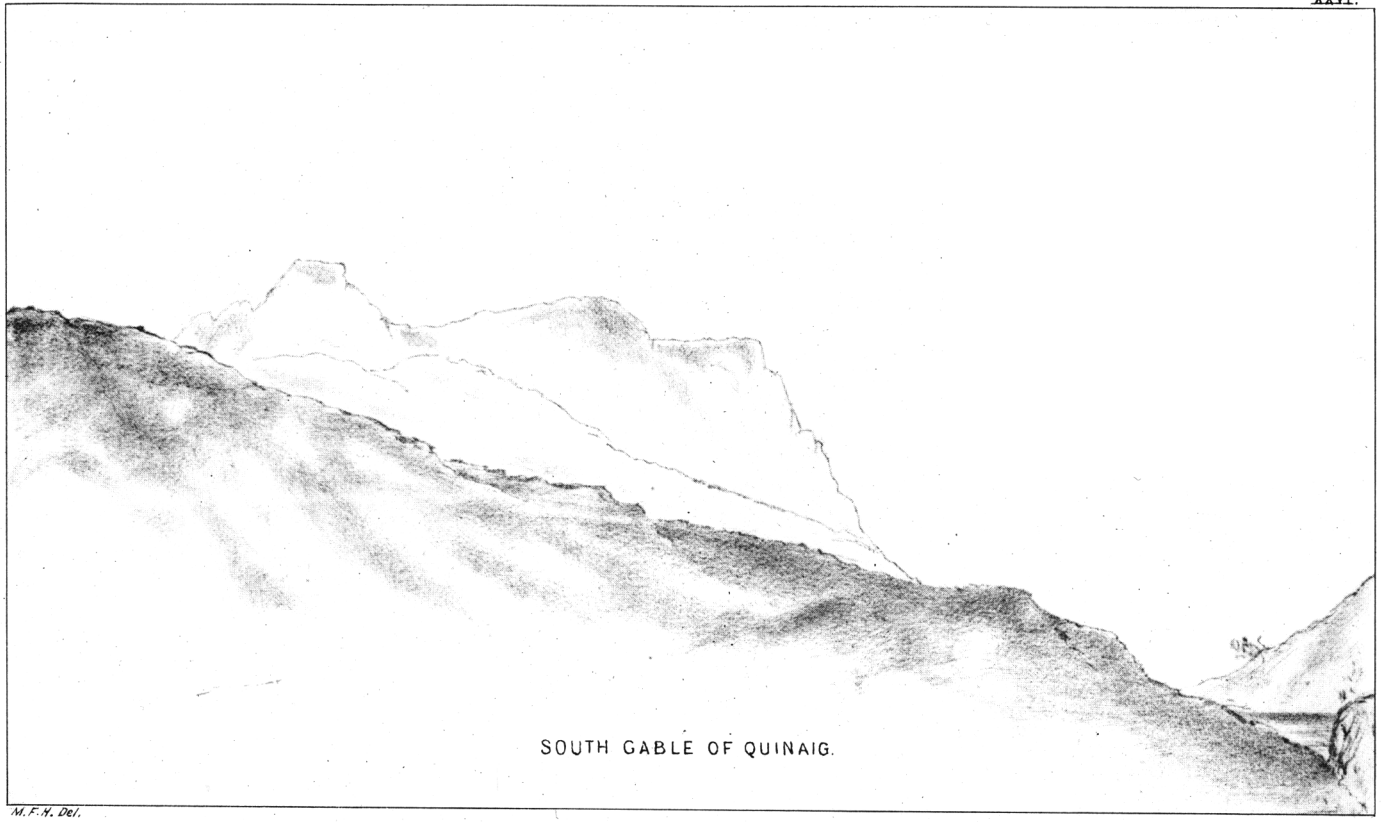
Western Escarpment of Quinaig.



Broken Escarpment of the Conglomerate, seen in Flank. —— from Handa.



SOUTH GABLE OF QUINAIG.

M. F. H. Del.

away its slopes, so that it is in that last stage of ruin, which exposes the increased surfaces of a ragged edge, disintegration is here advancing with abnormally rapid strides. Parts of the rock, as stated, are being blown away in sandy dust.

The contemplation of such a spectacle of rapid disintegration as is here presented, would lead one to conclude that the time requisite for cutting out the trenches which lie between,—or, to be precise, which *actually form* the Torridon hills,—need not have been by any means vast.

When the features of the formation as a whole, however, and the circumstances which obtain at this one spot, are considered;—in a word when the *mode* of sculpturing here and elsewhere is investigated, it will be found that the spectacle at Stack Polly is altogether an exceptional, and a very misleading one.

It was stated that the beds of this rock were divided by a "rude prismatic structure:" this is a marked feature of the formation. It is the falling together into one line of many faces of these prisms, which gives rise to that rectilinirity of the cliff-faces which is seen to prevail. Other faces falling together, produce more or less continuous transverse rents. Into these the peeling of disintegration throws the sand-grains which fall from the opposed surfaces; and out of these the wind, striking the flatly-extended line of cliff, sweeps them,—as it insinuates itself with concentrated force into the crevasses, like the separated fingers of an opened hand.

As the prismatoidal rents pass down through many beds, the rock is gradually cut up into a system of isolated rugged pillars. Striking instances of these are seen in Teallich, Coul Mohr, and most markedly in the "Old Man" of the Rhu Storr.

At Stack Polly the sides of the pillars have peeled off; until only needles, separated from one another by rents, widened into wind-funnels, now remain.

The disintegration of a Conglomerate rock is accomplished by the loosening asunder of its component granules, through the soak of water,—very much more than through the per-oxidating effect of the air. The rounded and agglutinated granules had come through a worse trial as regards the attacks of the latter agent, when they rolled as a loose shingle, than they had to do when packed together as a mutually cohering mass.

The amount of action of solvent water upon a granular, that is an interstitially-porous mass, is in the direct ratio of its penetration. In calm, that penetration is simply due to capillarity; under wind-pressure it becomes wedge-action. A sandstone wall may make a dry house if

the rain is merely streaming over it, in calm:—that rain streams down the innerside of the wall when blown through in a storm; and that the more, the heavier the gale.

Say that the penetration is an inch, with a wind-pressure of 10 pounds on the square foot, on the wall-precipice of Quinaig:—what is the pressure, and what is the amount of this loosening penetration, at the top of one of the wind-funnels on Stack Polly's ridge?

One such funnel the writer ascended,—situated on its N.W. face. It was about five hundred and fifty feet in height; and the extent of cliff-front, which in a northwest wind would direct the blast into and up this funnel, was about six hundred feet, at the base. The whole of this concentrated force of action, (which,—making a large allowance for a great deal being thrown out of the funnel by its elasticity,—must yet have approached the point of liquifaction of the air,) was thrown upon the narrow neck which connects the summit with the ridge. What has it done there? Doubtless it formed that neck originally; but lately it may be said to have cut the neck in two. The exact date at which the Cairn on the summit was erected, we could not ascertain; but that Cairn, now overthrown by the wind, has not been reached for seven years. And after all, the *one step* which was blown away, grain by grain, and the want of which renders the summit inaccessible, was little over a cubic-foot in bulk.

While a cubic-foot, in say twenty years, seems a most rapid destruction, it has to be borne in mind, that elevated ridges of hills, which catch every wind, and which are so constantly steeped in mist, or enveloped in condensing-cloud, are altogether differently circumstanced from the main bulk of rock which lies in comparatively sheltered trenches; and such spectacles of destruction as are to be seen upon Stack Polly, however instructive in their way, are altogether misleading, in a consideration of the time necessary for the removal *of the general mass* of a formation.

It indubitably would be equally aside of sound arugment, to maintain that those portions of this formation which have been removed, were the softer; and that the remaining fragments were self-evidently more enduring, because harder. The nature of the even-bedding, and the unvarying texture of the many layers of the rock, in themselves form an ample contradiction to such a view.

The occurrence of east and west faults, either in the centres, or along the lines of the trenches, entitle us on the other-hand to hold, that the already-considered process of continuous widening of a crack, and sweeping out of the resultant waste, might have been the first step in the process of this trench-formation. That the succeeding steps

may have consisted in the rush of waters through the wall-sided chasm so formed;—in the establishment of a drainage system,—and in the continuous downward wash, and slip and slide, and flood-scour, which constitute the various steps, by means of which a rain-drop is the primal operator in the forming of a valley. And thus we might argue that it is through their *intermedicity between these faults* alone, that the the remaining fragments stand. But while holding that the ordinary processes of valley-formation, operating along lines of weakness, are sufficient to explain the isolated position of these residual masses, the preponderance of probability indicates another mode of channeling of the gaps which occur in the continuity of the formation. Indeed the level of the Hebridian pediment at east and west, is too perfect to lead us to believe that the scour of running water had much to do with the abstraction of the material which originally linked hill to hill.

The facies of those lines of rock-wall is altogether that of sea-cut cliff; so much so that we can scarce entertain any other explanation, than that an angry ocean had for long ages lashed in fury against their sides; and formed the basement-line out of, and over which they rose, sheer and inaccessible.

And in this consideration of the mode of waste of this formation, we cannot but pause as the spectacle which these isolated rock-islands must have presented, images itself forth upon the mental eye. No such spectacle does Britain anywhere now present:—much do we question if such is to be seen in the wide-world.

It is worth the seeing, and there is but one way of seeing it;—clearly, as if by open vision, has the writer often seen it;—he could even *picture it;* but it is indescribable. The Farões shoot up their trappean cliffs from deep lanes of water, with a precipitancy so great as almost to close the land over-head, and eclipse the Zenith; but even their stepped rocks would appear altogether tame when compared with those of mountains standing isolated in the sea. St. Kilda is of the type: sprinkle the Ocean *with a group of such,*—gigantic in their bulk,—and then consider the picture.

Whether the land was dissevered by scouring rivers, or beating waves, matters little in a consideration of the amount of force, and of the time requisite for the work:—both are but modifications or outcomes of the same primal power. Deltas might establish the operation of one; sand-banks and shoals of the other; but the clean sweep of the after ice, has left neither:—so that calculations which we might have based upon either, are not within our reach.

We may cite the extreme apparent hardness of certain portions of the rock, as an offset against the loose grains of Stack Polly. Or point to the rolling boulders on the shore of Handa; the smooth external polish of which, equalling that of the surfaces of the imbedded nodules themselves, points to a durability which has, through long ages suffered no diminution. We simply find ourselves, with the data within our reach, unable to master the problem of the time, or the force called for to accomplish this great disrupting work. Fortunately, it has been approached from another starting-point; and a sister science has held out a helping hand. We have all agreed to go to the Sun as, of material objects, the one from which all force, as concerns our Globe, emanates.

Dr. Haughton, in a very remarkable paper lately published, (from which I extract, briefly, results only) lays down, that—The heat *received* by the Earth per annum, would melt an average thickness of ice over its whole surface of 80 feet. The mean annual *radiation* of heat *from the Earth*, is equivalent to melt a coating of ice 28·5 feet in thickness; so that we have 51·5 feet of ice representing heat, *not accounted for as heat*, (for the mean temperature of the Earth's surface is not being increased year by year).

This large balance of heat is expended,—

1st. By being converted into geological work, done by rainfall and rivers.

2nd. It is converted into chemical and vital work, done by vegetables and animals.

The mechanical or geological work done in crushing to fine powder a cubic foot of rock, was estimated from data taken from the stamps of Polberro Tin Mine. Each stamp weighs 600 lbs, and is lifted and falls through 9 inches, 45 times in one minute. Each stamp crushes 28 cwt. of tin-stuff in 24 hours. Hence the work done in crushing one cubic foot of rock is equal to 713·5 foot-tons.

The geological work done by rain and rivers, takes 3,090 years to crush and carry off to the sea, one cubic foot of surface rock. (One foot in depth evidently meant).

So far Haughton. Let us now apply this: taking a portion of the district under review, to do so.

Suilven stands in nearly the centre of a great denuded tract; it remains as a voucher for the ruin and removal of all that once connected it with Quinaig on the north, and Coul Mohr on the south. It was hewn out of a great flat sheet of the Conglomerate, in much the same way that there is reason to believe the Sphynx was hewn out of an isolated block of stone, in the Desert: from both, the sides were cut

away, and the residual block fashioned very much each in its present image. From Dr. Haughton's data, we can get at the amount of force necessary, and the time necessary to cut out Suilven; and then we can calculate the cost.

The depth of the formation is got at by drawing from the height of Quinaig, say 2650 feet, an air-line to the top of Coul Mohr, say 2,700; and abstracting the height of the Hebridian foot of Suilven, say 650 feet: leaving 2,000 feet of thickness, cut away. This, multiplied by 3,090 years for each foot, gives six million one hundred and eighty thousand years, for the time requisite for the full *geologic-work power* of the earth's share of sun-force to accomplish it in. That is for *the chiseling out*, but not *the building up* of the hill.

In laying our rule across the country to ascertain the amount of work for calculating the cost, we have to apply it, first as regards the *width* of the rock which had to be removed, in order that the tombstone might stand well isolated; and we find, that from the cliff-face of Quinaig, to the equally well-cleared off frontlet of Coul Mohr, is eight miles, (42,440 feet); that is the narrowest part. Next, for the *length*. As no other tombstone has been left to obscure the view, either in front or rear, the Conglomerates are clean gone, from the point where they dip under Canisp, to where a fault, apparently, has hitched them down out of the way, at Stoir. This is eleven miles, (58,080 feet).

42,440 × 58,080 × 2,000 = 4,889.830,400,000 cubic-feet,—or 181,105,829,629 cubic yards of Torridon, to be shunted out of the way. And this had to be done, not by dynamite, tossing a thousand or two of tons aside at once, but grain by grain; through the operation of a process which *used up* precisely the same amount of sun-energy as is consumed by the force employed in crushing by a stamp-mill.

What is the labour-value of this work?

In India and Australia, where the time-value of attendance on stamping mills is the lowest; and where experience has adapted the force of falling water in the most perfect and the most thrifty manner, the lowest cost of crushing a ton of rock (after it was quarried) is three shillings and seven-pence.

Each cubic-yard of the Torridon rock may be taken as weighing two tons. So the *money power* necessary for cutting out this one hill is £63,386,690,587. This may be regarded as the value of Suilven,—*scenically*: and it imparts some faint idea of the immensity of the forces of nature!

The *second element* of the diverse scenery is afforded by an almost

equally dissevered range which stands immediately behind and eastward of the sentinel-hills of Coigach.

The hills of this more easterly range, from the purity of their colour, and from the brilliancy of the light reflected from their peaks after rain, were declared by Pennant to consist of marble; but the material is quartzite.

Occasionally they stand isolated, blocking up at short space behind, the interspaces of the Torridon range; generally, however, the rock which composes them forms merely a cap to some portion of these elder-born hills.

We have already seen that when the old Hibridian land was depressed, and when the gravels and grits of the Torridon sandstones were deposited upon it, the eastern range of its hills still remained above water. But it was not so when the land again sank.

There is no peak, not even the loftiest of the range, which was not now overflowed.*

The shore-line of the new sea was not far distant from that of the older, though here again denudation does not permit of its being laid down with any pretension to accuracy. Two facts are patent,—the waters in which the sediments which were to form the new land were laid down, lay nearly altogether to the *eastward* of the previous; and these waters, with the coarse gravels and sand which settled in them, overlapped to an extent of over a mile westward, the shore-line of the Conglomerates.

The fact of, and the manner of this overlapping, renders it easy to fix the period when the great trenches of these conglomerates were channeled.

First, as to the manner of the overlapping. It is, at least for a long stretch in the northern portions of the junction,—in fact throughout all the Sutherland and Cromarty portion of it,—easily seen that the two formations are not conformable. The contrast of their colours makes this readily observable. The easterly dip of the Conglomerate averages 5°;—that of the upper formation, which is also easterly, averages 7°; while in its dip it swings more round to the south.

It is evident that there had been some amount of denudation of the outcrop of the Conglomerates, before the covering beds were laid down; it is also evident that now the great *general depression* of the land, or at least the *localisation of the sedimentation* was to the east; this is proved by the upward succession and continuance of these beds in that direction; while the higher dip of these to the east is strong ground for holding that the sinking land subsided to the *greatest*

* I cannot speak as to the Maiden, never having ascended it.

vertical extent to the westward, but was, upon re-elevation, restored to much the same horizontal level it had stood at when the table-land of the old gneiss was formed.*

The overlapping of the Conglomerates had to be upon their upper beds—but that overlap must perforce *have shown itself upon their lower beds also, if these had been trenched by any local denudation, previous to the sedimentation of the newer rocks.*

This overlap is seen stretching westward over the slightly-denuded outcrop-beds of eastern Quinaig; it sweeps up the hill to an altitude of about 2300 feet, and to within a fourth of a mile of the peak; and its altitude upon an opposite peak might entitle the assumption that, had it not been since denuded off, it would have appeared overlying the summit itself of the hill. The opposing peak of Torridon Sandstone upon which it appears, is the more northerly and more elevated of the twin summits of Coul Mohr. It is an outlying patch of quartzite which thus appears; but the main bulk of the rock creeps over the eastern bosom of the hill, into close proximity with the outlier.

Thus then we see that the ocean of this new rock,—the snowy Quartzite,—had extended westward, at least to the line of the summits of Quinaig and Coul Mohr, and had there welled upward to a present altitude of over 2600 feet.

Had then the great trench-valleys which lie between the Torridon hills—as the two between Quinaig and Coul Mohr—existed *before* or *when* the land was depressed, the waters would have rushed into these gorges or channels of the island-hills, and *deposited in them* the lowest beds of the quartzite.

But no particle of the quartzite has *there* been found;—it extends westward only on the hill tops;—it is there that the lowest, most pebbly beds are found. The denudation of the Torridon was quite trifling before the deposition of the quartzite. That quartzite therefore was laid over it while the lower rock was still a continuous belt; and that enormous transverse scooping of the Torridon, which resulted in the formation of those monolithic hills,—which according to

* There probably was a fault some miles to the west,—the Lewisian Land being left, throughout the deposition of the quartzite, above water. Was it the fault which cuts-off Handa? It would be an easy explanation of the reversed dip of the Torridon rock—usually S.E. in Sutherland, N.W. in Torridon—to hold, than an axis of elevation ran up the country along the line of reversal. It would be most satisfactory if this could be found; unfortunately, although that line is in many places admirably exposed for investigation, there is evidence *along it* of neither folding, crushing, nor of fault. Of course, in accordance with the requirements and dogmas of fire-side geology, there *must be* one or other.

Macculloch, "have *no connection* with anything around them,"—but look "as if they had tumbled out of the clouds,"—took place in some comparatively recent time. Certainly more recent than the faults which have cut through both formations;—a time indeed when Conglomerate and Quartzite, and still more recent rocks, were trenched together.

So that here as elsewhere, "Nature's first step—like the patriarch of old—had been to bury her dead out of her sight. She hastens to conceal and hide the ruins she has made. Then after a time,—often a long, long time,—she again exhumes them, bids them as it were live anew, rise up and tell their story."

In the marked contrast afforded by the dead-white quartzite capping the purple grits, and in the full exposure of that contrast in the clean-cut transverse trenches, we have arrived at a *second* explanation of the striking scenery of the west.

For *the third*, neither eye nor foot has to stretch far; we have but to step a mile or so further inland,—passing over the debatable ground, the shore-line of the ancient Torridon Sea,—and note the strange contrasts which present themselves, where the snowy rock sweeps over and inwrapps the higher summits of the sombre Hebridian Hills.

There is here far from the same tranquil reposing of the one rock upon the other, that we found to obtain where it overlaid the Torridon. There was not here as there, anything like a gently-sloping platform for the sedimenting sand-grains to rest upon. The bottom was one of the most uneven imaginable; for the range of hills had, during two successive epochs, stood bared to the agencies of waste, and had been cut-up into sharp-featured, and, in some cases, into isolated peaks.

From the vast quantity of debris which has rolled down all the slopes of those hills which are capped by the quartzite, it is not easy to find spots where, either on the slopes or at the lower parts of the hill, the foundation-beds are disclosed; and so co-ordination of the several beds is well nigh impossible. Nor is it easy to pronounce where the faulting has let down a huge junk into a totally anomalous position. But from their great thickness in some localities along the strike, and thinness at others, there is every reason here to believe that the sands may have been in some spots deposited in pre-existent troughs.

The great hill of Arkle seems to have been cut out of such a sand-filled trough; if not so, the space between Fionaven and Stack must have been faulted down, before the more recent denudation carved out the hill.

Ascending Foinaven, which flanks it on the north, we do not, at a point immediately opposite to Arkle, reach the quartzite until we attain the height of about 2,500 feet. Upon Stack, which opposes it upon the south, we find the lowest pebbly beds of the formation at the height of 2,350 feet; while in Arkle there are beds (but whether the pebbly beds, cannot be ascertained) as low as 800 feet, resting upon a low hill of hornblendic gneiss. From off the southern portion of this low hill, they have been denuded, leaving a flat terrace, which slopes gently to the east, but precipitously to the south. This terrace when viewed from the swellings above the head of Loch Stack, has a most singular appearance; forcibly illustrating both ancient and recent denudation.

This central district of the range is typical as exemplifying outlier cappings of the quartzite.

Its more northerly stretch however, illustrates what may be regarded as the appearance normal to a hill-range, which is overlapped by a new formation. Northward of Foinaven, the linked chain of hornblendic hills is taken up by Cranstacach, then by Spionnaidh, while lower elevations stretch onward, to end the land in Kean-na-Bin.

Of these hills, the first-named are overlaid by a long sweep of quartzite, in a range of vertical precipices of over 100 feet in height,—the over-lying beds drooping gently eastward till they pass under the waters of Loch Erribol. From off the green hornblendic rock of the more northern, the quartzite has been denuded.

The continuous eastward slope of the sterile quartz formation has conferred the name of *Hill of Desolation* upon the middle height. No spot of earth could surpass it in sterility and deadness, it is typical of inertness and absence of motion. "All this barrenness, sterility, utter absence of life, is the result of the indestructibility of the quartz. It is dead, because the ordinary powers of nature cannot act upon it. It wants the higher organic life, because it endures too long as an inert inorganic mass."

Regarded from the west, again, as we pass down the lower Strath of Dionard, the appearance is altogether different; for the towering green rock, capped by the long stretch of white, is the very embodyment of a great ocean-billow, sweeping westward with its curling crest of foam. In Meal Maonich and Meall Meddin, the billow is heaving upwards, but the curling cap is gone.

The main bulk of the quartzite,—and this belongs to the highest member of the system,—lies in the vicinity of Ben More and Braebag.

There is much greater thickness here. The unevenness of the bottom partly accounts for this; for the Hebridian rock had here been denuded down to an altitude of about 1,500 feet; only one small point indeed of such an altitude,—which is seen west of the Dhu-loch-More—appearing. But there is also here a much greater actual thickness of the formation.

The hills of this upper series bulk well as back grounds, from their tone of colour exalting the effect of those already noticed; but they cannot, apart from their gashed and riven cliffs, be said to be possessed of either grandeur or beauty. "Their cold, spectre-like aspect, when remote, is almost warm and living, compared to the bare icy sterility that reigns amid their glens and corries. The rocks smoothed and polished by ice-action, shine with dazzling whiteness. No flower or tree, scarce the hardiest lichen can find root or soil in crack or crevice. Rare patches of black moss—blacker from the white basin in which they rest,—a few detached stones, broken by the winter storms from the higher pinnacles, alone diversify the surface. There could scarce have been less life there when the snow nevé filled the upper corries, and the ice-river flowed down the Glens."

Still, here, just where something is wanting to break in upon the sameness of their interminable bands of white stone, that something appears. An interstitial band of grey limestone finds a most fitting place; here, presenting a craggy ivy-clad frontlet, there a stretch of verdant sward; here a chain of pellucid lakelets, and there again just that sufficient glimpse of the greenery of cultivation, which introduces the element of human sympathy into the scene. And here, yet again, to relieve the eye both from sameness of colouration and tameness of outline, there start up bosses of igneous-rock, and cleft face of fault,—intruded sheet, and great lime-swallow; churning the land into a tossed heap of fragments, so that this is the accepted summer-haunt of the querulous, the much affected battle-ground of the quarrelsome.

Had we to assign special forms to the hills of each of the foregoing formations, we would connect the conoid form with those of the Hebridian rock; the serrated ridge with aiguille peak would be assigned to the Torridon, and the long cliff-face escarpment to the Quartzite.

The forms assumed by the latter formation, however, depend much upon the underlying rock. When this consists of the Torridon sandstones, and the *lower* quartzite is under consideration, the definition of long cliff-face escarpment applies; because, from a certain similarity

both in the mode and size of the jointing of the two, and from the *underlying* rock giving way most, the amount of debris which results from the waste of each is much the same; and this debris having been equally thoroughly scoured off, clean-cleft cliff-faces, and hill-slopes but thinly covered with fragments, generally appear.

But, with the *upper* quartzite, and the uneven bottom of the old gneiss, it is very different; the fractures of this upper-bed are very much more numerous and open; in many places the rock, nearly pure silica as it is, appears rotten, and is highly shattered and fragmentary. There is a northerly projecting spur of Foinaven, which has a sky-line like the backbone of a skeleton horse; while the south-westerly shoulder and slope of Bræbag is a mere heap of ruins.

There is something altogether extraordinary at first sight in the amount of looseness of the clean-cleft blocks which lie in enormous profusion over this rounded, but exceedingly steep slope. One might almost suppose that they had been sparsely imbedded in a calcareous cement, which, having been dissolved away, had let them light upon each other, in all positions of loose arrangement. Each one seems to be upon the move, so that the descent over them calls for a most attentive eye and an ever-agile ankle.

The extreme looseness of the stones upon hill slopes had often puzzled the writer. Upon hill tops, the constant drench and drain of water cleans out and sweeps off all small particles and binding clay; upon most rock-runs and "scridans," the surface-stones at least, have been chance-caught, as each was experimenting for itself upon the angle of rest. These are evident; but the cause of the looseness of stones upon *moderate* slopes, and in such positions as that on Bræbag, the writer only attained to the knowledge of, very recently.

Mentally he saw it, or saw through it, a few years ago on the cliff-foot of Cranstacach; visually he *saw it operating* a year or two after, upon Am Binnian, in Perthshire.

Driving snow and sleet is forced, first from this side then from that, into every crevice of the loose-lying blocks. As these blocks have the warmth of the earth, a certain amount of the snow is melted. The water trickles into the crevices, and is held by capillary attraction in the narrow chinks between the stones, and in the close neighbourhood thereof. At night this water freezes;—expansion, irresistable expansion takes place; and every stone, at least of the superficial layer, is lifted upwards; settling, when the thaw ensues, gently down into an altogether-loosened poise.

So, precisely as the bird, by thrusting its bill through them,—or the dandy in "sprushing up his hair,"—so does old Mother-Earth

yearly plume herself,—shaking her stone-feathers loose. The only difference being that she chooses the winter-time to do it in, and the dead of night.

A strange feature of the scenery of this sterile formation remains to be noticed.

The closeness of the rents and fissures, especially of the superior member, has been adverted to; it was specially instanced in the loose blocks of Bræbag, and the stone-runs of Foinaven. But disintegration goes no further; that ultimate loosening of the cohesion bonds of the rock, which would result in shifting sands, is nowhere seen; and thus, grim and ghastly, like the dead bones of an older world, it protrudes above the surface.

It is the destiny, and it is the duty impressed upon every particle of matter on this globe zealously to prepare for a new service as soon as each earlier commission is performed; and, measured in the great cycle of revolving time, it is not long that any particle lingers in any one stay,—in the performance of any one function,—or as the special property of any one fabric;—for it is urgently called for by others. The wondrous machinery of nature is fashioned of materials, which no one of its parts can ever claim as peculiarly or abidingly its own. The attrited nodules, for example, which went to form the eldest-born conglomerates,—fall out of place, ever to rise higher and higher, performing, with constantly diminished bulk, the self-same function, to younger and still younger rock.

Similarly rounded and worn *pebbles* of this quartzite formation have been recognized by Bonney in the conglomerates of Arran, and in the Bunter pebble-beds of Staffordshire; and the writer has fancied that they formed a part of the conglomerate of Heclabir in Orkney. But the *sandgrains themselves* are not set free,—as usually obtains in a sand-grained rock.

That this is, and was such a rock is proved beyond doubt by the myriad worm-holes which pervade it. These may be seen in ascending Bræbag from Lynn, throughout the whole thickness of the last heave of the mountain,—over 1,500 feet.

At right-angles to, and through each bed, of less than two feet in thickness, do these plugged sand-pipes pass; sometimes proportionally as close as are the holes in a draw-plate. Silent witnesses,—beyond number numberless,—to the fact that the whole great hill was in its successive layers once tide-washed by the waters; and that its shifting grains then gave place, and yielded a ready passage to such a teeming of existences as, in the life-history of our globe, has never been surpassed.

But these sand-grains yield no longer. They are now united by the dovetailing of partial inter-penetration, and by the cincture of silicious and ferruginous cements; and that so closely, that the rain-drop finds no chink for its wedge-edge, and nothing which it is potent to sap out.

Neither have the *saline* waters prevailed, in effecting more.

"As the sands of the sea-shore for multitude." Of *what* sea-shore? Truly he would be far-travelled who could point to the *sea-shore* whereon there were no sands. No tropic,—no clime,—no country; unless it were an ice-fringed verge. Nature,—conservative in general principle, willing to submit only to gradual and slow change,—knows well her best breakwater, and spreads out her gently-sloping sandbanks to fringe the land, and cheat the billows of their might by that gentle yielding, or appearance of yielding, which turneth away wrath.

As for *country*, so for *formation*; silica prevails throughout. Our own country teaches us this, not less well than any. The Hebridian gneiss of the Long Island is fringed on the west from end to end with great tracts of loose sand-grains. At Sandwood and at Kearvaig, the Torridons show the same. The disintegrating quartz-bands of the Upper Gneiss have filled up grand harbours, and *made* the cockle-growing Kyles of Tongue and of Duirness; great cliffs of the Old Red lie grovelling in the Bay of Thurso; so also of Coal-measure shores; and the recent formation at Gruinard, whatever it be, has, as it blows about, given the name of *Sand* to the locality.

But it is not so of *this* formation. It is anomalous in its lethargy. The bond which unites its particles is indissoluble; and the sheeted slopes of Spinnu, plunge, unswaddled by any such fringe, into the deep dark waters of Loch Erribol;—for the rock is, in its very nature, *iron-bound*. So is it also that it endures, the highest land in the county; but, in *even-bedded and shapeless forms*,—for it is unhewn; and, with the chisels at present at the disposal of Nature, it is unhewable.

The effect of lime as a fertiliser is nowhere so strikingly apparent as where it occurs in but small amount; or in isolated spots among rocks which are destitute of any mineral containing it. In this district of Sutherland, highly siliceous rocks so prevail, that its effect as such, may be said to be exalted into its acting as a *populator*. Such has for long been its enduring, or rather it may be said, its *still-abiding* function,—from Erribol to Loch Kishorn. The clustered hamlets at Innisnadamph, Elphin, and Knockan, give evidence of local amplifications; while intermediately-disposed shepherds' houses form with these the connecting links of a far-extending belt of greenery.

Beyond or aside of this, the limestone has little effect upon the scenery; it has indeed little of its own that is visible.

Of that which is invisible, except to the mind's eye, it has much; and a wondrous scenery it must be,—judging from the glimpses of it which we can obtain.

The traveller who passes along the road which, southward of Knockan, skirts the foot of the great limestone cliff, must, after wet weather, be delighted by the numerous gushing springs which discharge their sparkling waters, apparently from forth of the solid rock. These, however, from their small size, can hardly prepare him for the spectacle of a rapid-running brook, issuing from beneath his very feet, to whose sources and beginnings the perseverance even of a Livingstone could never attain. On this side of the road it *was not*;—you rest upon the solid rock, which towers overhead. On that,—there flows the brook, ready formed; rushing with such ample and such swift flow, that you speculate whether even the agile trout could stem its waters, and shoot into those dark abysses to learn the secrets of their mysterious vaults.

There can be but little doubt that the faulting which occurs in connection with the limestone throughout its whole range, suffices to explain its hidden streams, its "sinks," and "swallows." The surface-waters,—finding their way into rents, which primarily were no more than breaches of continuity,—soon would dissolve the walls on either side, and form free channels of escape.

To such an extent has this taken place eastward of Stronchrubie that the whole formation is in a carious condition. Loch Maolock Corry catches the drainage of an extended district, but the point of the escape of its waters is for the most part undiscernable. That they do escape, and that in no stinted flow, is vouched for by the "Boiling-spring" which gushes from the south side of Ben na-creisag: and, on the north side of the loch the secret is to a small extent declared, and a brief glimpse of their hidden workings is vouchsafed.

For short space the waters of a limpid stream quietly glide between softly-swarded banks, suddenly to be precipitated into the abysses of a gaping chasm. The horrors of that yawning gulf seem only the more horrible from the elastic softness of the green mantle which creeps to the very verge of its treacherous lips.

Short shrift to him beneath whose incautious feet that verge crumbles; jagged projection, and alternately protruding buttress, would unjoint him piecemeal, as he shot from the bright reflection of limestone effulgence, through that grey-gloom of middle distance, to plunge into a blackness of darkness, which looks solid in those far-off depths.

But it is far from solid. The thunder of the ever-falling waters sends up a hollow boom which tells of oft-repeated plunges; and the tortured and disjointed surface, gaping ever and anon with inosculating rent, and trenches cinctured with treacherous sward, speak to the rottenness of the land. The firmest foot may well tremble; the stalwart stride, brings no safety to its possessor, for *it* will be the first to break the crust. Tread gently here, you are over a grave, and the firmament is "waning awa."

Göthe must have been in Scotland! He must have looked over that horrent verge; he must have imagined *his* body taking that crashing plunge,—or he never could have written "Abandon hope,—&c."

Could the passage be explored? for the waters come to daylight again, less than a mile to the north. We should like to try,—armed with a rope, a pair of miner's clamps, a bag of compressed air, and a pocket-full of condensed sunshine, in the form of magnesium wire. And we might, were it not for the treachery that is around, above, on either side, and below. What hidden horrors there must be in that "middle passage," what scenes of gloomy grandeur, domes of blackness, and pitfalls of pitchy perdition!

Why go to the Mammoth Cave when we have a place like this in Scotland? There surely might be satiety with a tunnel a mile long! Could a pigeon be trained to prospect,—they are curious after holes! It were vain,—for the roof doubtless dips into the waters, with repeated flexure, and bars the way:—"*there is a path which no fowl knoweth, and the vulture's eye hath not seen.*"

The waters of this burrowing stream steal to light in the most covert manner, muddling themselves up with those of surface rills which have accommodated themselves to the "caved-in" trench of the subterranian channel. But there is just such-another darkness-loving rivulet, in the north of the county, which debouches in no such stealthy fashion; but which, from its raising its head just at the ocean's verge, as if it desired to render its tribute to the main with no insidious gliding, has produced a scene, to use Macculloch's words "alike extraordinary and impressive."

This is the cave of Smoo.

It is significant of its wonders that even the graphic writer above quoted has failed utterly in describing it; and, from the excuse which he offers, he seemed to have been conscious of his failure.

But even a greater than Macculloch would seem to have considered it beyond his powers. That he who wrote the wondrous descriptions of Coruisk and Staffa, should feel himself unable fittingly to grapple with Smoo is most significant; and we believe that by most who

thoroughly, and *in fitting circumstances* explore it, it will be regarded as the most wondrous scene ever beheld by them.

But the spectacle at Smoo is dependent to a very unusual degree upon circumstances ;—the circumstances here called for being an over-flowing volume of water. We do not suppose that even Niagara would be much *as a cliff*, if its waters were dried up ; and certainly Smoo is reft of all its eerieness and gloom, and of much of its glamour also, when visited in drought.

It may have been considered that in our remarks on the scenery of Sutherland, we have made use too much of the penetrative eye of the geologist, in detailing *subterranean* pictures ; but *here* we must descend to a still lower depth,—nearer yet a step to the central core,—and consider much that is *subaqueous*. Little that is subaerial has Smoo to show ; but that little has a charm which contrasts most forcibly with, and enhances by a contrast of altogether-unrivalled abruptness, the pandemonial blackness of its other scenery.

In ancient days a rivulet has thrown its waters in spray from off the verge of a straight-lined limestone cliff; and through long ages has eaten back, at right angles to that verge,a wall-sided trench ; this has an inward depth of over four hundred yards, and an altitude of well-nigh a hundred feet.

Those who wish to know the colour of pure Atlantic water may learn it, in the flooring of that chasm. Such cannot be seen in the English channel, or in the Pentland Firth ; for these are but the drains of the German Ocean,—the mud-polluted cesspool-sink of all Europe. It may be seen still purer to the west of Harris ; but that four hundred yards by fifty, is so glorious in its pellucid green, that it sparkles gem-like,—even in similitude of a huge aquamarine laid down upon the land.

The southern land-floored end of this great trench is a *cul de sac*, half-domed and roofed by a thin shelf of rock. The light which slumbers within that dome, once seen, is *felt*. The light—what they have of it—of all caves is fine ; that of this is surpassingly lovely. Poets would call it a *chastened* light. If by that, is meant that it resembles a character which, through the buffetings and disappointments of the world, shines with a softened sweetness, we partly understand the application ; and it would here be a fitting one. For chemists,—monsters, who are always insisting that "lovely visions are to yield their place to cold material laws"*—tell us that while the light which

* Beg pardon, Sir; chemists and other naturalists only maintain that beauty will be appreciated all the more if its *causes* are understood. P.D.

Right, my boy;—and so the *primal source* of these "causes" more nearly approached.

is reflected from a smooth metallic surface shows but little of the colour special to the metal, from its being overpowered by the glare and glitter of polished reflection, the same light when reflected back and back again from two similar surfaces, gradually loses the false glare, and becomes subdued; shining ever more and more strongly with that tint which is of its own true and inner essence. And here it may be the case that what little light finds entrance is reflected over and over again, beaten back and back with repeated buffetings from the cold grey walls of the opposing sides of the chasm; so that all false glitter, and mere blaze being eliminated, it shines in its own true tints, and with "chastened" splendour. And truly if the buffetings of the world could only educe from the character such soft sweetness as that which hangs mistily in the outer cave of Smoo, one might willingly, after presenting the one cheek, turn and exclaim—"this is the other, now."

It is in such light, that the pillars and fallen masses of rock, draped in their lichen-grayness and fernery of green, are steeped,—upon *one* side of the Cave. Upon the *other* they are not steeped, but drenched in dews which come not from heaven, but from——well, from an opening which looks very like one of the gates to it.

This is not only the other side of the Cave, but it is very decidedly the other side of the picture also. Blackness is blacker than blackness itself, when there is white near it, or mixed up with it; this is the case in the west wall of Smoo Cave. From forth of a perforation like a cathedral-window, but black as night, there roll and gush volumes of white misty vapour,—flung like snow-drift upon the dark night;—issuing unceasingly, as if the store of energy which propelled them was infinite; and backed within the gloom, by the crash and thunder of falling waters.

In order to ascertain the cause of all this turmoil, it is necessary to procure a boat; for a strangely-boiling chaldron intervenes in front of and below the only apparent entrance to the gulf within. That this is, apparently only, the sole entrance, is evident, as the boiling pool in front,(whose waters hold a direct course to those of the wall-sided geo), must have an underground connection with those heard thundering within the gulf of darkness.

The subaqueous scenery here consists of some perforation, situated immediately beneath the great steam-hole which is visible above, and from which it is separated by an arch of rock. This arch is in part submerged. The perforation as a whole has thus much of the form and appearance of a great mark of exclamation—!—of which the dot is subaqueous, the dash subterraneous. It would seem as if nature, in order

to emphasize the strangeness of her working, had breached the partition wall, with a rent bearing the similitude of the sign of wonder.

On being launched into the inner chaldron, the first sensation experienced is "that you are about to fall down into some abyss; though the least consideration is sufficient to show that this is impossible in a boat." The second is a desire to ascertain in some degree where you are; being dimly conscious of the fact that it is not exactly water which is beneath you, nor exactly air which is above. What little light there is, whereby you ascertain this, emanates from an apparently glowing shaft, which seemingly radiates moonbeams; but which is ever emitting angry corruscations; corruscations which, smiting you in the face, you discover to be water. As the rapidly-dilating pupil admits more light, the shaft resolves itself into a lashing and waving cateract, thrown from some mysterious source, which seems mantled by gloomy skies.

The dome-shaped roof of this hidden hollow of the land, is nearly a hundred feet above its floor, and the falling waters are precipitated, from a height of eighty-five, through an orifice, which in flood they nearly fill. Some sixteen feet from the bottom, they strike upon a shelf, from which they are dashed in fan-shaped jets;—these, crossing at every angle, become pulverised into water-dust; while the smitten waters of the gulf itself, lashed into hissing foam, surge in whirling waves against the sides of the chaldron, from which, beaten back tumultously, they again converge, clashing against those of the outward flow, and conspiring, as it were, to give meaning to the expression "a hell of waters."

Such is what is gradually *felt* to be what is going on around; for, from the violent dashing of the water from every side, the eye is nearly useless,—the ear is stunned, and the feeling is puzzled, everything around being as wet as we are ourselves. For, aside of the utter contempt which Smoo evinces for Macintosh, the strange and perfectly-palpable mixture, or it may be called *emulsion* of air and water around, is potent in discovering the weak joints of the armour, and finding its way to the skin.

There is a second small opening in the roof of this cavern, through which light might enter, if it could; which in such circumstances it cannot. The opacity of fogs to light is well known, and the water-dust within, is very much more opaque than fog; indeed it will be seen, by anyone who stands above, and who regards the vapour gushing from the gash, to reflect the light almost as snowily as do the mammilated rolls of a fleecy cloud.

But Smoo's wonders are not ended. Nature has written *another* mark of exclamation on that wall which is directly opposed to the first.

Nay, more; as if to *invite* to further search, the writing upon this wall has been lifted clearer to the light; so that the dot of the point of exclamation is, on this side, partly above water. The rib of solid rock, which gave trouble in placing the boat in the cavern, in the first case, is here lifted overhead, and there is a continuous water-floor from where we are, to whatever may be within. But, though the arch of rock is, upon this western side of the cave, curved *overhead*, it is so only if the head assume a position lowlier than its wont. We must lie down in the bottom of the boat. There need be no hesitancy, on account of the quantity of foam which has overlapped its gunwale, inasmuch as we are thoroughly wet already; a fact which excitement alone prevents us from recognising.

This second water-floored cavern, though very much larger than the first, is more of the nature of a crevice. There is depth of water for the boat to advance for some short distance, when it is quitted; and the washed-out rent is traced westward and upward,—the explorer having to walk deliberately up the bed of a rapidly-running stream. He is suddenly arrested by three things. First, by a black pool which occupies the full width of the passage. Next by a cascade which falls from the south, into that pool from some height,—this also occupies its full width. And lastly, by the continuance of the rent or passage, or cave,—whichever it be regarded,—at right angles to its previous course; and that in so diminished a height as to cause him to hesitate as to advancing further, even supposing he could surmount obstacles one and two. As to the pool,—it is just as ugly a looking hole as could be seen; an oar finds no bottom, even when sent below the water with a mighty swish. As to the cascade,—condense Lodore in height,—not in width,—and apply to it all the adjectives which a once well-known poet fantastically picked out of the dictionary to irritate still more that fussy stream, and you would still feel a want in describing this. As to the continuance of the cave which is still the bed of the burn,—it is one of those pipes, several of which the writer has noted as being connected with dogs; dogs which have gone through them, and come out minus their hair; and up which pipers have gone, and never come out at all. All of which,* the reader is not expected to believe, for the best of all reasons, namely, that the writer does not believe one word of it himself.

And yet after all, this pipe is better than the most of these, for it *has* got another end. In wading up the bed of the burn, many lumps of peat are to be seen. And what is there worthy of regard in a lump of peat, lying in the bed of a burn? Nothing in general; but the

* Dogs and Pipers

nearest spot where the peat-bog comes to this place is more than two miles distant; and these pieces of peat have therefore done what the spectator has neither done or probably could do;—they have *explored the pipe*.

Little or nothing of what has been described will be seen by those who visit Smoo Cave when its stream is not in flood. It were as unreasonable to expect it,—nay, it were more unreasonable to expect it, than it would be to expect to behold a fair scene from a mountain top, at dead of night. For, whereas light only *discloses* the scene from the mountain top, the rush of waters into the cupola-cave of Smoo, both *purveys* the light, which most fittnigly discloses the scene,—dragged down in its own mass and radiating therefrom like the jet from a water-sheathed electric-lamp,—but it is also itself the source and power of all that which is most worthy of being seen.

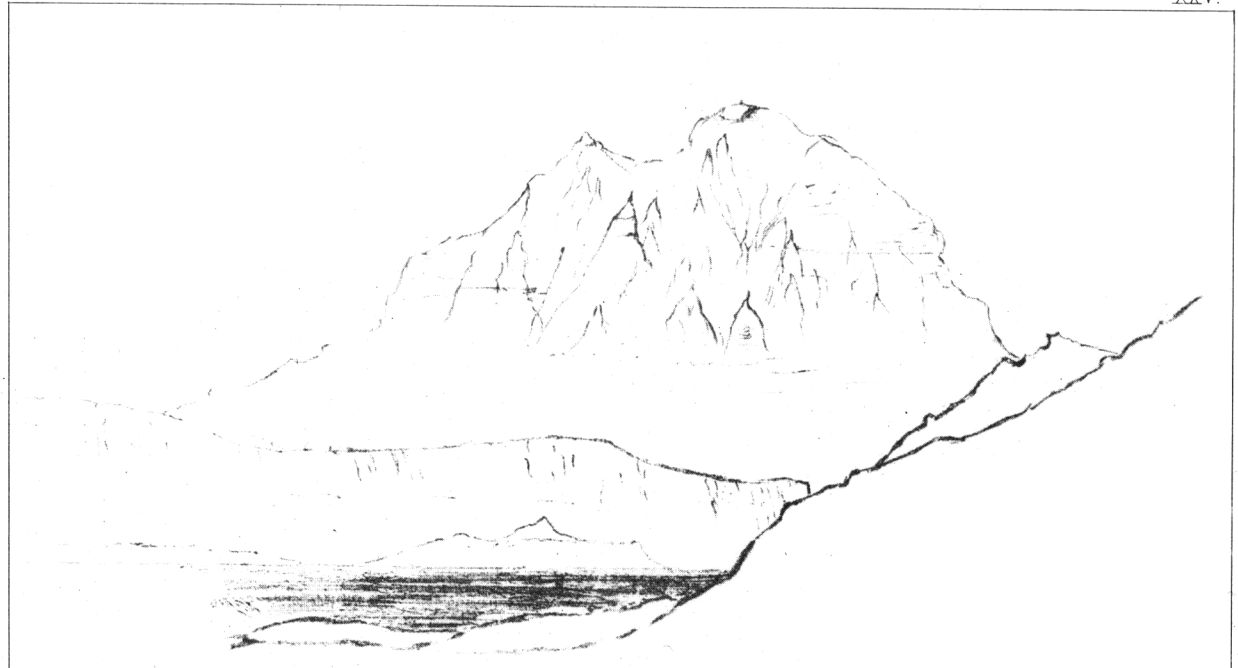
After it has been visited while in full force, by all means should it be revisited, during what may be termed its calm; especially if the configuration and mode of formation of the Cave is to be considered. The judicious employment of magnesian wire will then educe *a spectacle*, wondrously grand in its way. But to see it *first* in such a manner, would most assuredly rob it of that glamour-might, which lies embosomed in its light-dispensing waterspout; and present it shorn of all that tremendous clash and conflict, which makes its grim depths such a "naughty place to swim in."

As the mode of formation of this strange chasm is closely connected with geologic cataclasm, its consideration is deferred until the limestone of the district is spoken of.

The writer would just say in parting with it, that he considers the Cave of Smoo as being *beyond measure* the most wierd and wonderful sight which he ever beheld; and he understood his companion, who has seen very much more of the world's strange sights than he has, to be of the same opinion.

The series of very diverse, and on the whole markedly schistose rocks, which go to form what has been called the Upper Gneiss, cannot be said to be characterised by any special type of hill.

The first I notice is the somewhat dome-shaped Ben Hope. It is only a dome when viewed from the eastward, for it is precipitous to the west. This hill is formed of a very loose and fissile mica-slate. Where exposed in cliff-escarpment it is disintegrated, in consequence of the openess of its foliation. Runlets of water have cut gashes in its bold western front, and the fall of the loose foliæ of



BEN HOPE. BUTTRESSED MICA-SLATE.

M. F. H. Del.

the stone has accuminated the upper parts of each intervening prismatioidal mass of rock; so that we are now presented with perhaps the finest illustration in Scotland of *a buttressed hill.* But here they are the buttresses of disintegration, formed out of weakness; though like other buttresses, they also tell of internal weakness. (*See sketch of Ben Hope.*)

Another hill of this formation I note, for the consideration of those who do not believe that falling-waters are potent to cut out valleys. It is Ben Hee. It has a hideous shape,—very like a Whale. That portion which performs the function of the neck,may be described as a stepped precipice. Upon examining this it will be found that the stream, which flows south-eastward, has been gradually running away with the material of the hill, and eating backward into it; undermining it at the same time, by having got a hold of an unusually shaley bed.

The superincumbent mass of rock is slipping into the corry; rending itself in the so doing, by a series of huge cracks; these, extending downwards, as each slice slips a bit lower and still lower, gape with hideous width,—a trap for snow, sheep, or the incautious foot which may be too inquisitive upon their crumbling lips.

The hills of Old Red Breccia which clustre round Tongue are of rounded outline and devoid of beauty; though, where cut into cliffs, as at Cnoc Veecdan, the forms are both grotesque and bold.

It would have sufficed to remark of the outliers, which remain as isolated remnants of a somewhat superior bed of this formation, that they have the ordinary heavy rounded form of Old Red Sandstone hills, had it not been that one of these forms "an honourable exception," and is beautiful exceedingly. This is Ben Griam Beg. Its big brother is not an honourable exception, for it is typically lumpish; yet there *it* stands, the parentage and the upbringing unquestionably the same; and so near do they stand to one another, that one cannot conjecture wherein lay the difference in their sculpturing, which opposed the noble form of the one hill, to the altogether tame and ignoble outline of the other. (*See sketch of Ben Griam Beg.*)

Griam Beg, being somewhat of a crag-and-tail hill, would be held by some to vouch for scour from the west.

Still one class of rocks, and but one hill of that class remains to be noticed,—the "volcanic" Ben Loyal.—(Laoghal).

Thinking of Scotland's Hills, we ever return to *this* as the Queen of All. For gracefulness, chasteness, versatility, and nobility of form, it stands pre-eminent.

It is more difficult to name *the King*; but we incline to a hill in Perthshire, when viewed from the shoulder of Ben Yoss; a hill, strange enough, of the same name,—Ben Laogh.

Ben Loyal is, more than any other hill in Scotland, an *Aiguille* hill. Not that there are aiguilles *upon* it, but it is *aiguille-formed* itself. Not a single projecting horn, like Teneriffe, Yan Mayen, or Scuir na Caiche; it would not be so fine by many times if it were; but it has many peaks, is in fact set round with peaks.

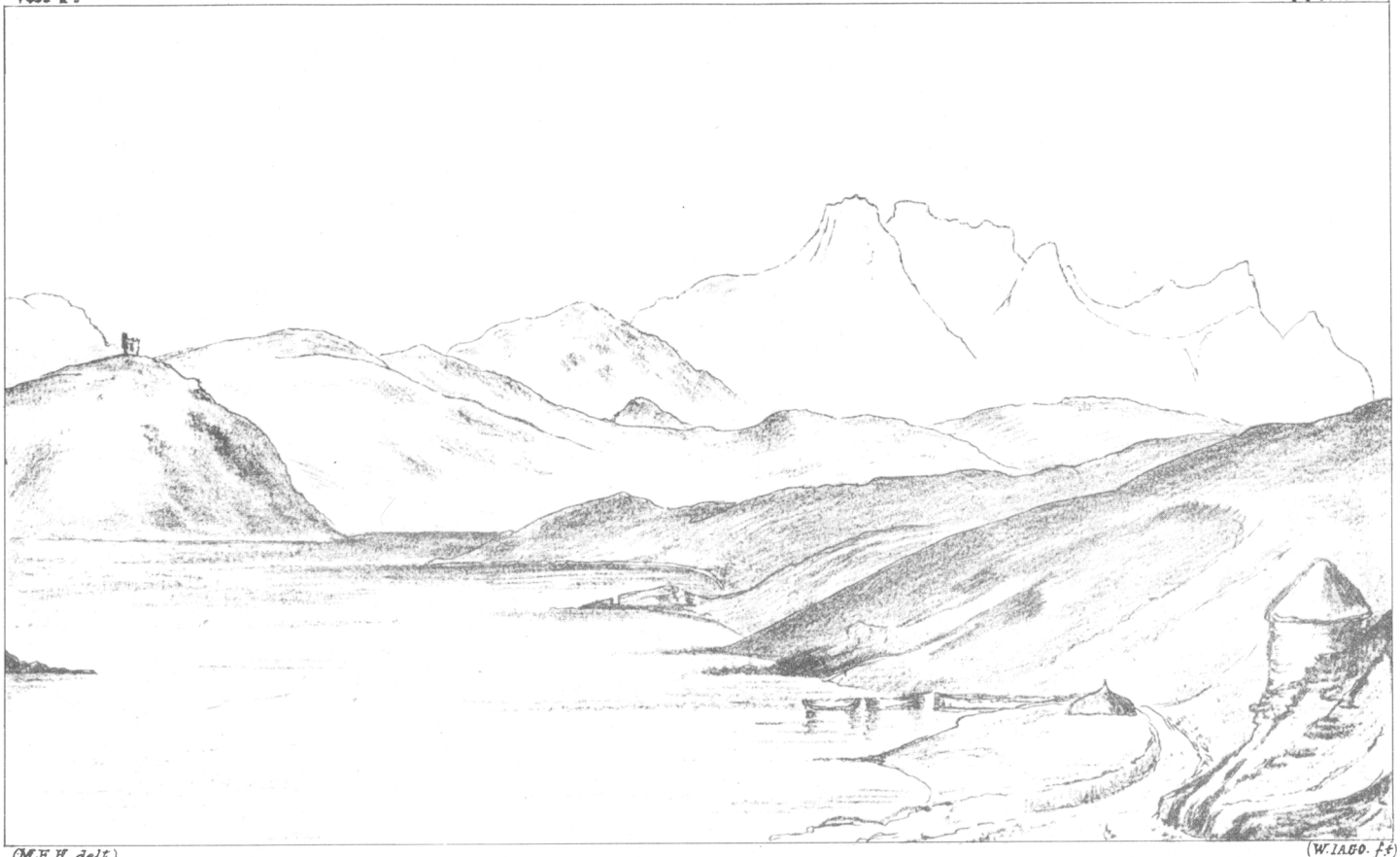
What can be finer than its northern face,—round about whose feet the loving birches cling, creeping closely up and up, till they find it is no use attempting more; for it is unapproachable! What more independent and grandly assertive than its western horns,—which seem as if they had shot up through separate throats, and had been congealed in the very heavens;—like sun-flames of hydrogen, photographed while yet they flash. What more enticingly mysterious than those corries and gulfs of blue haze, which separate peak from peak! And then the *setting*:—all the accessories are fine; the wavy outlines of the lesser hills which cluster to form a middle-distance, and the winding bay with its stretches of sand, banded with bright-green waters.

And then the mystery of *its being*. Not of its birth. Wonderful to relate, geologists have not quarrelled about that: they are ready enough to do so about granites generally; but about this granite they have not. Our own belief is that it has proved too beautiful to quarrel about.

Not of its birth; not of its death; that has not come yet, and we at once exclaim "Oh, Queen! live for ever!" But of its having, with these sharp serrated outlines, resisted the scour and sweep of the devastaters which ground down the table-land around it, and left the two Griams standing,—just as it were to show what they had done elsewhere.

Its hardness and unalterability would enable it to endure; but not to preserve such peaks, sharpened like tongues of fire.

Sooth to say, while contemplating this hill, one's energies are so absorbed in admiration, that there is no place for geognostic speculation concerning it;—and it is moreover hard to have to anatomise the thing we love. Murchison draws it as eruptive, turning up upon its flanks the adjacent rocks; nowhere was the writer able to perceive any evidence of such disturbance. What did appear evident regarding it, is connected with *cold*, not *heat*. It is impossible to believe that the great ice-sheet which by some is held to have scoured over



(M.F.H. delt) (W.IAGO. f.t)

Ben Loyal. —— Syenite.

all Scotland, ever topped these summits, and left such rough and rugged lines behind it.

In presence of those high angles and serrated ridges, and in presence of the lower rounded Stomino to lee of it, and above all in presence of the Skerry and Stack standing with similarly accuminated shaft above the waters, it is much to be suspected that far less of the grinding and wearing down of the waste midlands of Sutherland was the work of ice sliding in solid mass over the land, than of the wash of waters, and the scour of ice *floating among the shallows*, and pushed over the lesser heights.

That Stomino is glaciated is at once conceded; but its glaciation is an old story; for its sweeping curvatures pass under the scanty bands of Old Red Conglomerate which, with cliffy fringes, hang on to its skirts:—though it is not contested that *recent* glaciation may not have had much to do with the late scalping of its bared head,—a glaciation which very possibly was cradled among the opposing summits of Loyal.

It is not easy to say what is the angle of the peaks of Loyal; they would seem to be about the steepest, not to be *cliffs*, in Scotland. The clinometer does not much help here; because on the spot, one has enough to do to hold on, and not go to the bottom in a single slide; and when measured from a distance, on account of the over-lapping of several slopes, too low a result is got.

The camera is still worse. Justice without mercy, defines its portraiture performance; and in "performing" among the hills, it is sadly wanting even in the first. The lowering of angles, and taming down of distant hills so much complained of regarding it, is, as regards the former, probably due partly to the overlapping mentioned, and partly to our own *hankering after the extreme*, and so, picking out the steep bits for storing in our memory; while the camera on the other hand, very probably placed in the position which suits the whole hill, foreshortens the acuter angles. The *taming down*, again, which is indubitable, is probably due to this, that the lens of a camera has not the same *penetrative power* as the human eye, nor has it any power whatever in *resolving* aerial perspective.

While the penetrative power of an "object glass" is an actual defect,—though a most useful defect,—the penetrative power of the human eye depends upon an extra adjustment, or set of adjustments of such wondrous mechanism that it is very doubtful if any human mechanist could ever produce it. This he could do certainly neither in the space, and still less, so as to operate in the time necessary for the working of the adjustments, that the Great Mechanist has.

The "*penetration*" of a lens is a *fixed defect*,—being the name adopted to express its possessing a limited zone within which there is a near approximation to perfection, though no one absolutely perfect focus; the glass of greatest penetration being that which has a comparatively wide space of partial perfection.

The penetration of the eye is a *moveable perfection*; the limits of which extend from the seeing a fly upon the point of one's nose, to the counting of the stars in the Pleiades.

In taking photographs of scenery, therefore, when the lens is best focused to a certain distance, all the others must be more or less out of focus; and the steep angles of distant hills are merged into one another, and softened down by blurring.

In transmitting a picture to the retina which volition has commissioned it to record, the experienced eye does not focus, for more than the briefest fraction of time, any one part of the scene, but wanders over the whole, focussing near and far alternately with marvellous rapidity. The nerve all the time imprinting every perfectly focussed point upon the optic memory, which retains each and all sufficiently long for a perfect picture to stand forth. If the eye be focussed upon one point without moving, or *thus* travelling over the whole length and breadth of the view, all the rest of the picture is out of focus and blurred; and the side objects are hardly recognisable.

Aerial perspective—which John Phillip delighted to talk about, but in which Arthur Perrigal apparently does not believe,—would appear to be largely due to the presence of dust in the air; for after rain it is hardly perceptible. As the far-off is then brought so near that tints blende, there is no such perspective at all; and the pleasing softening effect, and that graduation of indistinctness which alike teach of distance, are, in the cleansed atmosphere, nearly altogether gone.

It would appear, therefore, that it is not distance which "lends enchantment to the view,"—but *dust*; and, indeed, it is difficult to understand how *distance* could lend enchantment to anything which is either pleasant or pretty; or dust either, for that matter.

Photographic lenses have as yet made very little progress at resolving that which is behind the dust; and cross-lights mystify them entirely: and here it is that the eye has its great advantage; for it *can* focus through that cobaltic-veil which the beams have flung across the picture through yonder opening in the hills; and read the wrinkles in those sun-lit crags, even through that blaze of evening glory.