A

DESCRIPTION

OF THE

WESTERN ISLANDS OF SCOTLAND,

INCLUDING

THE ISLE OF MAN:

COMPRISING

AN ACCOUNT OF THEIR GEOLOGICAL STRUCTURE;

WITH

REMARKS ON THEIR AGRICULTURE, SCENERY, AND ANTIQUITIES.

BY JOHN MACCULLOCH, M. D.

IN THREE VOLUMES.

VOL. III.

CONTAINING PLATES AND MAPS, WITH EXPLANATIONS.

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J. MacCulloch del.

Published ... Constable & Co. Edinburgh.

Pl.

J. MacCulloch del.

H.F. Rose sculp.

View of the SCUIR of EGG

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VIEW OF STAFFA FROM THE SOUTH WEST.

Published June 1.1820 by Constable & Co Edinburgh

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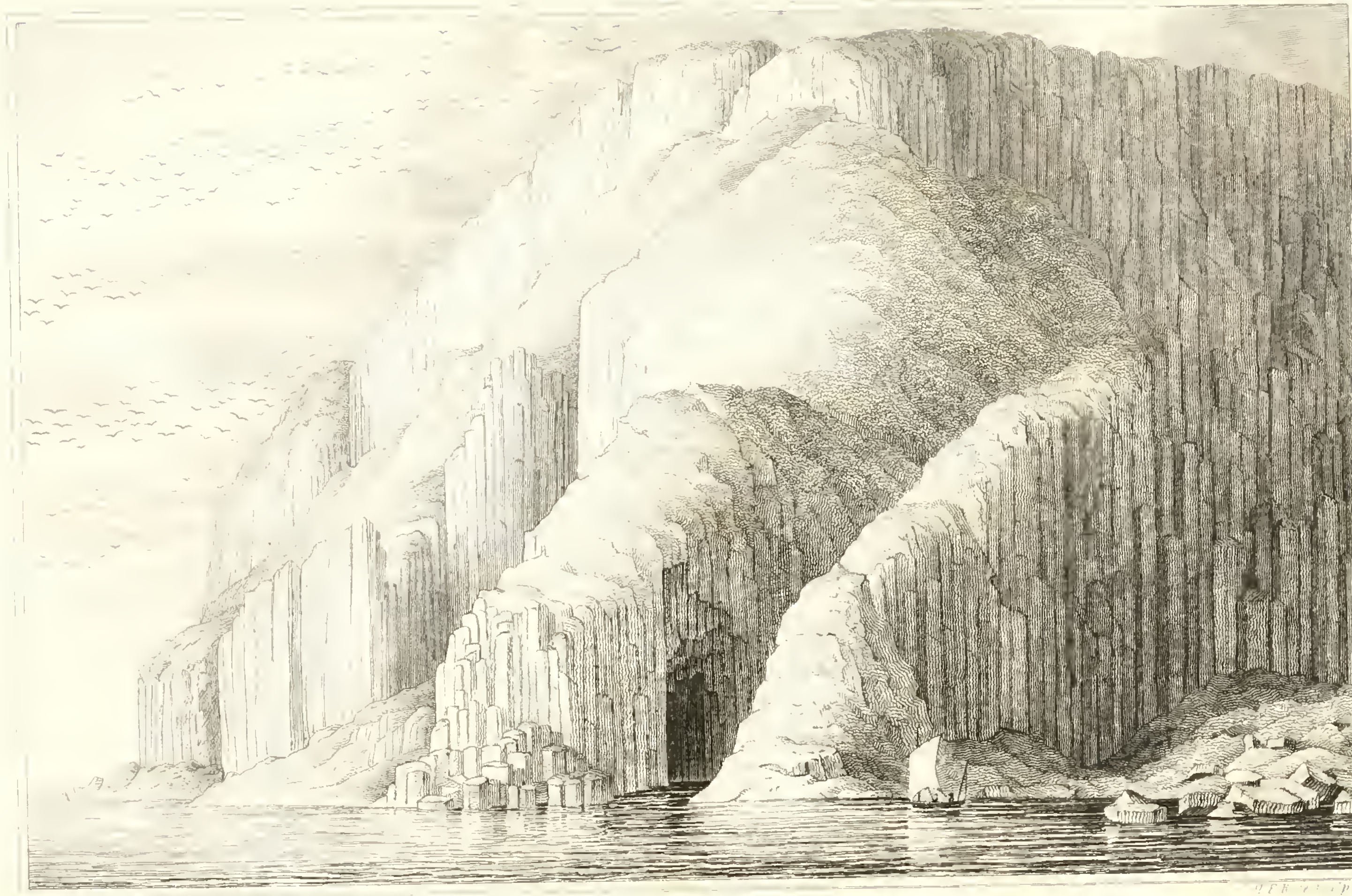
J. Archer. Sculpt

VIEW OF DUNTEGAN CASTLE & LOCH IN SKY

Published June 1 1819 by Constable & Co Edinburgh



J. MacCulloch del.

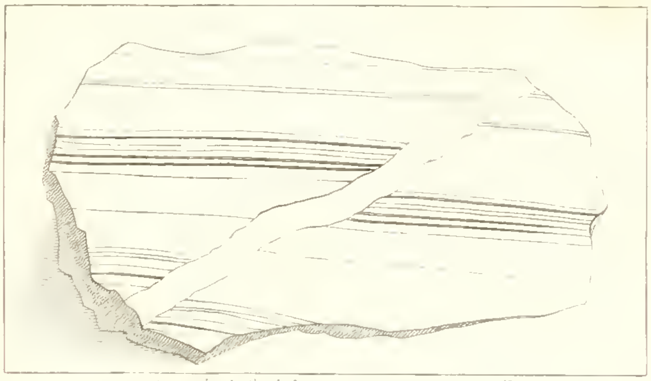
EXPLANATION OF THE SECTIONS AND DIAGRAMS.

The following Plates contain sketches of different kinds, intended to illustrate various circumstances occurring throughout the preceding descriptions, of which no accurate idea could be conveyed by words. The economy which it was judged expedient to study in these volumes, has rendered it necessary to limit these illustrations to the most indispensible. For the same reasons they have been, in most cases, reduced from the original drawings, to the least space on which it was possible to express them, and crowded together, in no very regular order, into a small compass. The defects hence resulting are numerous; since a general idea has been frequently substituted for a fact, an imaginary for a real section, or an assemblage of lines for a view. The proportions of the parts have also been almost every where sacrificed, for the purpose of condensing the abstract nature of the thing to be represented, not the object itself, into the space to which it was condemned. They must only be considered as the ghosts of subjects to which a body is wanting. In passing through the hands of the engraver, they have also often undergone no small changes of character; the peculiar circumstances, often minute, by which these characters were indicated in

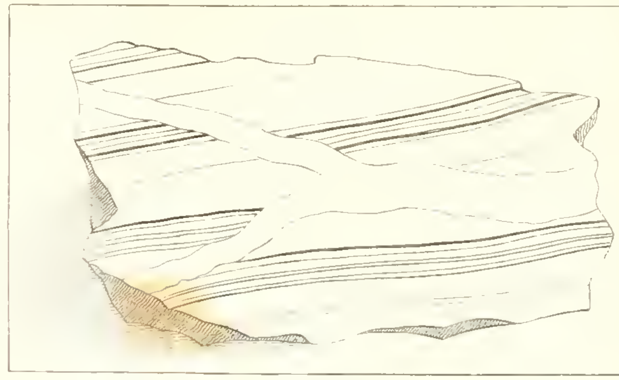
the drawings, having been lost in the mechanical translation to which they were subjected by this process.

This also has been the result of that attention which was supposed due to economy in the conduct of the work.

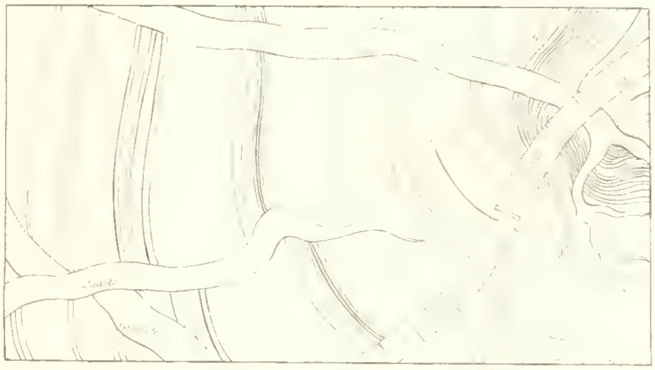
For the same reasons, they have not been coloured; a circumstance which generally renders such sketches more intelligible: yet it is to be hoped, that with all these defects, they will serve the purpose of facilitating the progress of the reader, who must recollect the imperious control to which an author is in these cases subjected by circumstances, without the aid of which no work can see the light.



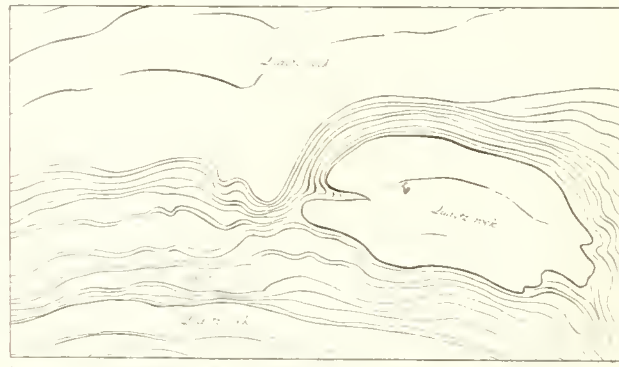
1 *Gneiss shifted by a Granite vein in Coll*



2 *Another example*

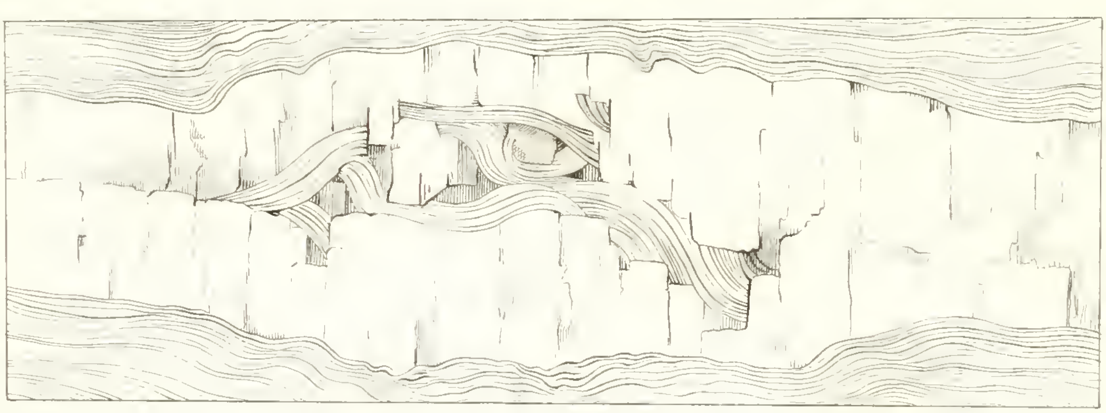


3 *Gneiss shifted by a Quartz vein in Fuda*



4 *Contortion of Schist & Quartz rock in Scarba*

5 *Contortion of Marble and Schist in Iona*



6 *Trap vein crossing Schist and Quartz rock in Lunga*

J. Mac[illegible] Plate [illegible] J. Stewart [illegible]

EXPLANATIONS

OF

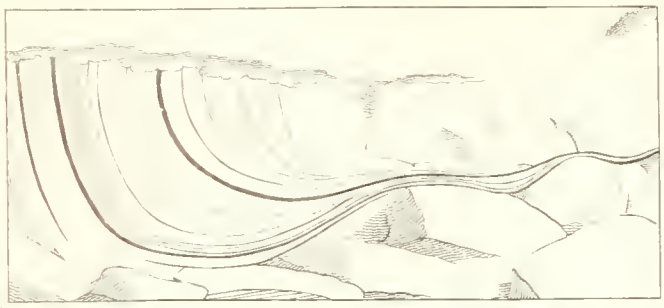
THE PLATES AND MAPS.

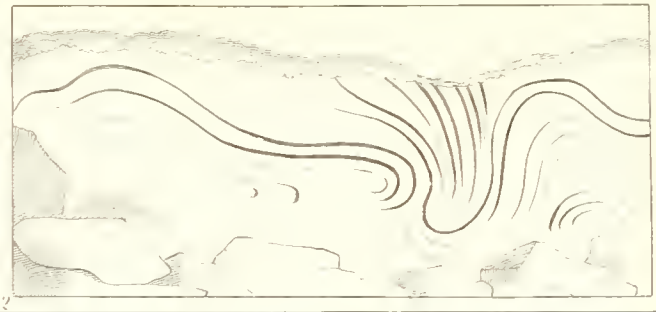
PLATE XI.

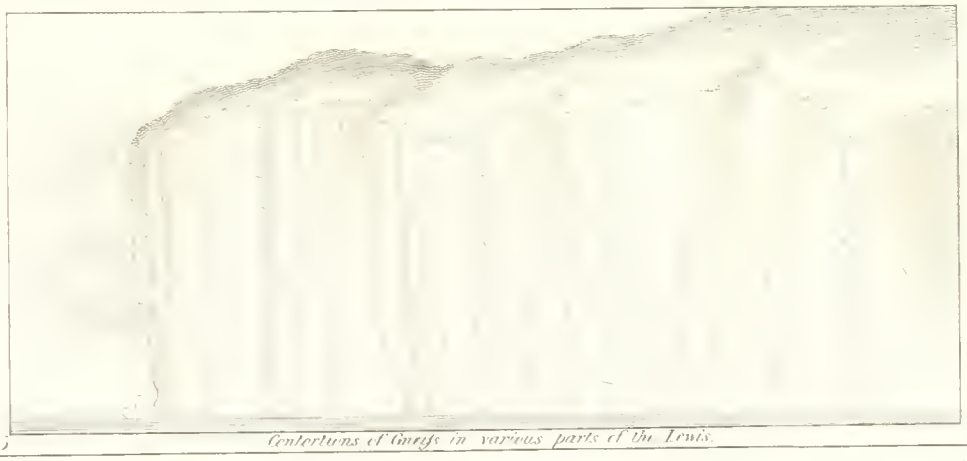
Fig. 1, 2.—These are two examples of granite veins traversing gneiss and attended by a shifting of the laminæ of that rock. Examples on a great scale are abundant; but even the present fragments are sufficient to explain the real nature of this circumstance, which leaves no doubt respecting the posteriority of these veins.

Fig. 3.—Represents a mass of gneiss in Fudia, which has been shifted by a vein of quartz that lies on the left hand of the sketch. That vein is also posterior to a granite vein, which it may be seen to traverse in the same place. A trap vein is also here represented.

Fig. 4.—Represents, in a ground plan, a contortion and intermixture of the white marble of Iona with the argillaceous schist







Contortions of Gneiss in various parts of the Lewis.

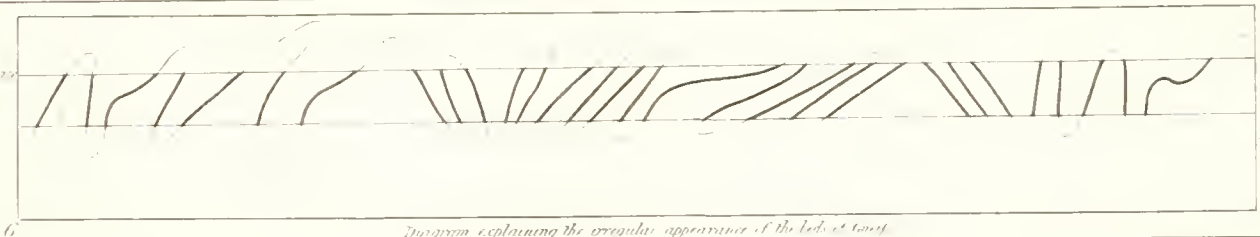


Diagram explaining the irregular appearance of the beds of Gneiss

PLATE XII.

Fig. 1.—Is an example of flexure in gneiss, occurring in the island of Bernera in Lewis. Of this sketch, as of many others, it must be remarked, that the truth of the subject, considered as a view of nature, and its character as a specimen of art, are sacrificed for the purpose of rendering the geological fact of the bending of the rocks more conspicuous. The different lines indicate the various colours by which the flexion of the gneiss is rendered sensible; and the blackest, point out the alternating beds of hornblende schist. At one side, the rocks appear to have been compressed and elongated at the same time.

Fig. 2.—Represents another case still more complicated, and occurring in the same place.

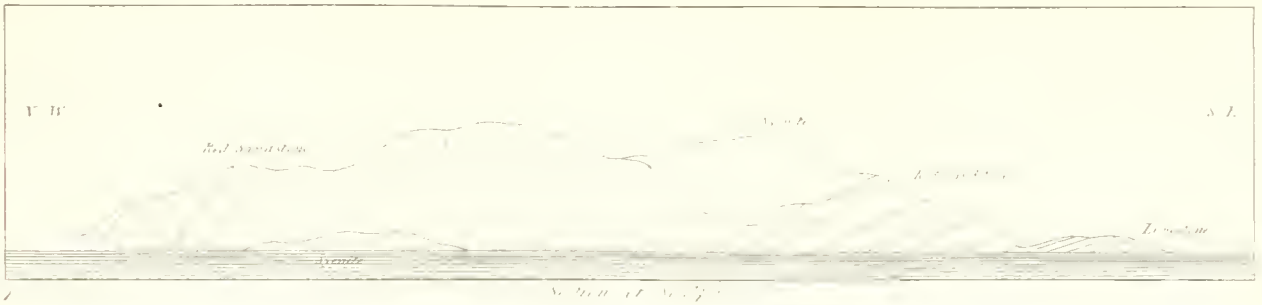
Fig. 3.—The complication in the curves is here still more remarkable; nor is it very easy to comprehend by what mode of disposition in the rocks it has been produced. This, like the two former, is from a drawing of the face of a smooth vertical cliff in Bernera; the lines representing the disposition of the beds having alone been preserved.

Fig. 4.—This figure is taken from a drawing of a rock on the north-western extremity of Lewis, not far from the Butt. The picturesque circumstances which render it an interesting object, have

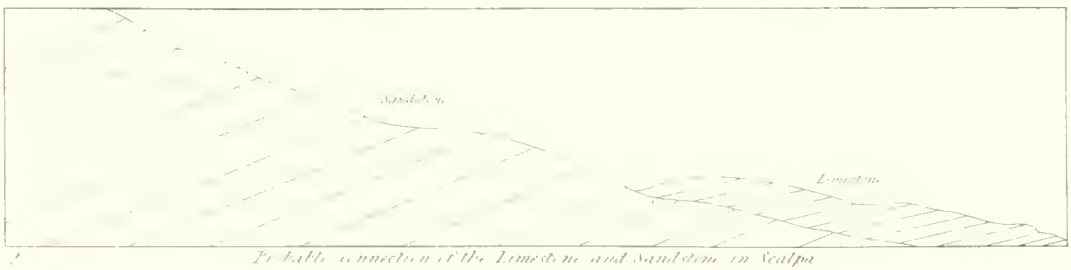
been sacrificed for the purpose of conveying an idea of the geological fact for which it is here introduced. The curvatures are here very complicated.

Fig. 5.—In this sketch an idea is conveyed of the vertical position and of the undulations of the gneiss on the eastern shore of Lewis. These cliffs are about 300 feet in height. This appearance extends for a considerable distance along the shore where it occurs, and offers an example of much greater uniformity in the curvatures than is in general to be observed.

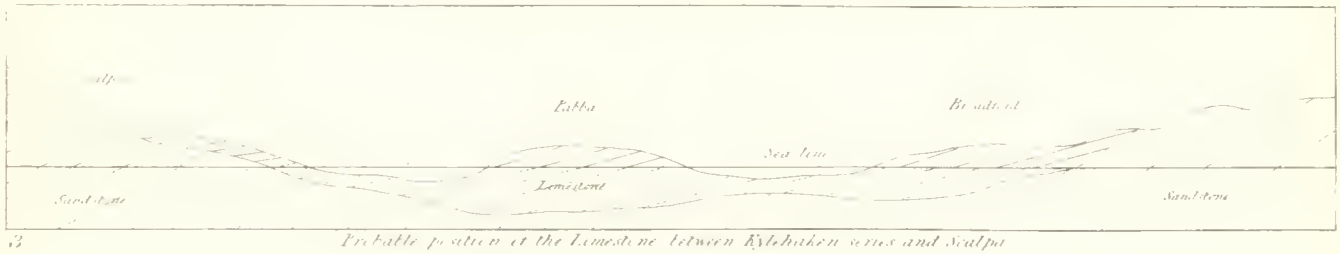
Fig. 6.—Is a diagram intended to suggest the probable cause of the extremely irregular positions occupied by beds of gneiss where their edges are found on the surface. The upper line represents the soil, and the darker portions between the two lines, the inclinations of the beds as they are actually to be observed. To simplify this view, it is here supposed that the whole is produced by the incurvation of one bed; but it will not alter the case if more be supposed to be engaged. As the fainter portions above the upper line represent the parts which are supposed to have been removed, so the lowest similar lines represent those which are invisible.



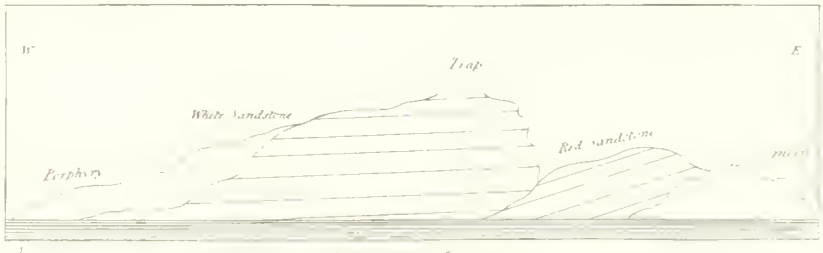
1 Section at Scalpa



2 Probable connection of the Limestone and Sandstone in Scalpa

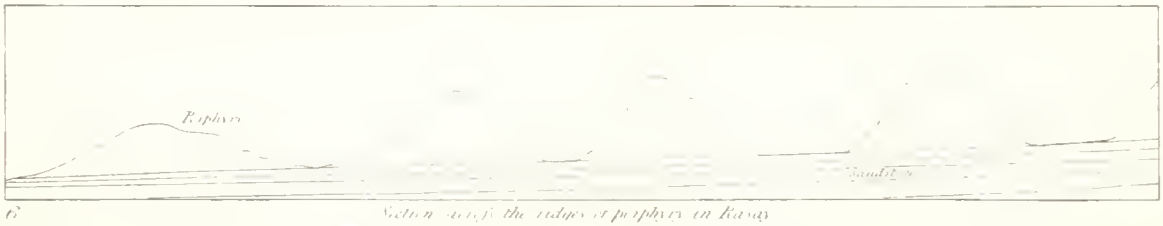


3 Probable position of the Limestone between Kylehakin series and Scalpa



4 Section at Raasay

5 Section at Raasay.



6 Section across the ridges of porphyry on Raasay

PLATE XIII.

Fig. 1.—Is a section of Scalpa transverse to the bearings of the strata. The position of the limestone, and the various inclinations of the sandstone, are here represented in a general manner; while the places of the unstratified rocks are also indicated, both on the summit and on the shore. Whether the latter is an overlying or a subjacent mass, cannot be ascertained.

Fig. 2.—Is a section intended to represent the probable position of the limestone with regard to the sandstone. Although the calcareous strata are conformable to the latter, it may here be seen that this position does not necessarily imply an alternation, but that, on the contrary, they are placed above the sandstone beds.

Fig. 3.—Is a more extensive section, including Scalpa, Pabba, and the shore of Strath. The object of it is to show that the limestone occupies a distinct and basin-like cavity on the surface of the sandstone, and that these three tracts are different parts of a common deposit. This section is curvilinear.

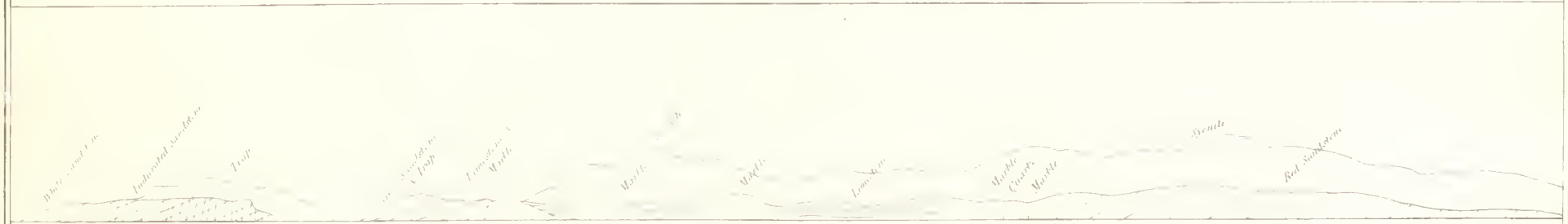
Fig. 4.—It is here attempted to represent, in a general and condensed manner, the relations of the different rocks which enter into the composition of Rasay. No attention is paid to their proportions nor to their real positions; the object in view being merely that of aiding the reader's conceptions respecting the structure of the island.

Fig. 5.—Is another sketch, which must rather be considered as a diagram than a section. It is intended to show the relative position of the red sandstone to the succeeding strata, and the probable connexion of the former in the several places where it appears along the eastern shore. These places are indicated by its superiority in three points to the sea line. The prolongations beneath the water are, of course, conjectural. This section also conveys a notion of the outline of the island when viewed from the eastward, and, were it prolonged to double the length, would possess a tolerably accurate resemblance.

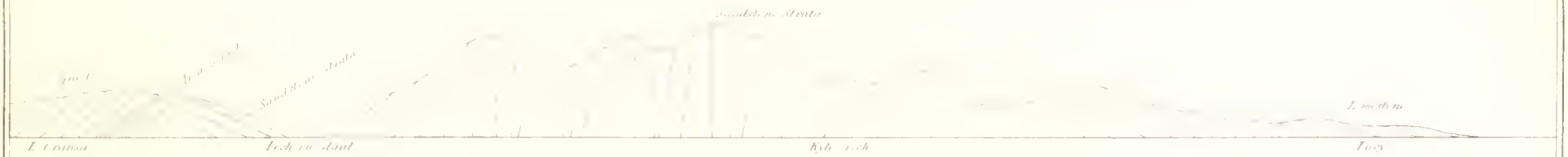
Fig. 6.—Is a section intended to convey a notion of the singular disposition of the porphyry in one part of Rasay. No streams run through these vallies, so as to lead us to attribute their peculiar forms to any waste of the surface. This sketch will also serve to show the reason why portions of the sandstone and limestone are found at the surface in various parts of the island. It will prove that these appearances are the consequences of accidental exposure, and that they do not arise from alternations between the two sets of rocks.

Various Sections in Sky

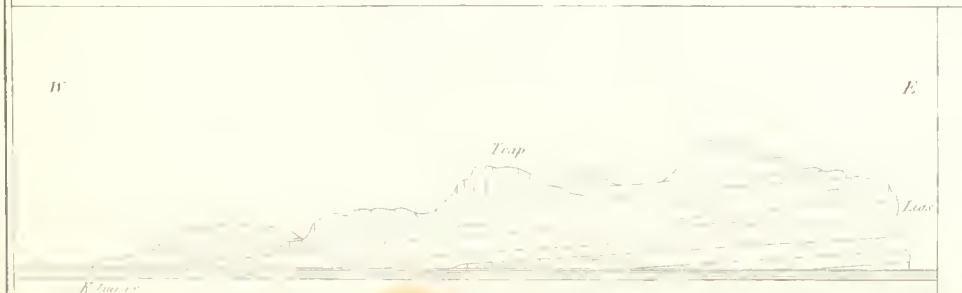
1 From Sleat to Aird through Ord and Kilbride



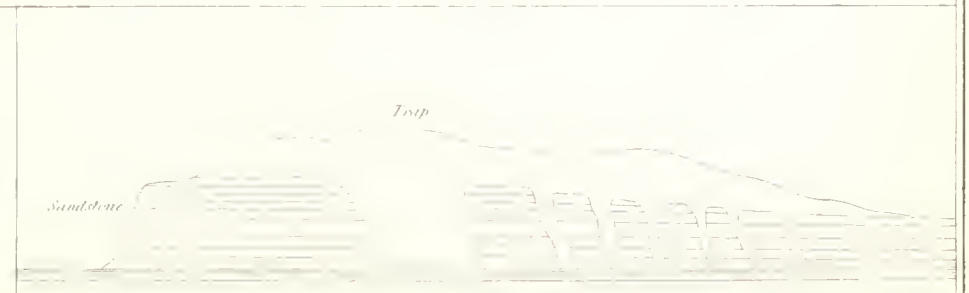
2 Along the North side of Loch Eishort across Loch Slapan to Strathaird



3 From Loch na dual to Lucy



4 Acreys Tritternish



5 Trap & Sandstone near Sushnish

PLATE XIV.

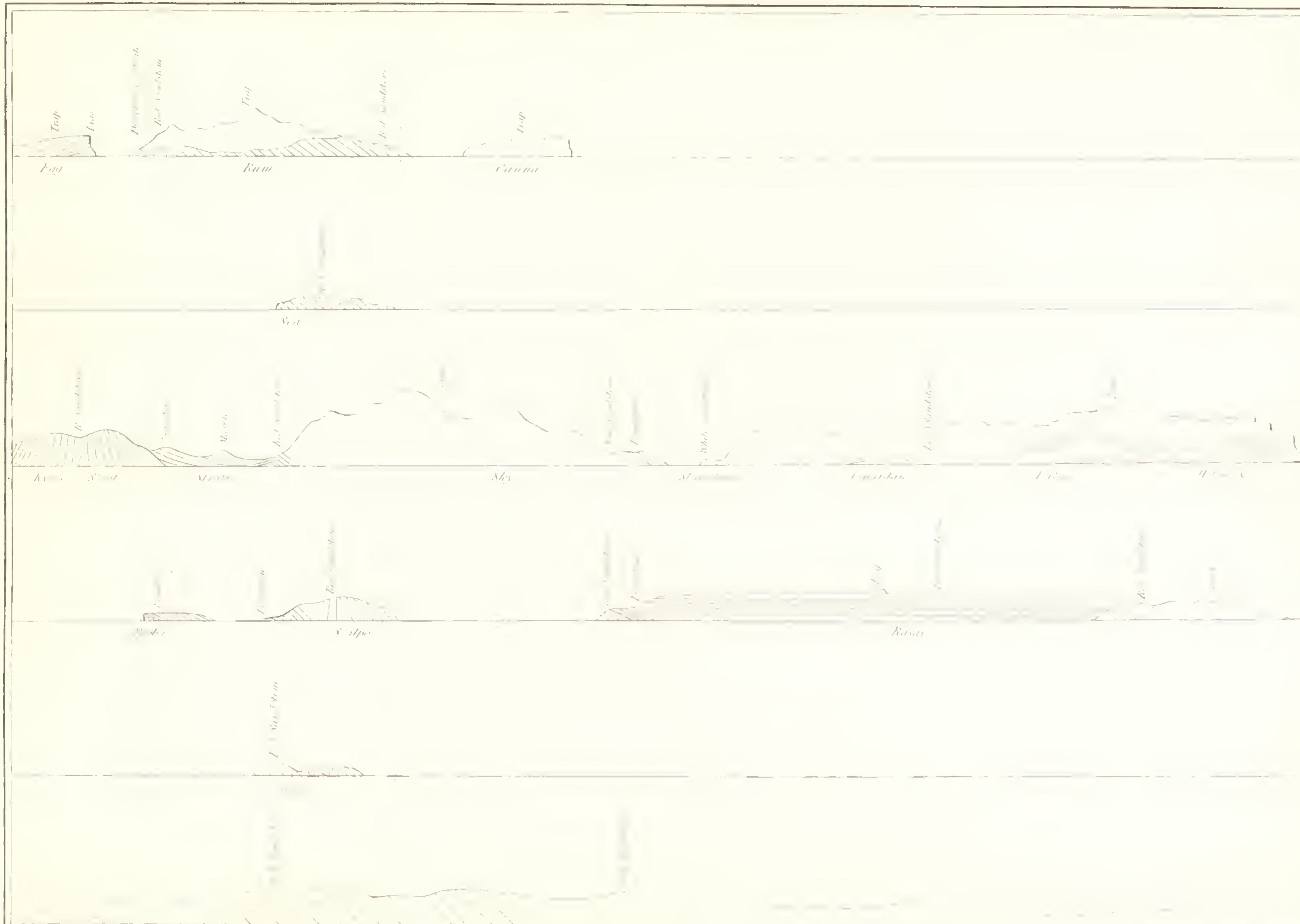
Fig. 1.—Is an imaginary section of Sky, made in such a manner as to include all the principal features visible on the eastern side of the island. It was necessary, on account of the minuteness of the scale, to abandon all attempts to represent the real dips of the strata or the proportions of the parts. It would require a great extent of scale and numerous plates to convey a true idea of the subject, but the present will explain the general relations, and assist the reader's conception.

Fig. 2.—Is an intricate, curvilinear, ideal section, intended for the purpose of showing other details of the same nature, and on which the same remarks may be made. It must here be observed, as of the former, that the several oblique lines are merely substitutes for colour, and intended to express the nature and limits of each rock; not marks for the quantity of the dip. They barely indicate its tendency. The map will assist in explaining this section more particularly.

Fig. 3.—Is an attempt to represent in the same general manner, the several dips to be found between Loch Oransa and the termination of the sandstone on the eastern shore. It is an imaginary and curvilinear section of the mountains which form the Kyles district.

Fig. 4.—Is an ideal section across Trotternish, deduced from the facts visible on the east and west sides of this promontory, and in the middle, on the surface of the land. The interferences of the trap with the strata, here represented, will explain the several ways in which the latter occasionally appear.

Fig. 5.—Is an abstract outline from a view of some trap veins proceeding from an overlying mass of that rock in Loch Eyshort. Whether the intruding material has ascended from below and overflowed the strata, or whether it has descended from the mass, the effect would here be the same. It is also easy to see that the progress of waste towards the right hand, will at some future time, leave the veins on that side independent.

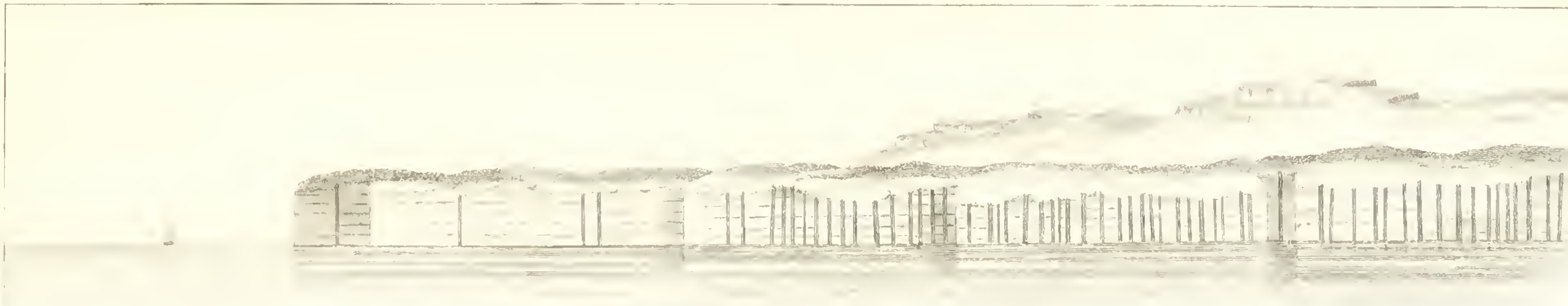


Comparative Sections of Sky with the adjoining Islands and the Mainland.

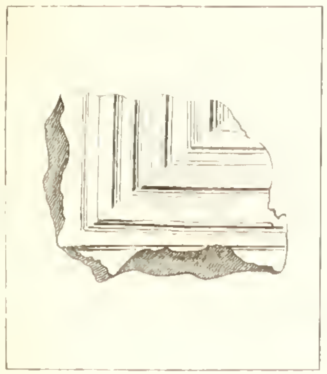
PLATE XV.

In this Plate it is attempted to bring into one comparative view, sections of Sky and of the several islands which bear a relation to it, as well as a portion of the adjoining continent. The connexions of the sandstone from Applecross through Sky to Rum, can thus be traced; as also those of the portions which are found at Loch Sligachan and on the neighbouring shore of Rasay. A parallel view is thus also given of the secondary strata of Strath and Pabba, and of those of Rasay and the district of Trotternish.

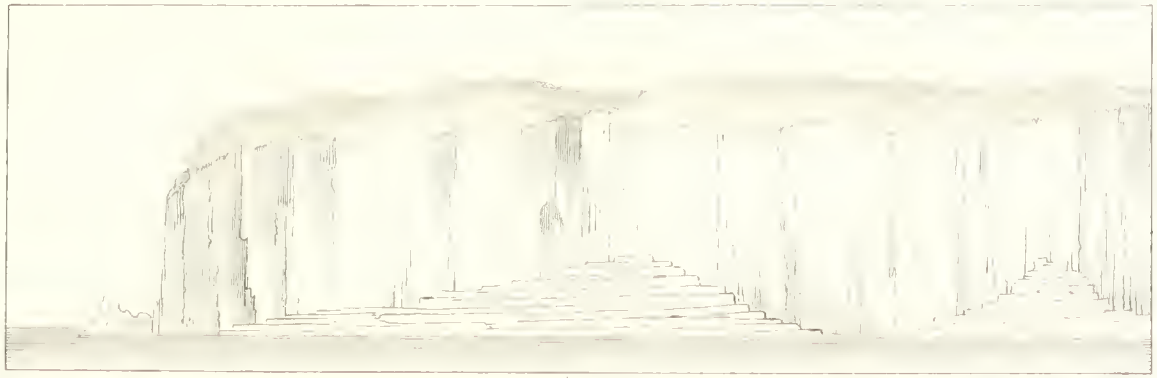
The probable existence of the sandstone beneath the overlying rocks of the middle mountainous district of Sky, is thus also pointed out.



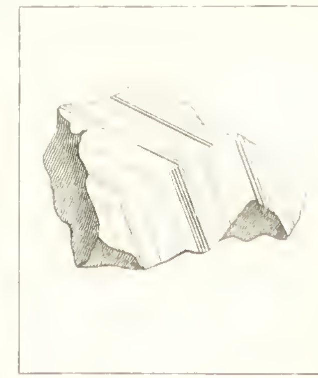
Sketch of the ...



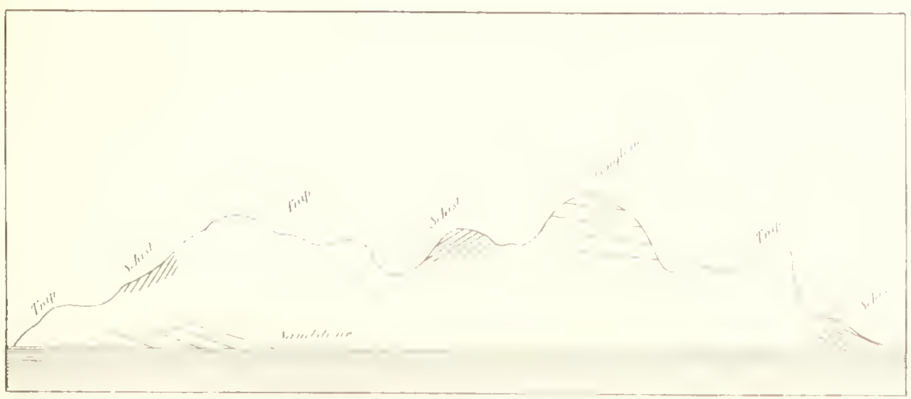
5 Gneiss in Lewis



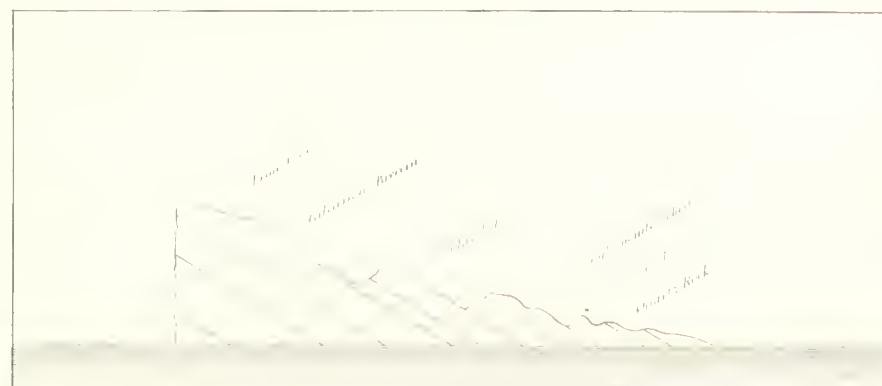
2 Section of the ... at Duntulm



5 Gneiss in Lewis



3 Ideal section of Kerrera



4 Section of the Garvelach Isles

PLATE XVI.

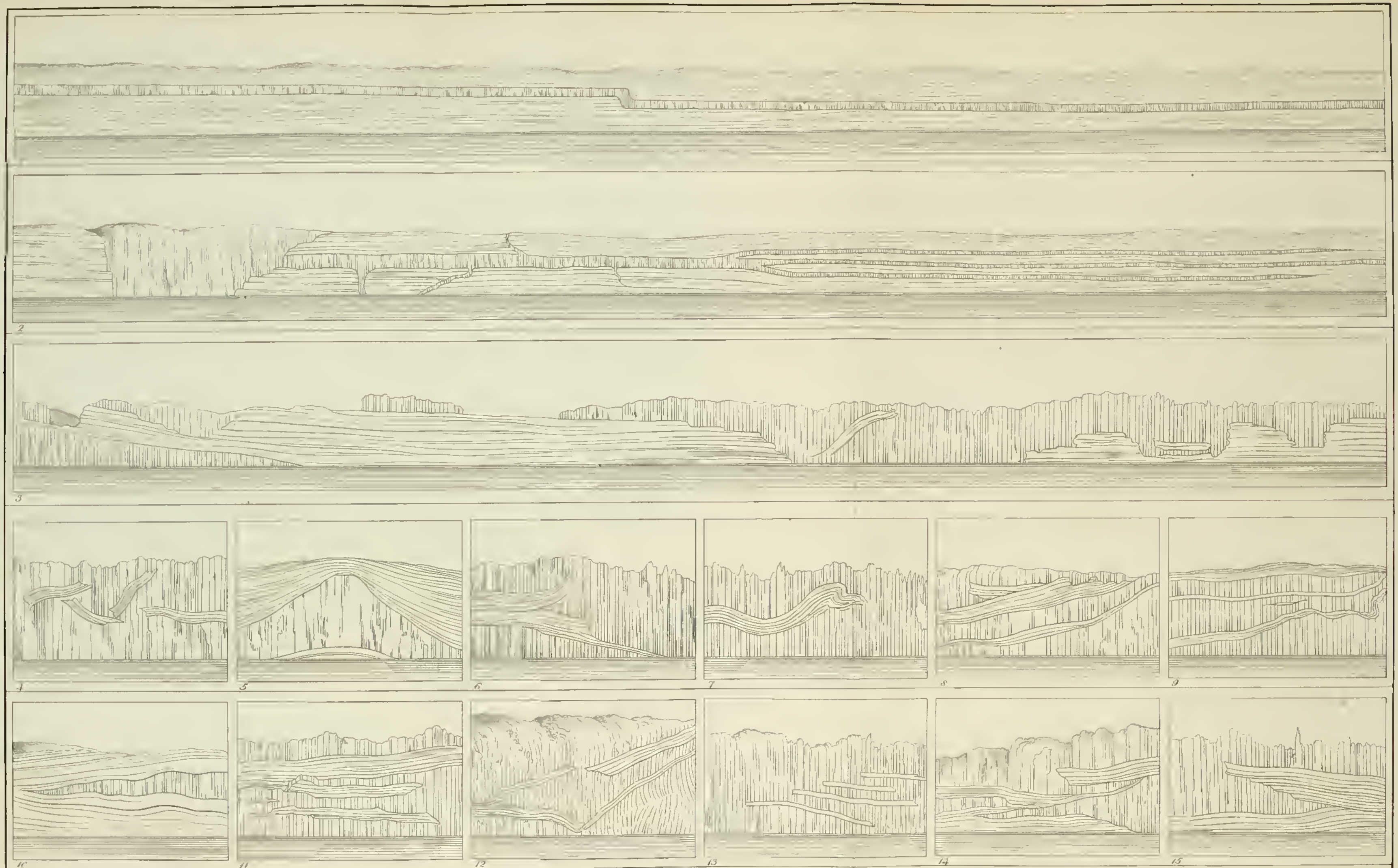
Fig. 1.—An attempt is here made to convey a notion of the general effect and disposition of the trap veins on the eastern side of Strathaird. It does not, of course, pretend to be a portrait, as, from the distance required to comprehend so large a space, the parts would be invisible. Their frequency, where they are most numerous, is scarcely exaggerated. It may also here be perceived, that they are most abundant in the vicinity of the large overlying masses of trap, of which a sketch is introduced in the distance, and that they diminish gradually in number as they recede from those, becoming rare towards the point of the promontory. The undisturbed state of the stratification of the secondary rocks, is also indicated by the regularity of the horizontal lines which mark the divisions of the beds.

Fig. 2.—Is a sketch from a drawing of the cliff which forms the south side of the promontory on which Duntulm castle is situated. The position of the schistose beds with respect to the trap, is indicated by the horizontal markings of the strata of the former, compared with the vertical fracture of the latter. The minuter circumstances occurring at the immediate junction, are necessarily omitted, in consequence of the scale and the style of the etching. The schistose beds, as will be perceived in the geological description, consist of Lydian stone alternating with an indurated, or jaspideous, sandstone; and they correspond in their general dip and position, with the beds of ordinary shale and sandstone that occur along the neighbouring shore.

Fig. 3.—Is an attempt to convey a general notion of the very irregular intermixture which occurs in Kerrera, between the stratified rocks of the primary and secondary divisions, and the trap. Such a section is necessarily ideal, but may be deduced from examining many parts of the island. It is evidently impossible to discover the exact mode in which the trap is disposed with respect to these different stratified rocks. The position of the strata of clay slate on the right hand side of the sketch, must be considered the natural one; as it coincides with that of the neighbouring islands and the surrounding country, and as they are here apparently inferior to all the trap. In the middle, there is an attempt to represent the unexpected position in which the sandstone and the clay slate are found on the surface of the island at nearly the same elevation; while on the left hand side the clay slate appears superior to the sandstone; a case doubtless arising from a combination of the intrusion of the trap with peculiar circumstances in the form of the land.

Fig. 4.—Is a transverse section of the ridge of the Garveloch isles, and it requires no explanation beyond that which is contained in the geological description.

Fig. 5, 6.—Two specimens of gneiss, showing the peculiar circumstances under which the direction of the laminar structure is changed. In the one, the two sets of laminæ meet at a right angle; in the other at an obtuse one. There is no appearance of a vein at the place of meeting, and the rocks whence the specimens were detached are of considerable size.



Selected parts of the East Coast of Trotternish

PLATE XVII.

This Plate contains a number of detached portions selected from the east coast of Trotternish, and is intended to represent the several appearances produced by the interference of the trap with the secondary strata. The most interesting have been selected; as the whole could not have been represented, both in their general connexions and in their more minute details, without adopting an inadmissible scale of plate.

As the cliffs are in general cut down in smooth faces, it has not required much alteration to reduce the drawings to the sectional appearance here given: in most cases indeed, the natural sections are as decided as if they had been made by art. One necessary alteration must however be noticed, but it does not interfere with, or misrepresent, the only circumstance for which these sketches are introduced, namely, the relative positions of the two rocks, and the distorted and broken condition of the strata. That alteration was rendered necessary by the economical mode of engraving adopted, and by the expediency of avoiding colouring. In many of the tablets, the relative spaces occupied by the trap, above or beneath the imbedded fragments of strata, have been curtailed, for the purpose of rendering the forms of the latter more visible; whence these often bear a larger proportion to the apparent altitude of the whole cliff than they do in nature. In other respects the truth of the objects is preserved, at least for the purposes of geology; no liberty being

taken that could tend to mislead a geologist respecting the real nature of these interesting appearances.

Fig. 1.—This figure contains a considerable portion of the cliff, here supposed to extend for a mile or more. If either the right or left hand portion alone be seen, as they actually are in nature in examining the coast, it is naturally inferred that there is a regular alternation of the trap and the secondary strata. But, in the middle, it may be observed that the apparent stratum of trap changes its position, passing through those beds of sandstone between which it lay, and then holding a similar course between others. Were that part alone visible, it would be considered a vein, as it is in a position transverse to the stratification; and it is evident therefore that the whole is of the same character.

Fig. 2.—In this figure there are condensed two or three remarkable circumstances in the junction of the trap with the strata, which, although they exist in this place, occupy a much greater space along the shore.

Near the left hand side, is seen one of those large masses of trap which are often found abutting endwise against the strata, and which, in fact, pass through them in the manner of veins. The example from which this general appearance is drawn, is a mile or more in breadth; and they must all, like this, be considered as veins on a large scale.

They are often connected with ramifications, of which a conformable one is here represented. That vein, it is obvious, if viewed

only in one or two particular points, might, like the former, be also esteemed a regular stratum. Its true character is shown by the smaller ramifications which proceed from it, passing through the strata in various directions. Such ramifications therefore, offer another criterion by which to distinguish a stratum from a conformable or parallel vein. In the vein that reaches from this horizontal one to the surface, may also be seen an example of the origin of trap veins from below.

It is evident that if the surface of the interior country alone were here to be examined, this specimen would present a common example of an independent vein. It is equally evident, that if the whole superincumbent mass were removed, down to the smallest ramification which lies to the right of this, we should also have another independent vein, which, in this case, would not have originated from below, but from a superior body of trap; a case which doubtless occurs frequently in nature, as suggested in the account of the veins at Swishnish point. Such veins must terminate at some indefinite depth beneath the surface. The others visible in the sketch, which proceed downwards, present examples of the oblique and of the vertical position, both of which are known to occur in trap veins.

In examining the surface of the interior country at this place, it would also be concluded that the great body on the left was an overlying mass; and it is probable, that in many cases, the extensive masses of trap now seen above the strata, are bodies, like this, passing through them and connected with deeper seated portions beneath.

At the centre of the sketch, the large conformable vein ramifies

into three equally conformable branches. If these should be viewed independently of this connexion, as they may actually be seen on this shore for a considerable space, they would convey the fallacious idea of a regular and repeated alternation of trap and sandstone. This case is parallel to that which occurs in Egg, where similar alternations are found, without any such clue for their explanation. The gradual extenuation of these veins is seen on the right of the sketch.

Lastly, it may be remarked of this as of the former example, that whenever the superincumbent sandstone shall have disappeared, as in progress of time it undoubtedly will, there will be found a thin bed of trap lying on sandstone, and presenting an example of a disposition which would scarcely then be conjectured to be venous. Thus the existing superincumbent flat beds of trap may in many cases have been produced.

Fig. 3.—This is a slight sketch from a distant point, of the general appearance of the cliffs to the north of Ru na braddan; the proportions being, in most parts, very little altered from that which they bear in nature. Among them are found many minuter interesting circumstances, which are invisible from the point whence the original drawing was made, and are consequently omitted. This figure will serve to convey an idea of the nature of the scale on which these appearances take place, and of the magnitude of the disturbances; the cliffs here varying from 300 to 500 feet in height, and the extent forced into the sketch being equivalent to a mile and a half.

One circumstance may here be noticed, as no other example of it occurs in the Plate. Near the left side of the sketch, there is seen an insulated mass of trap lying on the strata. If this should be examined in the interior country, it would evidently appear to be one of those portions which have been called basaltic caps. There can be no doubt that it has here been once connected with the mass on the right hand; and from similar waste may be explained the appearances so common in countries where these rocks occur.

Fig. 4.—Presents a very striking example of the insulated entanglement of fragments of the strata.

Fig. 5.—This case must be considered as one of an irregularly conformable vein; as is indicated by the portion of the strata seen below. But, on the surface, it presents an interesting fact, namely, the elevation of the strata by the protrusion of a subjacent hill of trap. In a certain future stage of waste, it is evident that the strata will here be found conforming all round to the shape of this invisible hill, in the manner well known to occur with respect to the primary strata. When that waste shall become greater, the upper part will protrude, and it will then represent the appearance which occurs when granite forms the summit only of a hill, and the primary strata repose in a conformable manner on its different sides.

Fig. 6.—This represents a striking, though here a common case, of the splitting and flexure of the strata.

Fig. 7.—In this figure there is an excellent example of the curvature which occasionally takes place in these entangled portions of the strata. It is not possible here to discover which of the several rocks form this portion. Whether only one, or the whole, it serves to prove that the influence of trap is capable of softening the strata in such a manner as to render them susceptible of flexure. The curvatures of rocks need not therefore excite surprise; nor is it necessary to imagine that such strata were thus originally formed, as there can be no reason to doubt that the present portion was once as straight as those from which it has been separated.

Fig. 8.—This is another remarkable example of displacement. It admits of one observation of another nature. When the superincumbent trap shall have wasted so as to reach that extremity of one of the beds which is now nearest the surface, the exposed portion will appear like an insulated fragment, whereas it is connected with a more extensive mass. It is probable that this case often occurs in nature.

Fig. 9.—Independently of the singular dispositions of the entangled parts in this example, it is evident that the interior surface of the land will here represent a body of strata lying in an undisturbed manner on a basis of trap; an appearance which might lead to the false conclusion that there are deposits of stratified rocks more recent than that substance.

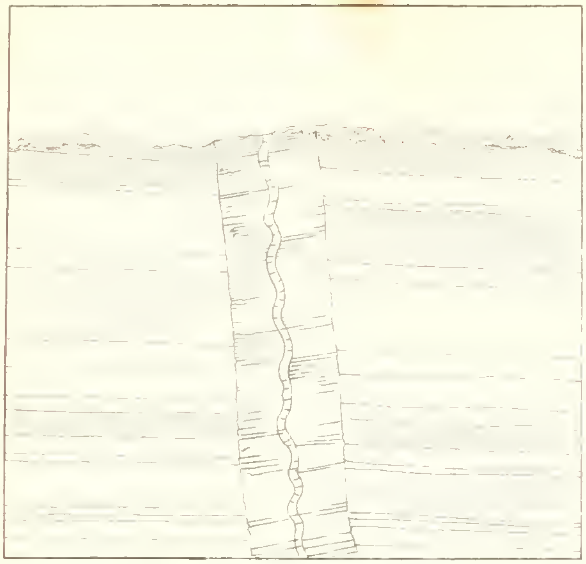
Fig. 10.—Is another, perhaps a superfluous example of the separation of the strata.

Fig. 11.—Is a remarkable example of fracture, accompanied by a displacement which is in one part so small as to admit of the re-adaptation of the separated portions.

Fig. 12.—Is a similar case, equally remarkable.

Fig. 13.—The minuteness and separation of the portions, cause this also to put on a very peculiar appearance. It must be remarked, on this and some of the preceding figures, that the rock is sometimes columnar, as is indicated in the sketches; nor do the entangled portions of the strata disturb or in any way affect that disposition, which continues unchanged even in their intervals.

Fig. 14, 15.—Require no additional remarks, as they are only variations of some of the preceding examples.



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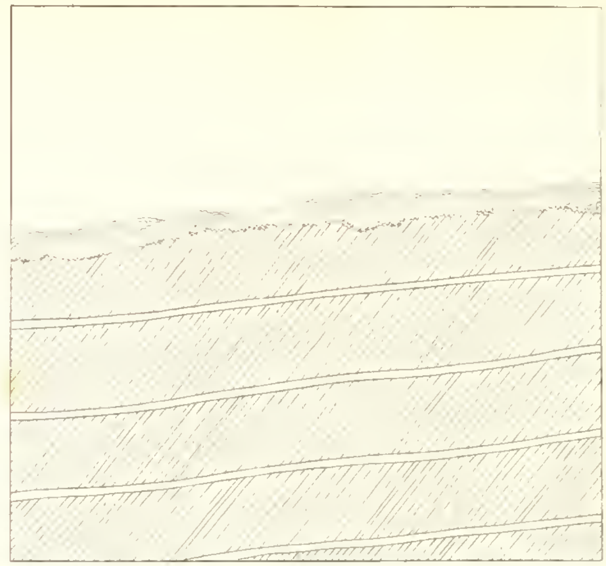

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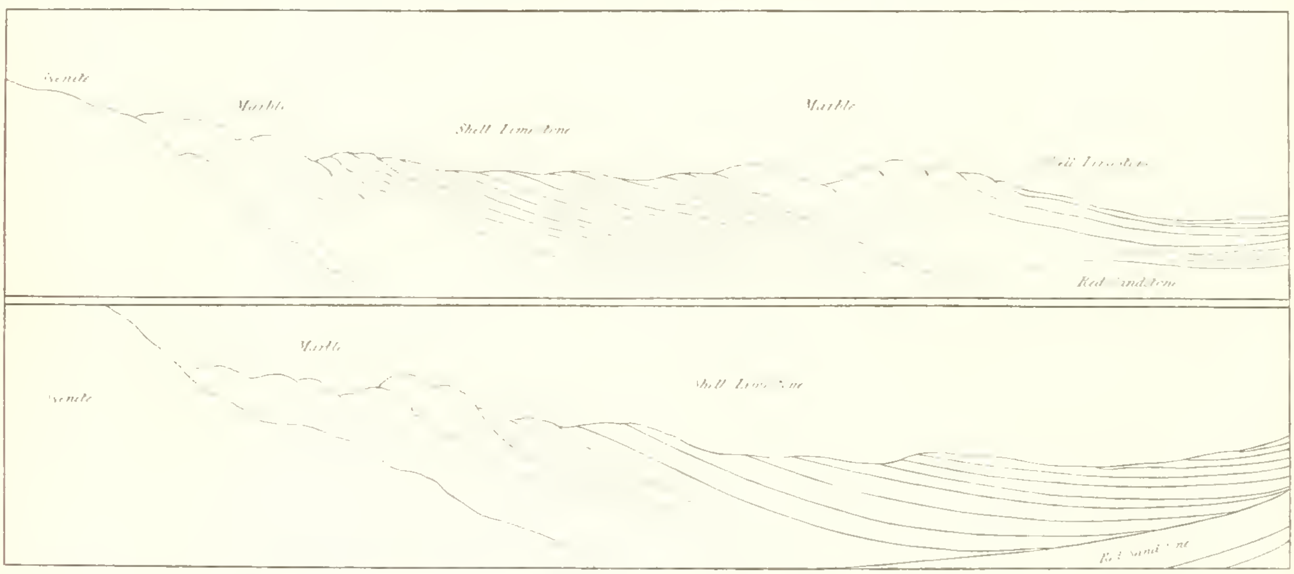

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4 … the Marble and Shells Limestone at Kilbride

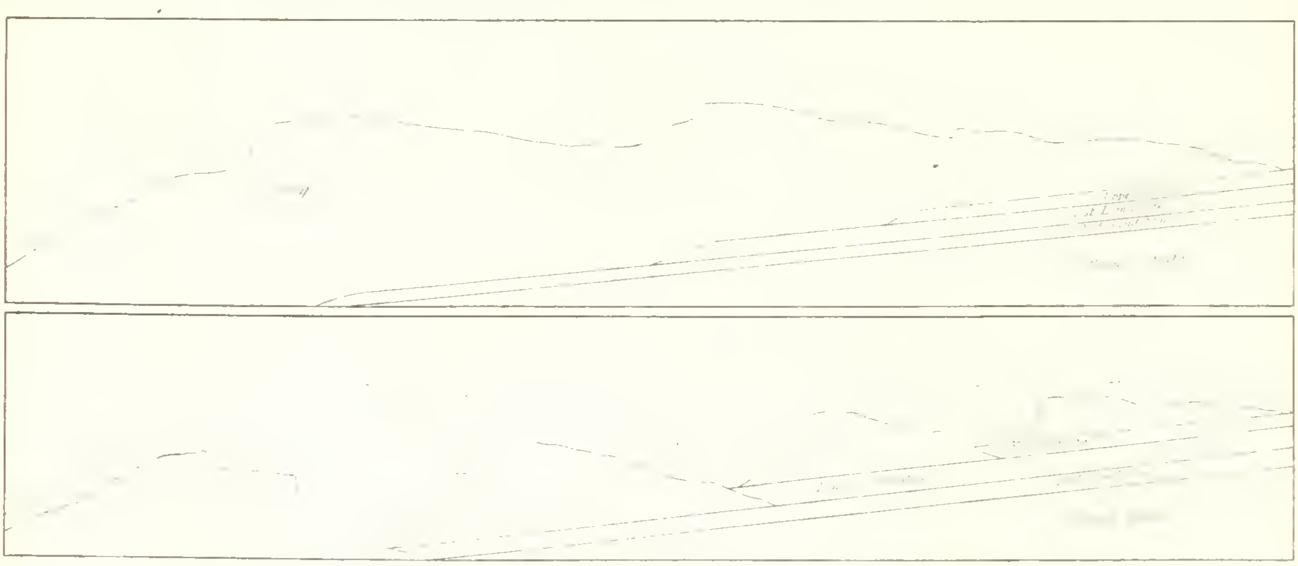

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PLATE XVIII.

Fig. 1.—Is a sketch of a trap vein traversing in a vertical direction the indurated calcareous sandstone of Strathaird, and again intersected in a parallel course by a second vein of the same substance, which is remarkable for its undulating course.

Fig. 2.—Represents the very peculiar schistose structure of the secondary strata of Strathaird, which is fully described in the geological account. The lines by which the grooves are marked, are in some places, and in a favourable light, scarcely less conspicuous than in this very hard and rudely engraved sketch.

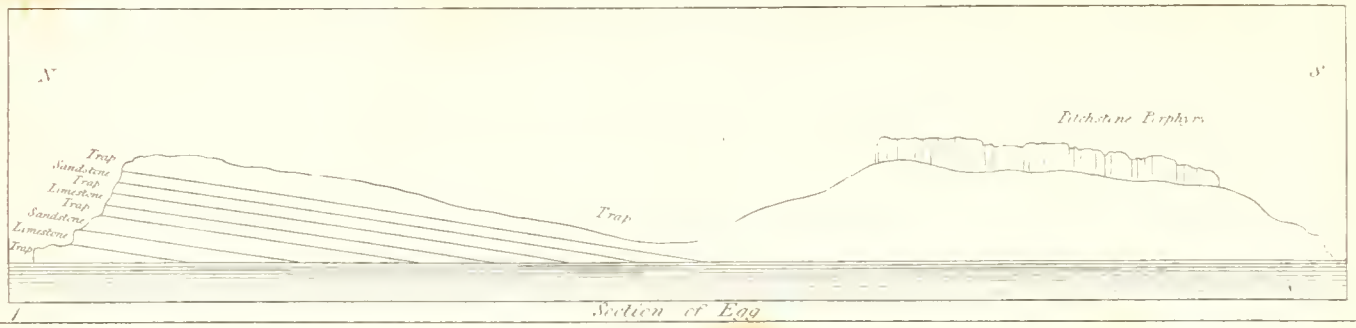
Fig. 3, 4.— Are two sketches of the intermixture of the crystalline limestone (marble) of Strath, with the stratified or conchiferous rock: these may be seen near the head of Loch Slapen.

In the first, it is apparent that there are two masses of the crystalline or amorphous rock; the one on the right hand side lying next to the syenite, and the other interposed between two portions of the regular beds. An attempt is also made to indicate, by the few lines admissible in such a sketch, the gradation occurring between the two.

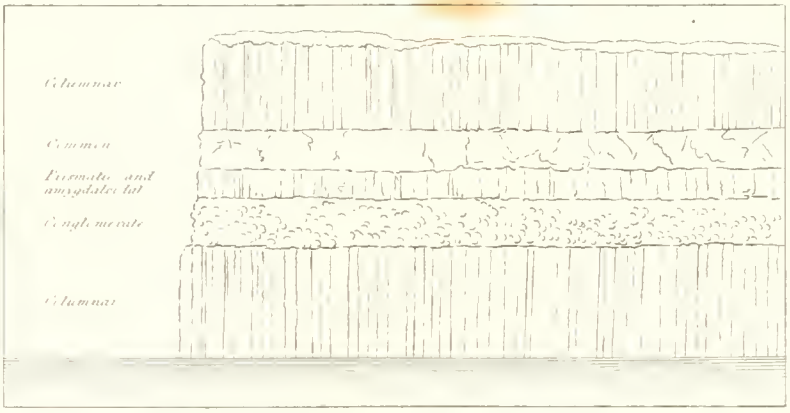
In the second, the contact of the amorphous limestone with the syenite is equally seen; while there is also an attempt to point out the change of position in the strata, and their unconformable position to the red sandstone on which they lie. These circumstances are all much more obvious in nature than in the sketch; but as they occupy

a considerable tract on the shore, they only admit of this method of delineation; a real view would not equally explain the peculiar nature of the facts.

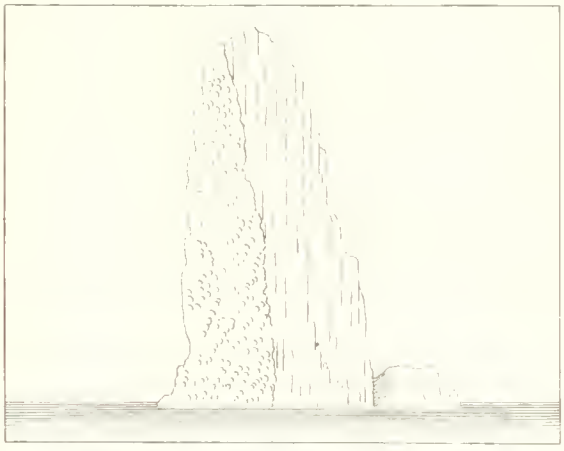
Fig. 5, 6.—These two figures are intended to illustrate the difficulty of judging respecting the relative age of any mass of trap, from considering those of the stratified rocks with which it may be connected. In the upper, an overlying mountain of that substance is represented in contact with a certain number of strata of different relative ages, an appearance very common. In the lower there are brought into the same space, four mountains of the same rock, each of which is in contact respectively with one of these strata. Whether it be supposed that these have put on their present independent forms from degradation through a long period of time, (as indicated by the including dotted line) or that they have been produced in their present independent state, it is evident that their positions with respect to the strata, prove nothing as to their relative ages; since, in either case, being the last deposited, they must necessarily lie in contact with whatever substance happened then to be uppermost.



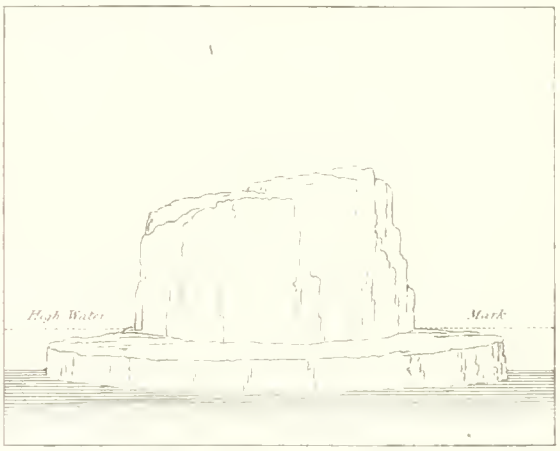
1 Section of Egg



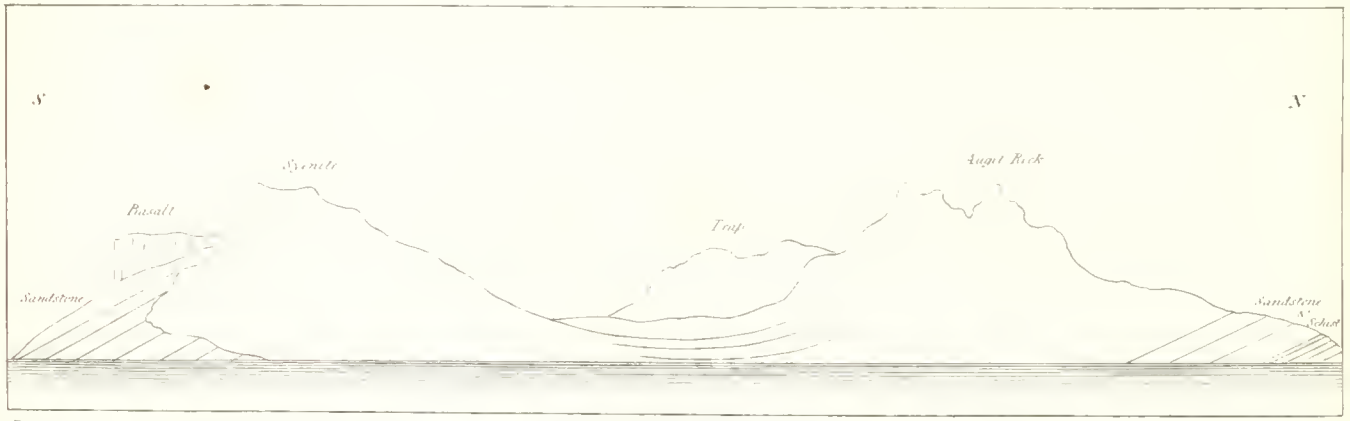
2 Alternations of the Trap in Canna and Sandy Isle.



3 Position of the Conglomerate in Dun Toclan



4 Rock on the N side of Canna shewing the preservative power of the Sea



5 Ideal Section of Rum.

PLATE XIX.

Fig. 1.—Is a section of Egg. The alternations of the secondary strata towards the left hand of the sketch, on the northern extremity of the island, are so intricate and numerous that they do not admit of being detailed except on a drawing of great size. The present is a mere epitome of their general characters and disposition. The position of the Scuir is also indicated, and the whole conveys a tolerable idea of the outline of the island when viewed in a particular direction.

Fig. 2.—Represents one of the simplest cases of the alternations of the several trap rocks which occur in Sandy isle, and it is equally applicable to certain parts of Canna. It is only to be regretted that the whole of these could not be introduced. In the present, it may be seen that the conglomerate lies above a mass of columnar trap, and that it is followed by a bed of an amygdaloidal variety, which is again succeeded by an amorphous mass, finally surmounted by a third columnar bed. It is scarcely necessary to observe that here, as in many other sketches in this work, the mode adopted for representing the rocks is rather a species of hieroglyphic, or picture-writing, than an actual representation of the objects.

Fig. 3.—Represents, in the same kind of character, the singular relative positions of the conglomerate and the solid trap in one

of the Gull rocks (Dun na feoulan) in Sandy isle. The rock itself is highly picturesque, and merited a far different treatment.

Fig. 4. — Is an outline, in a similar way, of a rock near the north side of Canna, and is here introduced as a specimen of the mode in which the presence and contact of the sea prevents the disintegration of these shores. The platform on which this rock stands, is that part of the mass which lies between the high and low water marks.

Fig. 5. — This is an ideal section of Rum, and it will serve to convey a general notion of the relative positions of the stratified and of the overlying rocks. On the right hand side, the sandstone which lies near Loch Scresort is represented, surmounted by the augit rock of Halival. The marks of strata seen in the middle of the drawing, are intended to represent the gradual passage from the amorphous to the stratified character at Harris, where the transition from the augit rock to the syenite occurs. In the distance are seen the basaltic cliffs above Giurdil, lying upon the sandstone.

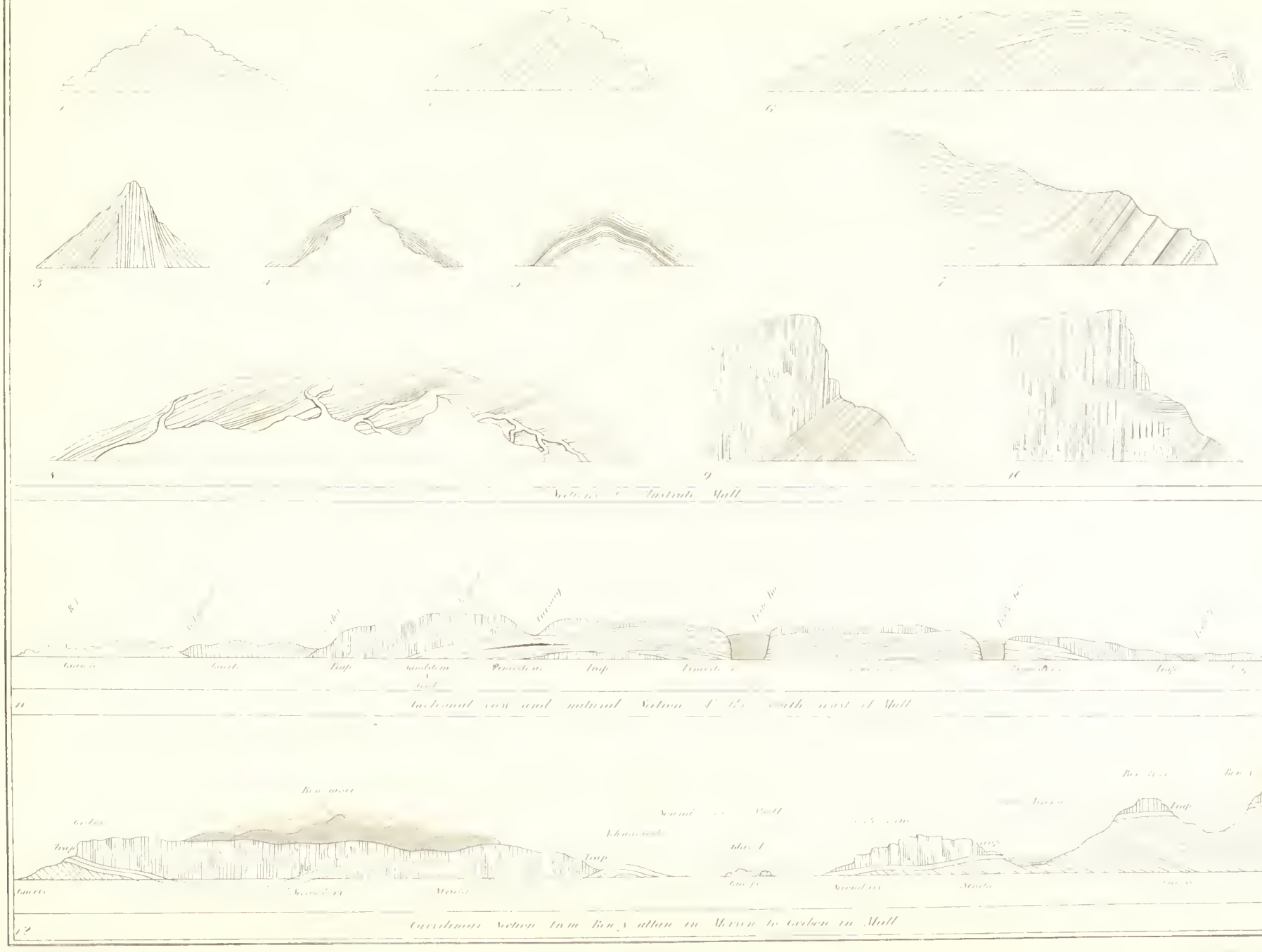


PLATE XX.

Fig. 1, 2, 3, 4, 5.—Are various sections, representing, in a general way, the manner in which strata are situated in mountains. Marks of displacement are visible in every case but the first, which indicates the position of the beds of trap at Gribon.

Fig. 6.—Represents the deposition of a series of secondary strata on an irregular surface of elevated primary beds. It is obvious that even the same secondary stratum may here be conformable and unconformable at the same time to the rocks on which it lies; and it is evident, that in the case of distant deposits, the same differences of relative position must occasionally exist.

Fig. 7.—In this case, the same effect follows from the deposition of the secondary strata within a cavity of the primary, as, in the former, from their deposition on a convex surface.

Fig. 8.—Is a sketch of the manner in which the junction of granite with the stratified rocks takes place. There is here no mark of a successive deposition of strata on a previous surface, as may be supposed to have occurred in Fig. 5.

Fig. 9.—Sketch of the junction of the trap with the primary strata at Gribon.

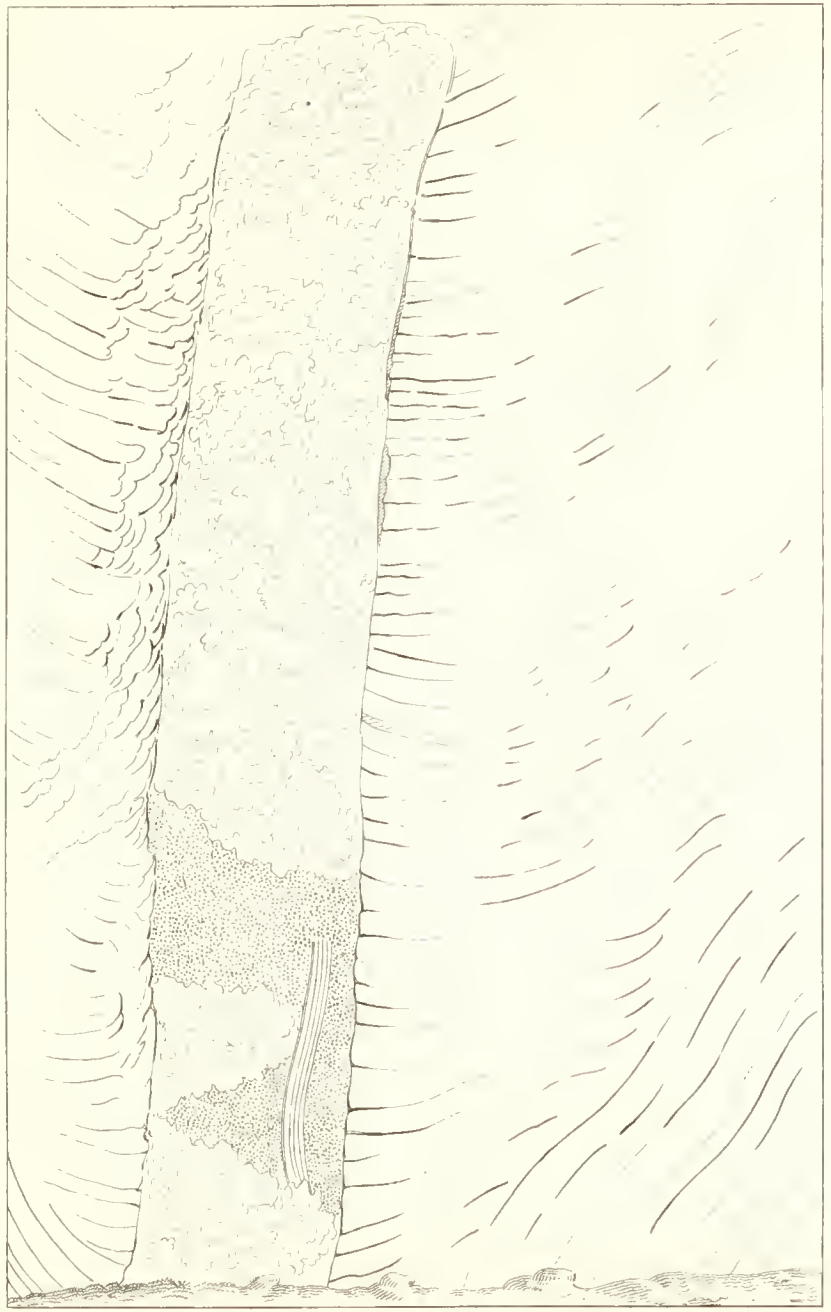
Fig. 10.—A sketch near the same spot, where both the secondary

and primary strata are seen. This is one of numerous examples illustrating a fact mentioned under the head of Sky, namely, that the same mass of trap might be in contact with rocks of distant ages. In this case, the two rocks are, the gneiss next to the granite, and the sandstone which lies above the coal.

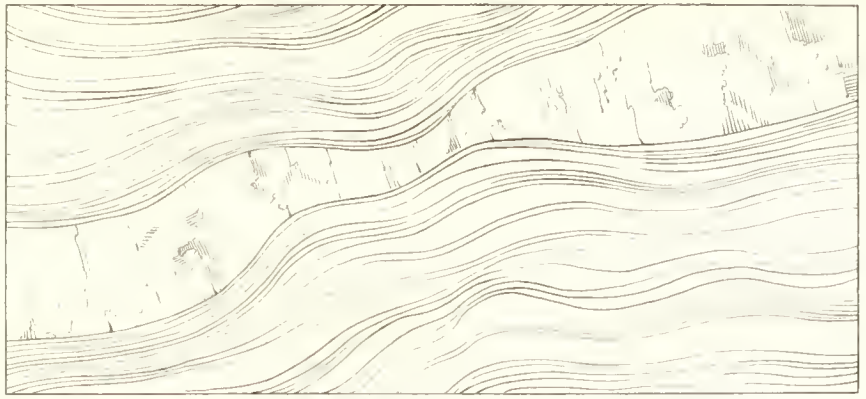
Fig. 11.—This may almost be considered a natural section of the southern coast of Mull, and is deduced from a connected drawing of the cliffs. It represents, as nearly as possible on such a scale, and in such a style of etching, the relative proportions and disposition of the parts. The positions of the beds of gneiss are not, however, intended to be real; the lines are merely hieroglyphics.

Fig. 12.—Is an attempt to connect, by an ideal section, the structure of Mull with that of Morven, for the illustration of the former. The general Map will assist the explanation; the detached trap summits of Ben Hun and Ben y attan having been marked on it for that purpose.

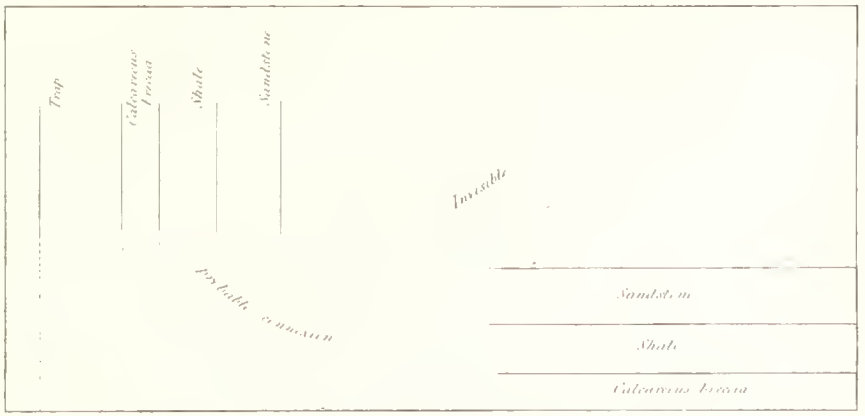
The dotted lines explain the supposed waste of the trap, and the imaginary position of the secondary strata, whether removed or actually existing. In the general comparison of the Trap isles, to illustrate which this sketch is introduced, it is said that the coal and sandstone are every where in contact with the gneiss. That is the case, at least, wherever I examined this country; nor did I discover any indication of red sandstone. It by no means follows, however, that it may not exist somewhere, as it occurs in Inch Kenneth, which is part of the same deposit.



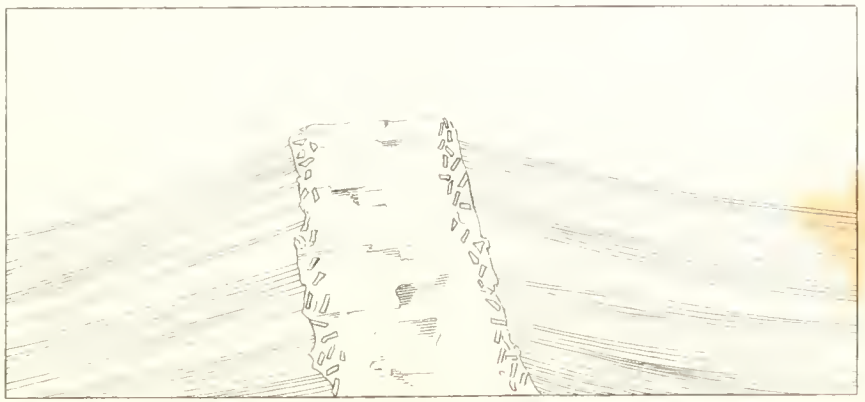
Portion of a Carbonized Tree in Mull.



Trap vein conterming to the Schist in Lunga



Trap vein with its probable effect on the adjoining Strata Bute



Trap vein entangling fragments of Schist. Neil

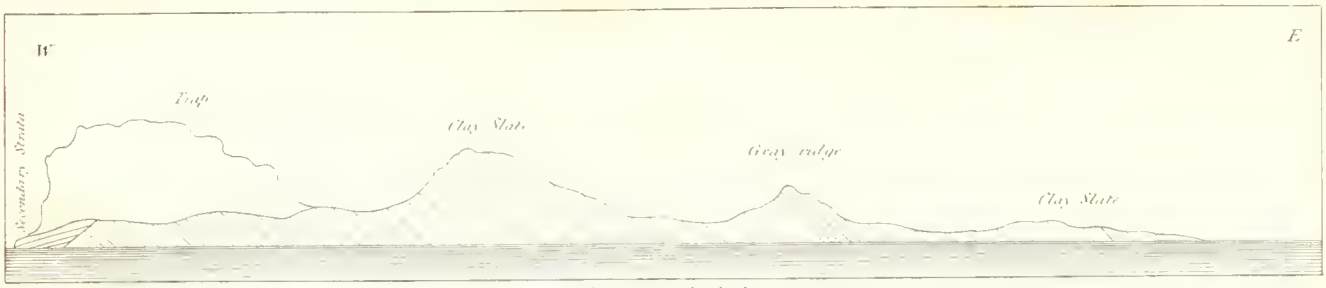
PLATE XXI.

Fig. 1.—Is a sketch of the general outline and appearance of the vein in Mull, in which are contained fragments of carbonized wood. The proportional altitude has been materially reduced, for the purpose of showing the manner in which this vein terminates above. The surrounding rock is an irregular congeries of imperfect columns. The vein is chiefly filled with a coarse conglomerate, or tuff; but in the part where the colour is increased by spots, it is blackened by the dust and fragments of the wood. The erect portion of the tree is seen lying in it.

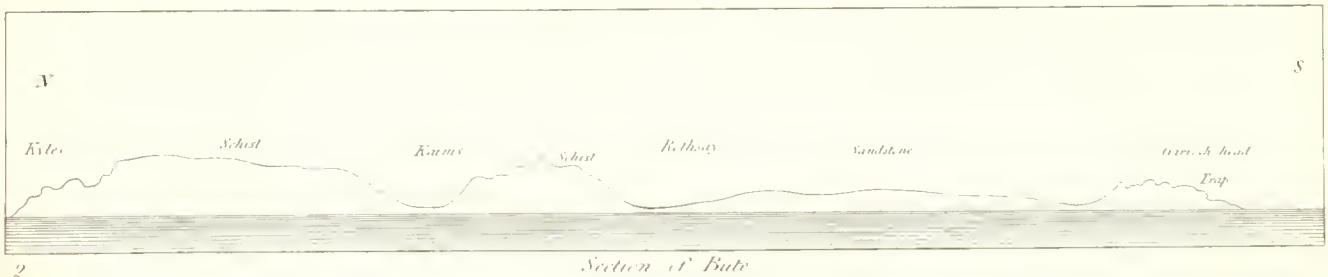
Fig. 2.—Represents the passage of a trap vein in a direction conformable to the lamination of the schist in Lunga. It is intended to show the peculiar form which these veins assume when they traverse yielding materials. The laminæ have been merely separated, not fractured.

Fig. 3.—Is a diagram of the positions of the stratified rocks with respect to a trap vein in Bute. Near the vein, they are vertical and parallel to its walls, while the shale in contact with it is also much indurated. At a small distance, the same beds are found in the same order. The invisible interval is here connected by lines indicating a curvature. It is perhaps more likely to be a fracture, but is not accessible.

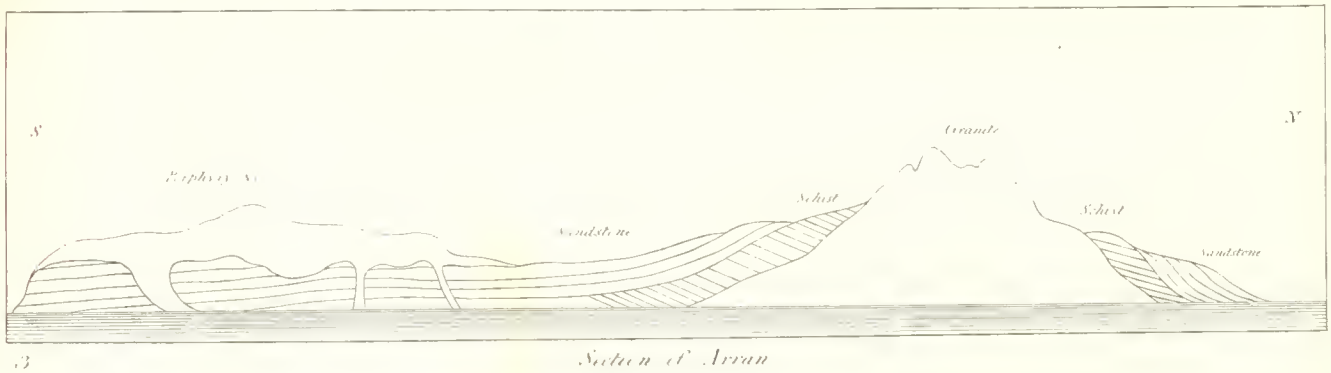
Fig. 4.—A vein of claystone in Seil, passing through the clay slate. To a certain distance from the edge, it is filled with fragments of the including rock, extremely numerous and generally of a small size.



1 Section of Sea

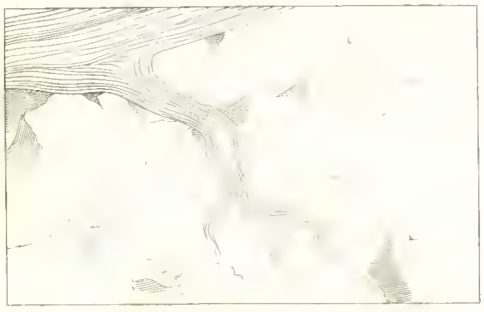


2 Section of Bute

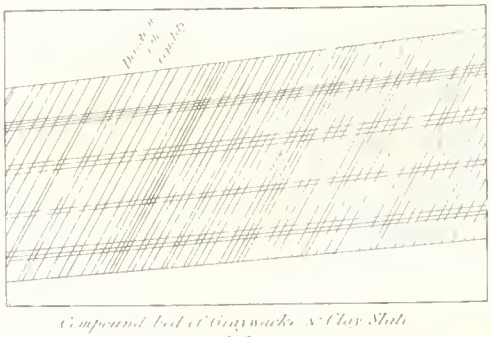


3 Section of Arran

4 Section of Isla



5 Schist elevated into veins
Isla



6 Compound bed of Greywacke & Clay Slate
Isla

PLATE XXII.

Fig. 1.—Is an ideal section of the island of Seil, oblique to the direction of the strata. In this, as in most other sections here introduced, there is no attempt to preserve the actual proportions of the parts, either with respect to the altitudes of the hills or the ground plan of the island. As the purpose has merely been that of assisting the imagination, it has been here judged sufficient to convey a general idea of their relations: a section of a more accurate nature would have required a much larger space than was compatible with the plan to which the engravings have been limited; nor indeed would one section have sufficed.

On the left hand is seen a small tract indicating the existence, rather than the place or proportions, of the secondary strata; as they would not have been visible in a real section. The space occupied by the argillaceous schist in the sketch, is more nearly consonant to that which it actually covers. The position of the overlying trap is also indicated, and a sufficient notion is conveyed of the relative proportions and places of the hills and valleys which traverse the island. The relative situation of that which is called the grey ridge, to the clay slate, is also deducible; and it is easily seen that it is interposed among the beds of that substance.

Fig. 2.—Is a longitudinal section of Bute. This, like the former, is merely intended to convey a general notion of the geological outline of the island, and of the hills and valleys into which it is divided. Neither the altitudes of the parts, nor their ichnographic

dimensions, are attended to; for the same reasons, namely, the limited scale of the drawing. Bute affords many very interesting sections, but they could not be introduced. To have illustrated in a proper manner any one of the principal islands described in this Work, would have required a large part of that volume into which it has become necessary to condense the whole. It will be easy nevertheless, here to distinguish the schistose primary rocks from the sandstone, and the latter from the trap of the Garroch head. The direction in which the section is made, did not permit the indications of the strata to be given without materially falsifying their positions.

Fig. 3.—This is intended to convey a general notion of the structure of Arran.

On the sides of the granite mountains, is seen the schist, represented by various sectional lines indicating the general irregularity of its position with regard to that rock, but not pretending to point out the real inclinations. This is covered by the secondary strata which, on the right hand of the sketch, are elevated nearly in the manner in which they are found at the northern extremity of the island. On the left hand they subside into the low elevations which predominate at the southern extremity. The overlying rocks are here also represented as forming the hilly tract of the southern division; surmounting the sandstone and connected with veins that pass through it.

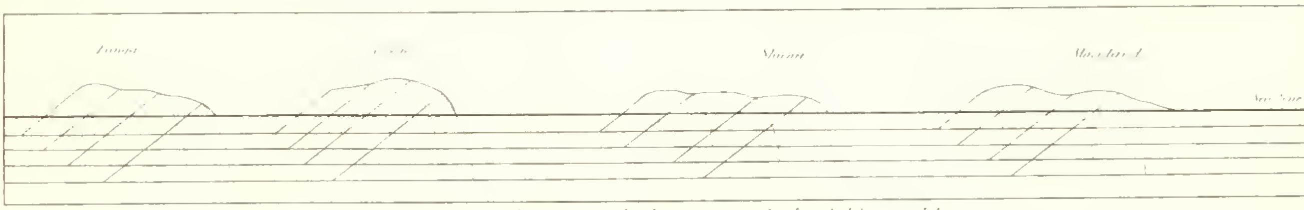
Fig. 4.—Is a general section across the centre of Isla, the eastern half of which is also applicable to Jura. It is, like the former,

ideal, but will serve to convey all the illustration which is here admissible, and will assist the reader in comprehending, both the varying inclinations of the strata, and the alternations of the different substances which enter into the composition of the island.

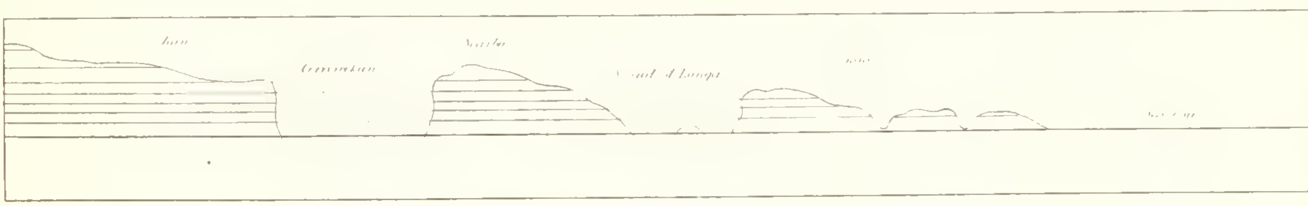
Fig. 5.—Is a representation of that contortion of the argillaceous schists which is sometimes found where they alternate with quartz rock or other inflexible substances, and which is peculiarly remarkable where they are intermingled with trap rocks. The appearance is so like to that assumed by veins, that it is not surprising if it has sometimes misled observers.

Fig. 6.—Is a portion of the schistose beds at Sanig in Isla. The whole mass is an alternation of graywacké schist with fine clay slate, indicated by the lines which lie at an angle approaching the horizontal line. Those which cross them are the indications of the laminar structure. It is here apparent that the deposition of the substances has taken place in the former direction, and that the fissility, being oblique to that, must have been the result of a concretionary structure unconnected with the stratification.

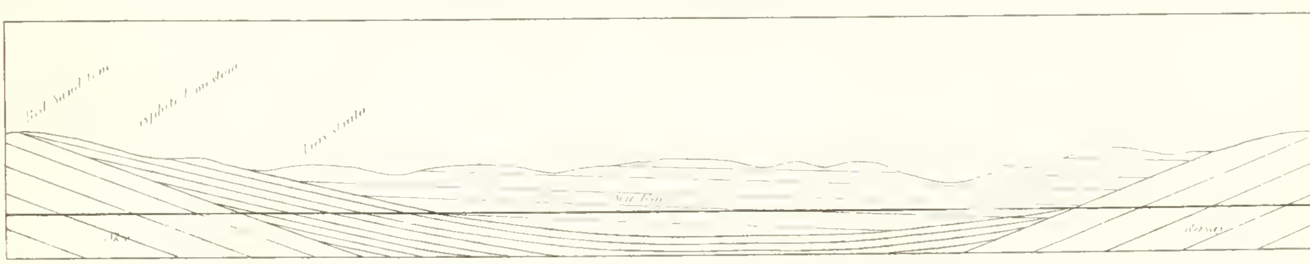
1 *Natural section of Scarba in the Corrievrekan*



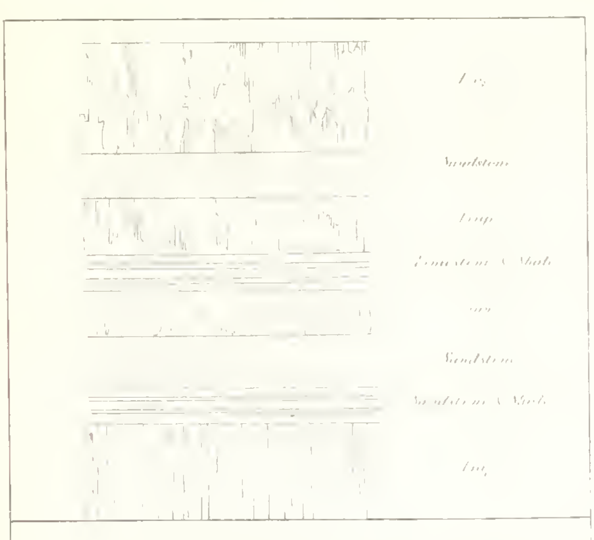
2 *Diagram of the supposed formation of the Schistose Isles.*



3 *Disjunction of Jura Scarba & Lunga*



4 *Section to shew how the Gryphite Limestone may exist invisibly in Rasay*



5 *Alternations of the Strata & Trap in Egg*

6 *Measurement of the Scurr of Egg*

PLATE XXIII.

Fig. 1.—Is a sketch from the natural section of Scarba, as seen in the Coryvrechan. It represents the elements of the undulations of the strata there visible, and the more regular dip of the western portion of the mountain.

Fig. 2.—Is a hypothetical diagram explanatory of those elevations of the strata which may be supposed to have formed some of the Slate isles. It may here be seen, that from four strata, presenting only one alternation, or succession, four such alternations may, on this assumed principle, have been generated. Four distinct elevations, or depressions, are necessarily productive of such a result, which may illustrate the more limited occurrences of this nature so often found in hilly countries.

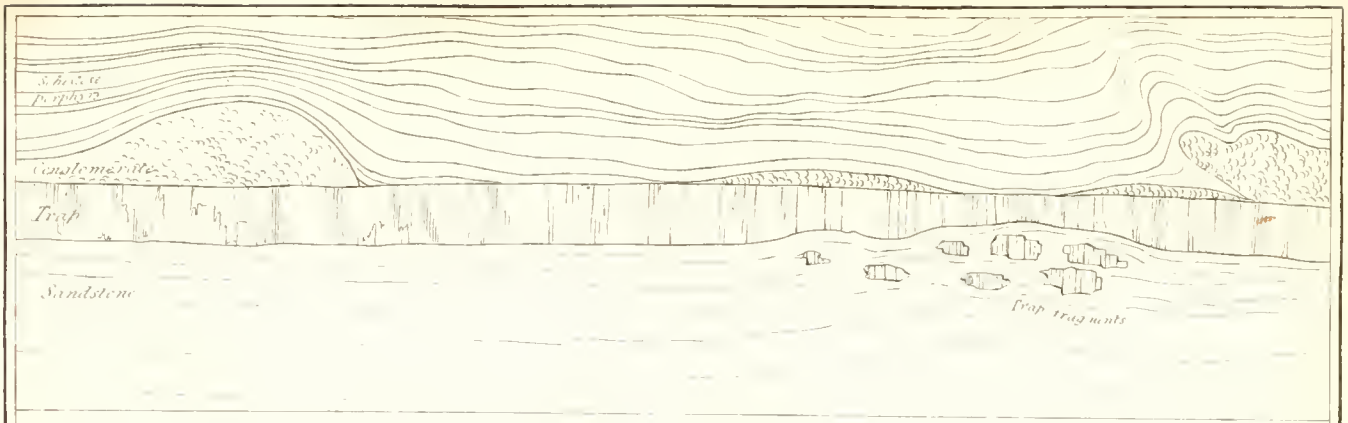
Fig. 3.—Is an ideal section from Jura to Lunga, intended to show the correspondence of the planes of stratification throughout the chain. It is here imagined that they once formed a continuous mass, and that the present separation has been the result of waste without disturbance. In the Coryvrechan is indicated the rock which causes the gyrations of the sea in that passage.

Fig. 4.—Is an ideal section intended to show the manner in which all the strata found in basin-like deposits may come into contact with the fundamental rock; the lower occupying a more

limited horizontal extent than the upper beds. It also shows how such strata are either conformable, or the reverse, to the planes of the primary strata on which they lie.

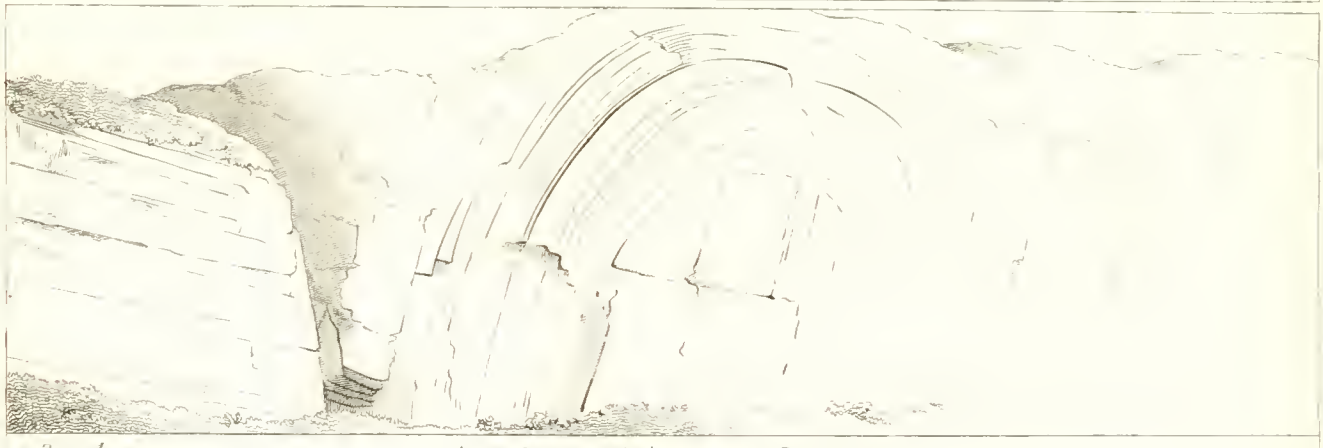
Fig. 5.—Is an abridgment, if it may so be called, of the alternations visible at the north end of Egg. The more extensive strata are laid down, and the whole simplified, by the omission of those parts which are least regularly persistent.

Fig. 6.—Is a diagram to represent the mode of measurement by which the altitude of the Scuir of Egg is estimated. It is evident that the application of the plumb-line to one point only, does not give a true measure.

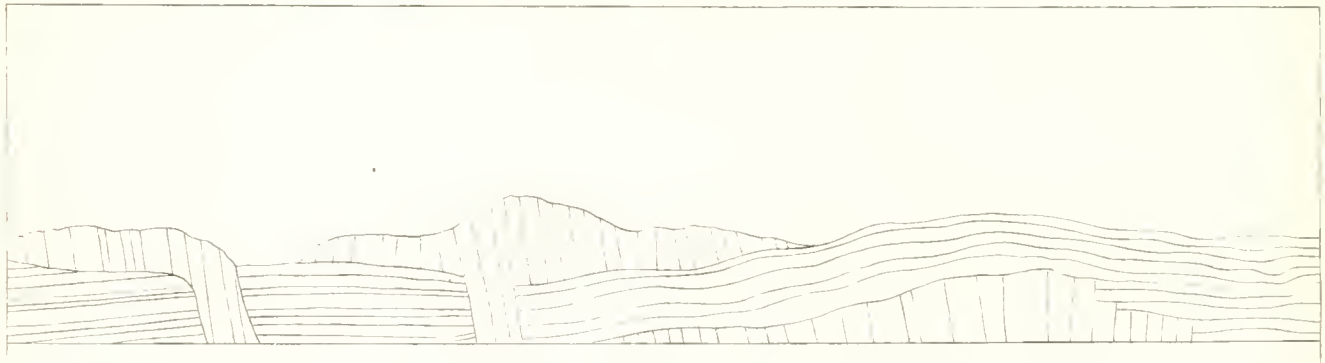


1. Arran. Contact of Trap and porphyry veins with intermediate fragments of conglomerate and detached fragments of Trap.

2 Lamlash Position of the Pitchstone veins and other rocks on the east side



3. Arran. Curved vein of Claystone. Blackwater



4. Arran. Relative position of the Sandstone and overlying rocks.

PLATE XXIV.

Fig. 1.—Is a ground plan of the relative positions of the approximate veins of trap and claystone on the shore near Corygills in Arran.

It may here be seen, that although these two veins are in some places in contact, in others there are portions of the conglomerate of the red sandstone interposed. The claystone (or porphyry, since it possesses both characters) undulates round these fragments and gives indications of a laminar structure, while it is also to a certain degree contorted.

In the sandstone are entangled fragments of trap; which are not rounded, but possess the same decided angularity as the vein. This part of the appearance is not very intelligible, unless it be supposed that these are produced by the sections of smaller veins ramifying from the principal one; a circumstance that might be determined by quarrying in the spot.

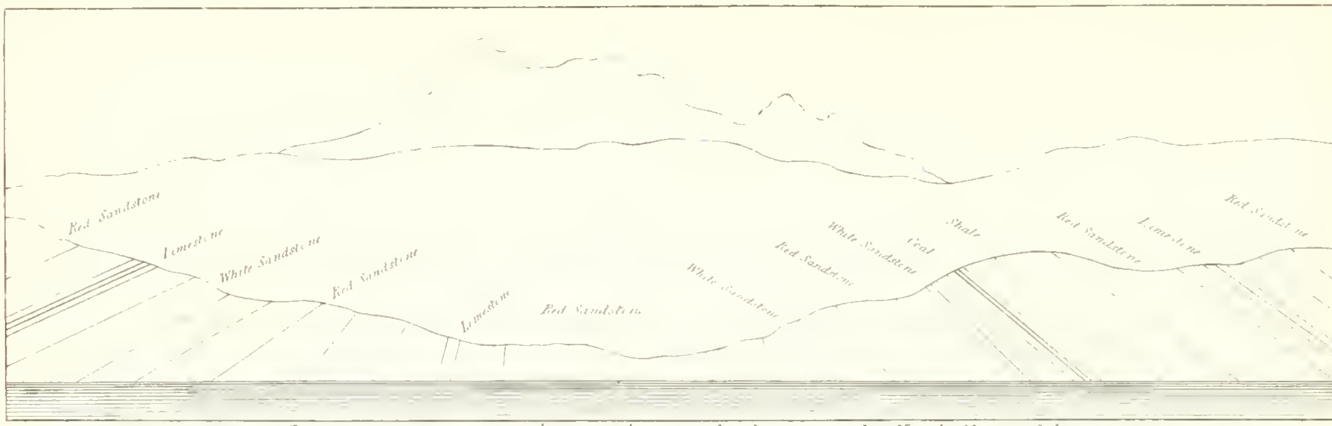
Fig. 2.—Is a species of diagram taken from a drawing of the eastern shore of Lamlash, and intended to convey an idea of the relative situations of the principal rocks there visible. The proportions, and the picturesque circumstances, have all been sacrificed to this object. On the left hand side are seen the sandstone strata, intersected by an oblique vein of trap. That vein is traversed by another vertical vein, bounded by double lines. This is the vein of which the exterior surfaces consist of pitchstone, which is indicated by the double lines. Owing to

the incumbrances of the ground, it cannot be traced beyond the limits of the oblique trap vein. A vertical vein decomposing into spheroidal forms, is also seen in this place, traversing the last mentioned vein and the secondary strata also.

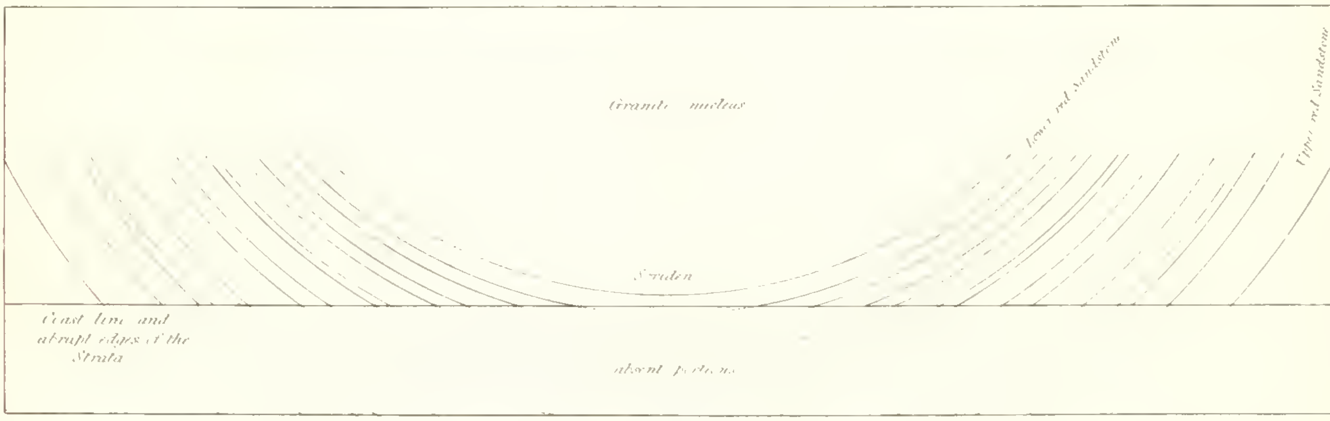
Towards the middle of the sketch is seen a great mass of sandstone beds, cut off in a decided manner towards the right hand, by the clinkstone which also lies above it and forms the body of the mountain. Its prolongations towards the left, are obscured by soil and vegetation, but the two parts are probably connected. The clinkstone is represented as being columnar, that character being prevalent.

Fig. 3.—Is a slight etching from a drawing of a vein of claystone on the southern shore of Arran, between Drumodune and Sliddery. The curvature is a remarkable, and a rare circumstance. The strata in which it lies are of sandstone.

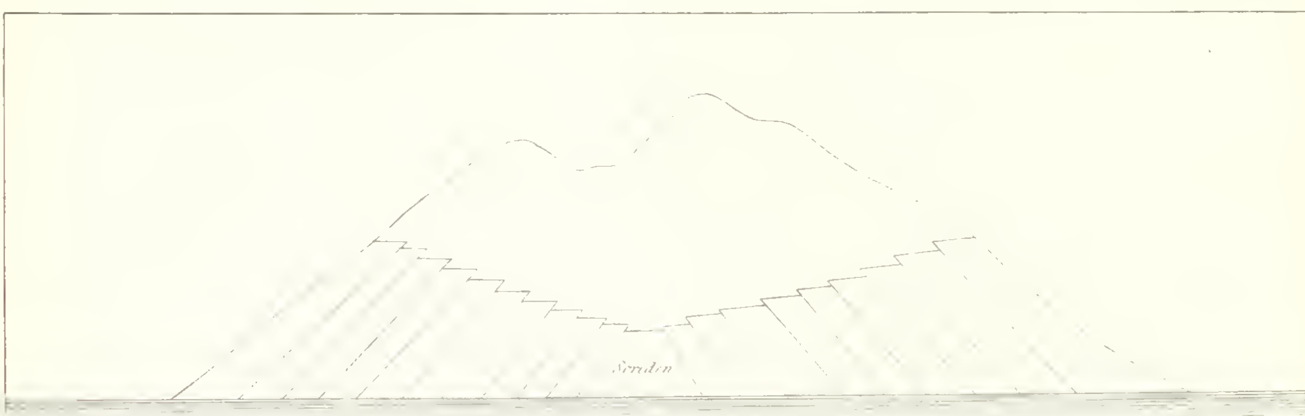
Fig. 4.—Is intended to convey a general notion of the positions occupied by the trap, or other overlying rocks, with respect to the sandstone strata. In the middle is seen the manner in which veins are sometimes connected with the overlying masses. On the left hand, a portion of the overlying mass is removed: it is only to imagine the remainder absent, and the vein will acquire that appearance of independence which these often present. On the right of the sketch, the trap is beneath the sandstone; and towards the middle it seems, consequently, to form with it a regular series of alternation; of which the true nature is detected by the veins.



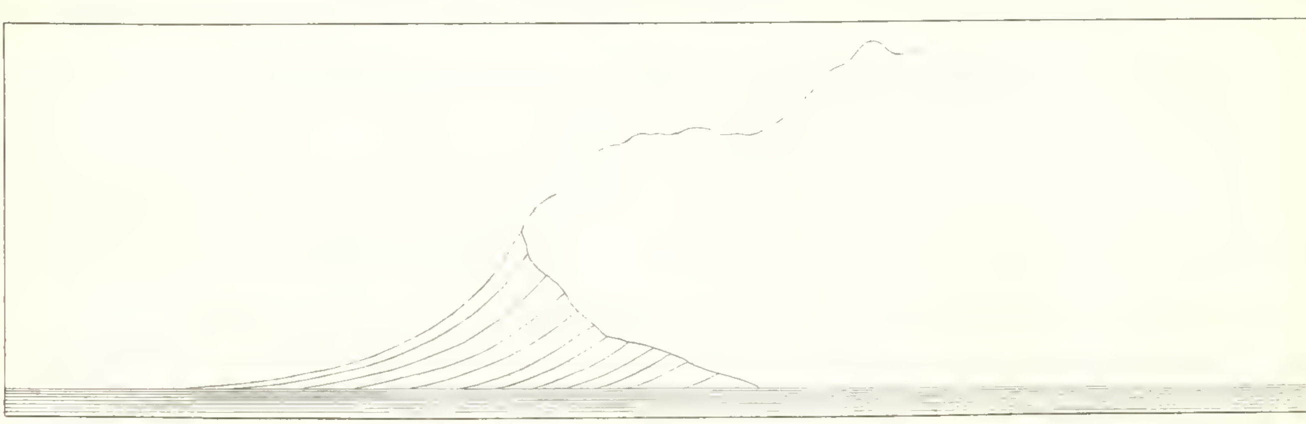
1 *Diagram representing the successions of the Strata on the North Shore of Arran*



2 *Horizontal Section of the same Strata to explain the variations in their direction &c*



3 *Vertical analysis showing in another way the loss of the exterior Strata.*



4 *Curved position of the same Strata explaining the variations in their dip.*

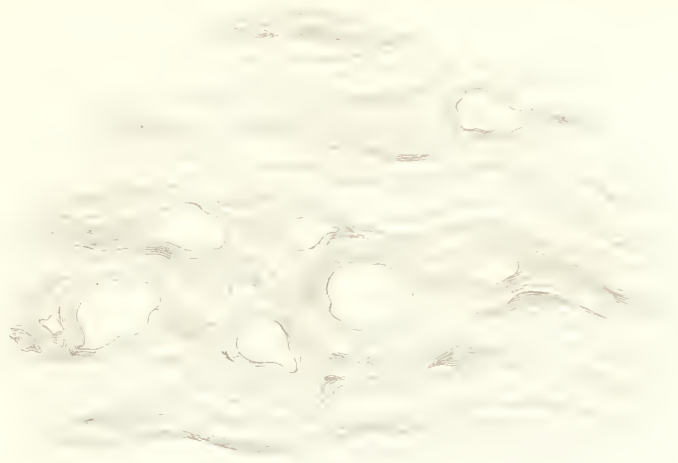
PLATE XXV.

Fig. 1.—Is intended to convey a general notion of the manner in which the secondary strata on the north-east shore of Arran, dip toward opposite quarters from the central point at Scriden.

Fig. 2.—Is an imaginary horizontal section of the whole body of the strata in the same place, supposing them to be reduced to the artificial form of a conoidal frustum. It is thus easy to perceive why, in commencing at the central point and walking both ways, the edges of the strata are met in each direction. It may also here be seen, how the smaller strata are all included between the lowest bed which forms the mass at Scriden, and the upper which, at the Cock and at Corry, constitutes the two extremes.

Fig. 3.—Is an ideal development of the same structure, and of the same successive removal of the beds, in another position. The forms are here also reduced to their elements.

Fig. 4.—Is a profile imaginary view, intended to convey an idea of the curvature of the sandstone strata against the mass of the hill, and of the consequent varieties of dip to be observed in different parts of the declivity and on the shores.



1 Bending & Gneiss round concretions of Hornblende in Gill

3 Trap vein traversing Granite in Iona

2 Granite vein with imbedded fragments of Schist in Mull

4 Trap vein traversing Hypersthene rock in Skye

PLATE XXVI.

Fig. 1.—Is a sketch of a mass of gneiss in Coll. The laminæ of the gneiss are bent over the concretions of hornblende, as if these latter had been indurated while the former were in an yielding state.

Fig. 2.—This is a map, rather than a drawing, of parts of the junction of the granite with the primary strata near Loch Laigh in Mull. The latter are considerably distorted, and many fragments are seen included within the granite, without any alteration of their original character; being, in some cases, so well defined that it is easy in imagination to replace the fragments in their original situations.

Fig. 3.—This is a sketch of a vein at the upper end of Glen Catcol. It is easy to see that the granite, instead of dividing in a parallel manner, as the secondary strata do, to admit of the vein, has yielded according to the directions of its natural joints; thus showing that the separation was the result of force, and that the vein is posterior to the granite.

Fig. 4.—This vein presents a remarkable instance on a large scale, of the entanglement of fragments of the including rock. It is here easy to imagine, that by compressing the sides together, the parts might again be brought into contact, and restored to the state in which they were before the forcible intrusion of the vein.

Chang[illegible] the common to the crystalline limestone in the direction of the strata
Isle of Man

Change of the common to the crystalline limestone according to the repetition of the strata
Isle of Man

Section of the Rock near Niarat Point
Isle of Man

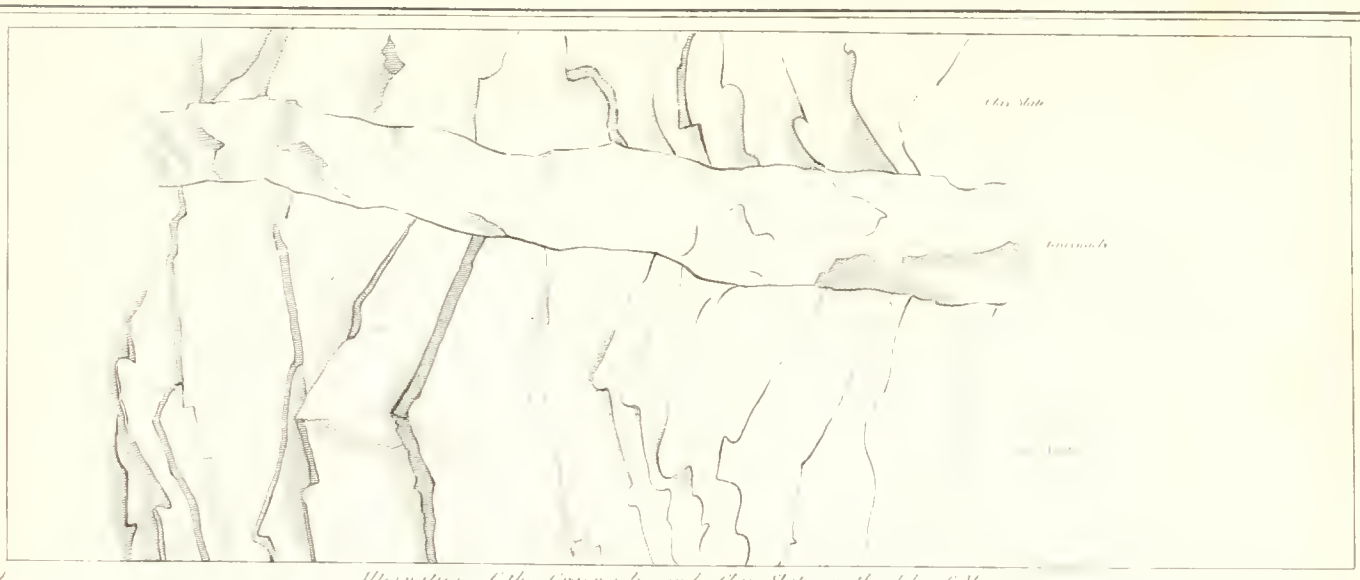
PLATE XXVII.

Fig. 1.—Is an example of the change which the stratified limestone undergoes in the Isle of Man, where it approximates to the schist. In this instance each bed loses the stratified disposition, becoming irregular and crystalline where it is in contact with the fundamental rock. The change takes place so gradually that there is no point where the one modification terminates and the other commences.

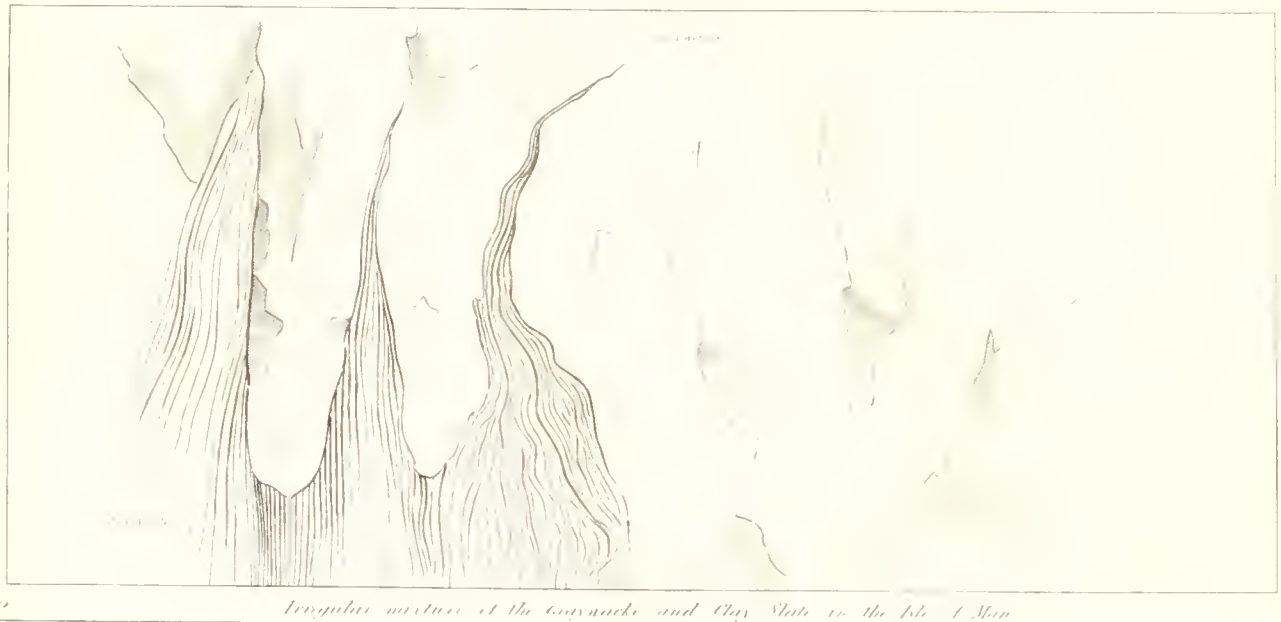
Fig. 2.—In the former case, the change from the stratified to the irregular disposition may be traced in each bed; but, in the present, it occurs according to the succession of the several beds above the fundamental rock. The lowest is irregular and perfectly crystalline. In the next, a slight approach to the stratified disposition is seen. By degrees that character becomes more distinct, until at length the beds become perfectly flat and even, as in the places where they are furthest removed from the schist. The texture, in both cases, becomes earthy when the stratified disposition is perfect; and, in this case, the organic remains, which were absent in the crystalline mass, are again found as in other parts of the deposit.

Fig. 3.—Is an imaginary section of the rocks near Scarlet point, where the trap veins are found. The same changes from the stratified to the irregular disposition are here seen; but it is also

apparent that the rock is not necessarily irregular wherever the trap veins intersect it, as the smaller ones pass through the stratified rock. Under these circumstances, it may be doubted whether they are connected with the causes of this change, or whether it is not rather the effect of the same obscure agency which has produced the former and predominant examples. This section also represents the irregularity of the schistose breccia above the limestone; and it is evident that it becomes irregular, principally when in contact with the unstratified rock. In one place it appears to alternate with the upper strata.



1 Alternations of the Greywacke and Clay Slate in the Isle of Man



2 Irregular mixture of the Greywacke and Clay Slate in the Isle of Man

3 Decomposition of the Granite in the Isle of Man

PLATE XXVIII.

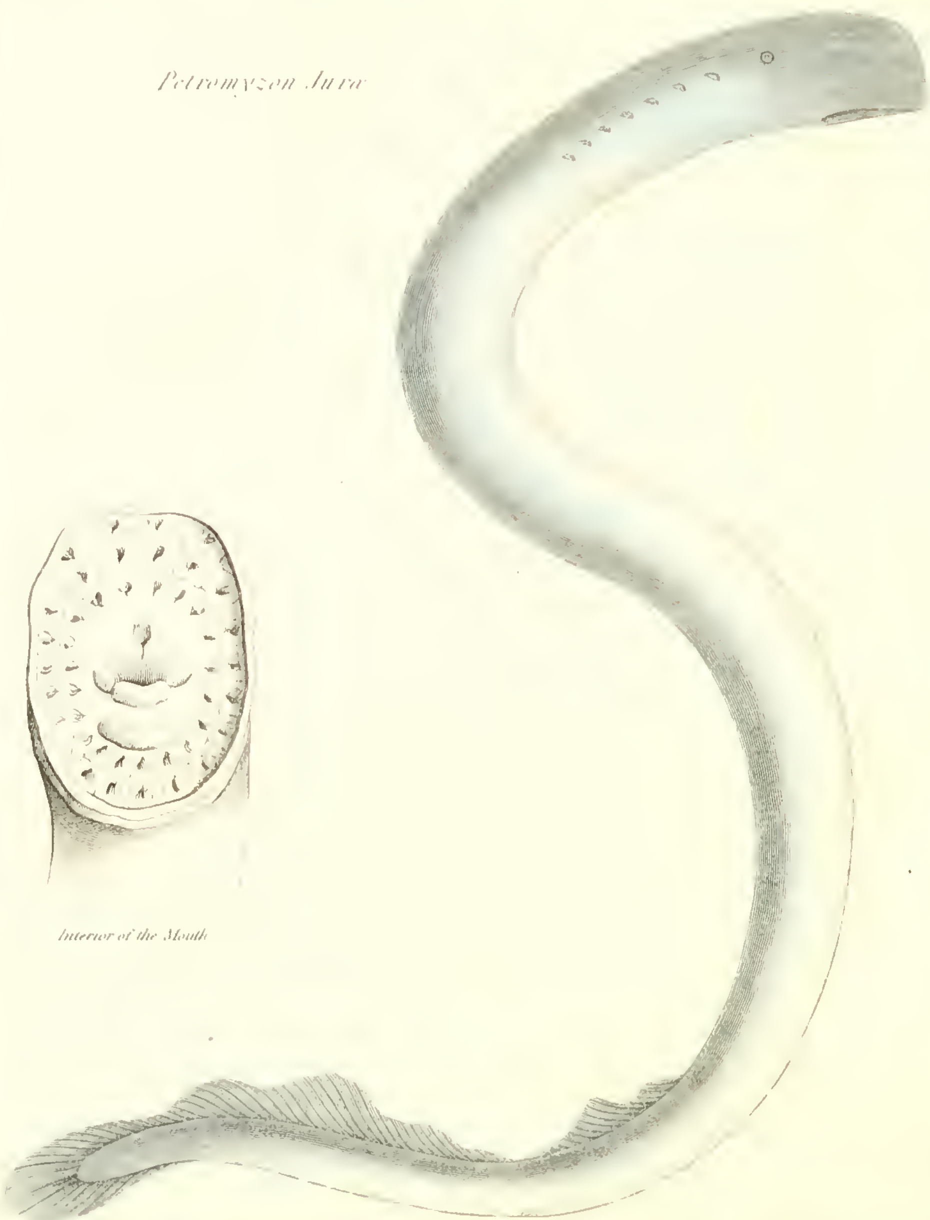
Fig. 1.—This is a rude sketch of the alternation of the graywacké and the clay slate near Douglas. The schistose structure of the latter is evident, and it is also obvious that it is at angles to the bed of graywacké, and consequently to that of the alternating clay slate.

Fig. 2.—Is another instance of alternation between the graywacké and clay slate, attended with some contortion, by which portions of the latter have been compressed between the protuberances of the former.

Fig. 3.—Is a sketch of the lines seen on the surface of the decomposing granite near the Doon river. In this particular case it is probable that the effect is a result of the concretionary structure, as it is too complicated to have arisen from the mere action of air or water on the surface.

Plate 29

1



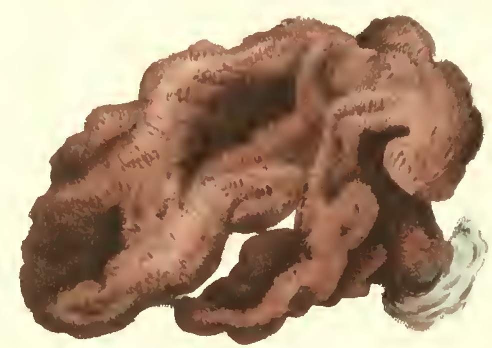
Petromyzon Juræ

Interior of the Mouth

2

Salpa moniliformis

3



Ulva montana

J. MacCulloch del.

Published by Archd. Constable & Co. May 31st. 1819.

Josh. Cross sculp.

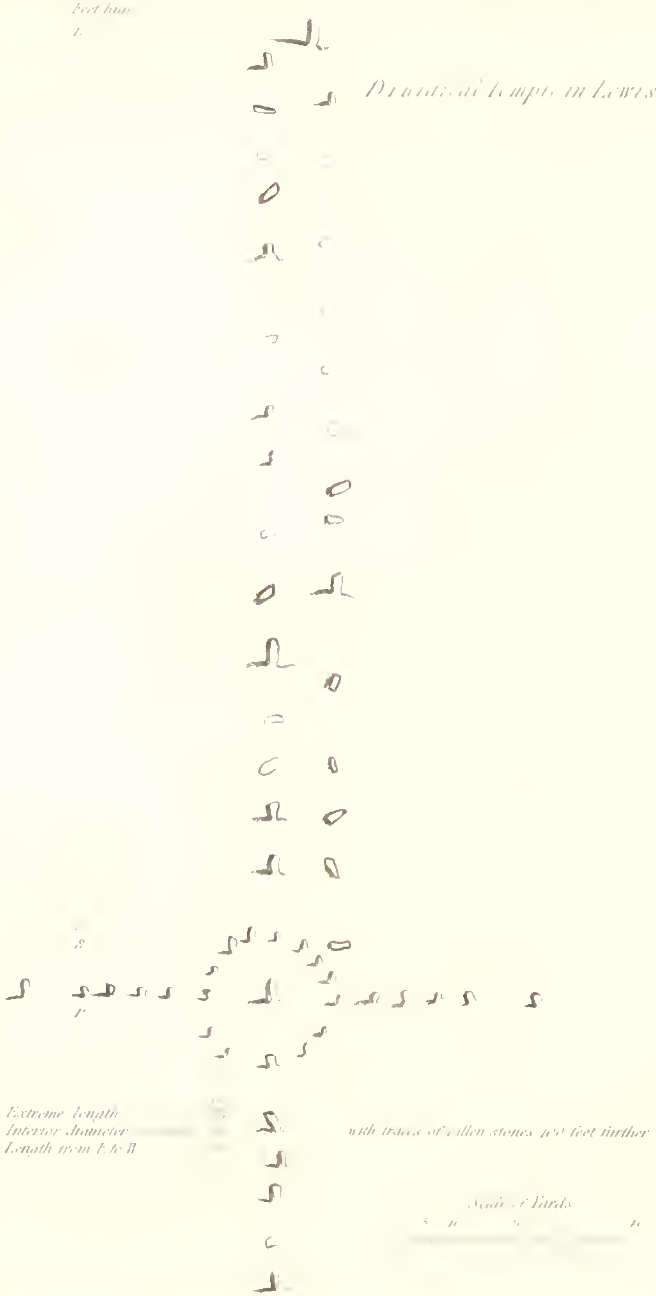
PLATE XXIX.

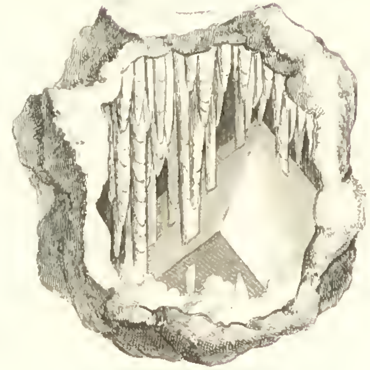
Fig. 1.—Is a sketch of the Petromyzon Juræ, together with one of the interior of the mouth. This is also the size of the specimen which was taken.

Fig. 2.—The different specimens of this animal which were taken, varied in size, and the largest were about a third longer. This is but a small portion of the chain, which often extended for many yards.

Fig. 3.—The green part is that by which the plant is rooted to the ground. Wherever it occurs it is generally so crowded as to cover large patches of the soil in such a manner as to conceal it entirely from the eye.

1





Agate Pebble

2

Caschrom

3

Origin of the Arch

5

Shoulder of Mutton Sail

6

Antient Boat Iona

I. MacCulloch del.

Cross sculp.

Published by Arch.d Constable & C.o May 31.st 1819.

PLATE XXX.

Fig. 1.—Is a ground plan, from measurement, of the Druidical structure in Lewis. To render the stones more visible on this reduced scale, they are drawn in the manner in which they are viewed. The fallen stones are distinguished from the erect, and the conjectural places of the deficient blocks are also noted.

Fig. 2.—Is a drawing of the interior of an agate nodule, showing the stalactitic forms of the chalcedony, and the included crystal of calcareous spar. It is plain that the infiltration of the carbonate of lime has taken place after that of the chalcedony had ceased, as the calcareous crystal surrounds the stalactite; and it is equally evident that the latter process has also ceased before the cavity was filled. Had it proceeded, it would have produced the appearance, much more common, of a solid pebble.

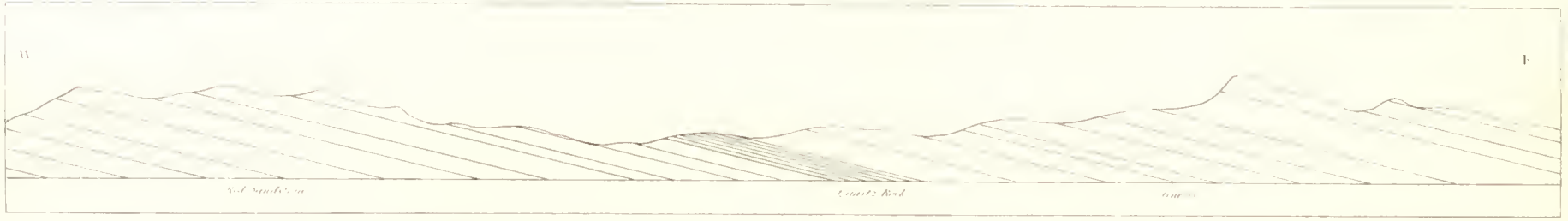
Fig. 3.—Represents a series of arches gradually assuming the form of the circular one.

Fig. 4.—Is a drawing of the caschrom. The iron shoe resembles the share of a plough, and the pin at the heel is pushed forward by the foot of the man. After it has entered the sod, the long handle is pressed down laterally so as to reverse the turf, as would happen in the plough from the divergence of the mould-board.

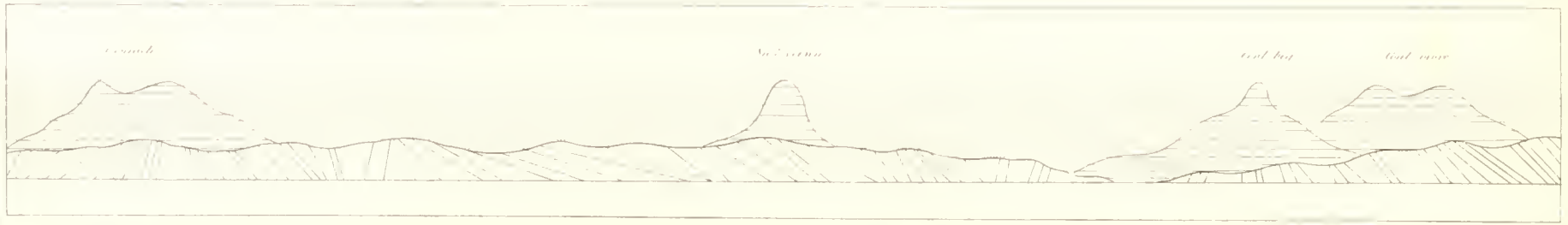
Fig. 5.—The shoulder of mutton sail.

Fig. 6.—Sketch of an ancient Highland boat from one of the sculptures in Iona. The original is cut into the stone nearly in the manner of the Egyptian hieroglyphics.

Gneiss and Granite seen at Cape Wrath



2 Alternation of the Red Sandstone with Quartz Rock & Gneiss at Loch Broom



3 Degradation of the mountains of Red Sandstone on the north west coast

PLATE XXXI.

Fig. 1.—Is a portion of the rock which forms Cape Wrath. The present sketch is an epitome of the original drawing; all the picturesque forms having been removed so as to render the peculiar structure of the rock visible with the least quantity of etching. The geological character, and the truth of the essential parts, have however remained untouched. At the point whence it was drawn, it was not possible to distinguish always between the pale gneiss and the granite; although the dark varieties, and the hornblende schist, are very visible, even at a great distance. Could a finished and forcible engraving have been admitted, the general effect would have appeared still more extraordinary. It would seem that the greater portion consists of an entangled mass of granite veins, possibly of the mass of granite itself whence the veins ramify. It also appears that there must be two sets of these veins, as they can in many places be seen to cross each other.

The fracture and separation of the hornblende schist is peculiarly visible, from the strong contrast of colour. In nature, this rock is perfectly black, while the gneiss and granite are reddish and white. The general resemblance between these separated portions of the primary strata, and those of the secondary, on the coast of Sky, is very striking; and the effect of the granite in this case, is precisely the same as that of the trap in the other.

Fig. 2.—This is a general section of the land on the north side of

Loch Broom; and it is easy to see, from the conformity of the dips, that the sandstone, together with the quartz rock, is here beneath the gneiss.

Fig. 3.—This sketch is an abstract of a view on the coast of Ross-shire near Loch Inver, including the indications of Cuniach, Suil veinn, Coul beg and Coul more. In the direction of the view, the edges of the strata appear nearly horizontal; but there is a small dip from the spectator towards the south-east, which however does not affect the reasoning to illustrate which this sketch is introduced. It is probable that these mountains were once connected according to the lines which here indicate the protractions of the planes of the strata.

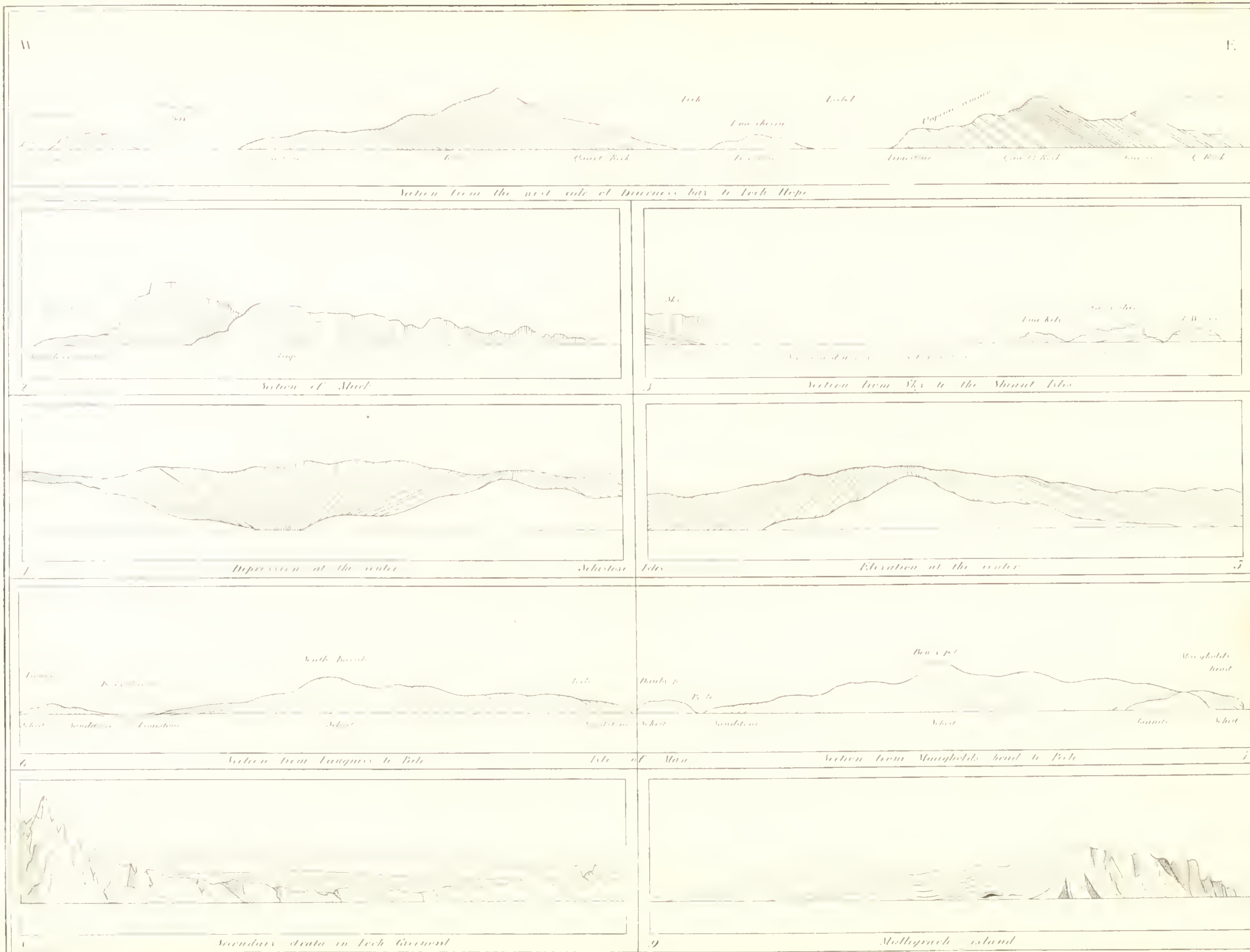

W
E.
Section from the west side of Durness bay to Loch Hope
2
Section of Mull
3
Section from Sky to the Shiant Isles
Depression at the water
Schistose Isles
Elevation at the water
5
6
Section from Langness to Peele
Isle of Man
Section from Maughold's head to Peele
Secondary strata in Loch Gruinard
9
Melligrach island

PLATE XXXII.

Fig. 1.—Is a section passing through Diurness loch and Loch Eribol to Loch Hope, and representing the relative positions of the calcareous strata of these two tracts to the gneiss and quartz rock. The bed which contains the organic remains near Eribol house, is also indicated.

Fig. 2.—Is a section of Muck, pointing out the relative place of the secondary strata to the trap.

Fig. 3.—Is an imaginary section from the Shiant isles to Sky, indicating a connexion between the secondary strata in both. It is not necessary to suppose that connexion actually existing as it is represented.

Fig. 4, 5.—These two figures represent the two cases of diverging, or converging, strata, and the supposed causes in which they may respectively have originated.

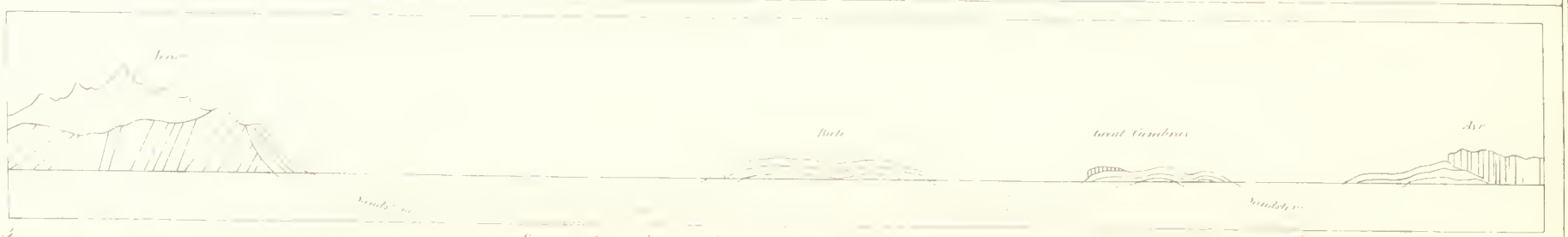
Fig. 6, 7.—In these two sections are included all the essential circumstances which relate to the positions of the different rocks in the Isle of Man: they require no explanation, except to remark that the granite probably occupies a much greater space above the sea line than is here represented. As that cannot however be proved, it was judged proper to limit the indication to the place where it is actually visible.

Fig. 8.— Is a section of the secondary strata in Loch Greinord. The secondary red sandstone is here in contact with the primary, which is at this place much broken, and elevated to a high angle.

Fig. 9.—Is a sketch of the shore of Muligrach island, showing distinctly the gradual change which takes place in the primary sandstone, from a low position to a high angle of elevation. It is also apparent that the change is attended by a fracture and separation of the beds, which produces those vacuities that form the caverns and fissures visible in these cliffs.

1 Trap veins traversing limestone in Ardnamurchan

2 Section from Cumbrae through Arran to Ayrshire



3 Section from Arran through Bute & Cumbrae to Ayrshire

PLATE XXXIII.

Fig. 1.—Is a sketch of a portion of the cliffs at Airdnamurchan point. It is evident that there are more than two sets of veins here; but it is not possible to determine how many, as the fractures of the rock in nature, interfere with the nicety of examination that would be required for that purpose. The present sketch has been divested of all these accidental circumstances, with the intention of rendering the essential parts more visible.

Fig. 2.—Is a sketch of the imaginary connexion, either former or present, of the sandstone of the Ayrshire coast with that of Cantyre; the line of section being carried through Arran. The waste of the sandstone of Cantyre, is here indicated, as is that on the shores of Arran. The structure of the little Cumbray will also be rendered intelligible by this section.

Fig. 3.—Is another similar section for the purpose of illustrating the connexions of the Clyde islands. It is equally possible that the sandstone, here represented as existing beneath the water, may have been removed. This sketch also serves for a section of the great Cumbray.

EXPLANATION OF THE MAPS.

GEOLOGICAL MAPS.

I HAVE attempted in the following maps to introduce in as commodious and economical a form as possible, all the geological and geographical details which were required for the illustration of this Work. A larger scale and a greater number would have been convenient for many purposes, and there would thus have been obtained a degree of accuracy, which, although existing in the original draughts, could not be transferred to the present reduced copies. The defects however, it is hoped, are not such as materially to detract from their utility as illustrations.

It must not be imagined that geological maps, even though accompanied by every necessary section, can, in the present state of the science, supersede the use of geological descriptions. Were that science perfected, they might indeed render descriptions unnecessary; but at present they can only be considered as topographic records of unconnected facts, or as aids to the imagination. To trust to this species of information, is to stop in the beginning of our career; is to imagine that geological knowledge is confined to the details of mineral topography. Nor is it possible that an accurate knowledge, even of this department of geology, can ever be obtained from mere observation. Innumerable circumstances render it impossible to examine the rocks which are near the surface,

and, still less, those beneath it. These details are often matters of induction, not observation; nor can such inductions rest on any basis but a previous knowledge of the laws by which rocks are related to each other; which must be the result of observations much more widely generalized. It is thus that geological science facilitates the execution of mineral surveys; while the latter, unless pursued in a philosophical manner, conduce nothing towards the improvement of the science; every such survey requiring a distinct labour, and deriving nothing from previous observations. This can not be too much inculcated on those who with talents for more useful and profound investigation, are sometimes satisfied with displaying the state of the surface only.

The reader who has laboured through the preceding Work, may be surprised to find in the account of the following maps, that a minute accuracy of topographic detail is so often disclaimed. Such accuracy is in fact rarely attainable; although readers accustomed to contemplate mineralogical maps where every thing is nicely defined, are apt to suspect a want of information and of accuracy when the strongest proof of the existence of both may often lie in the apparent imperfection. He who has seriously laboured on the construction of a mineralogical map, will know that such details are, from the nature of things, very often unassignable.

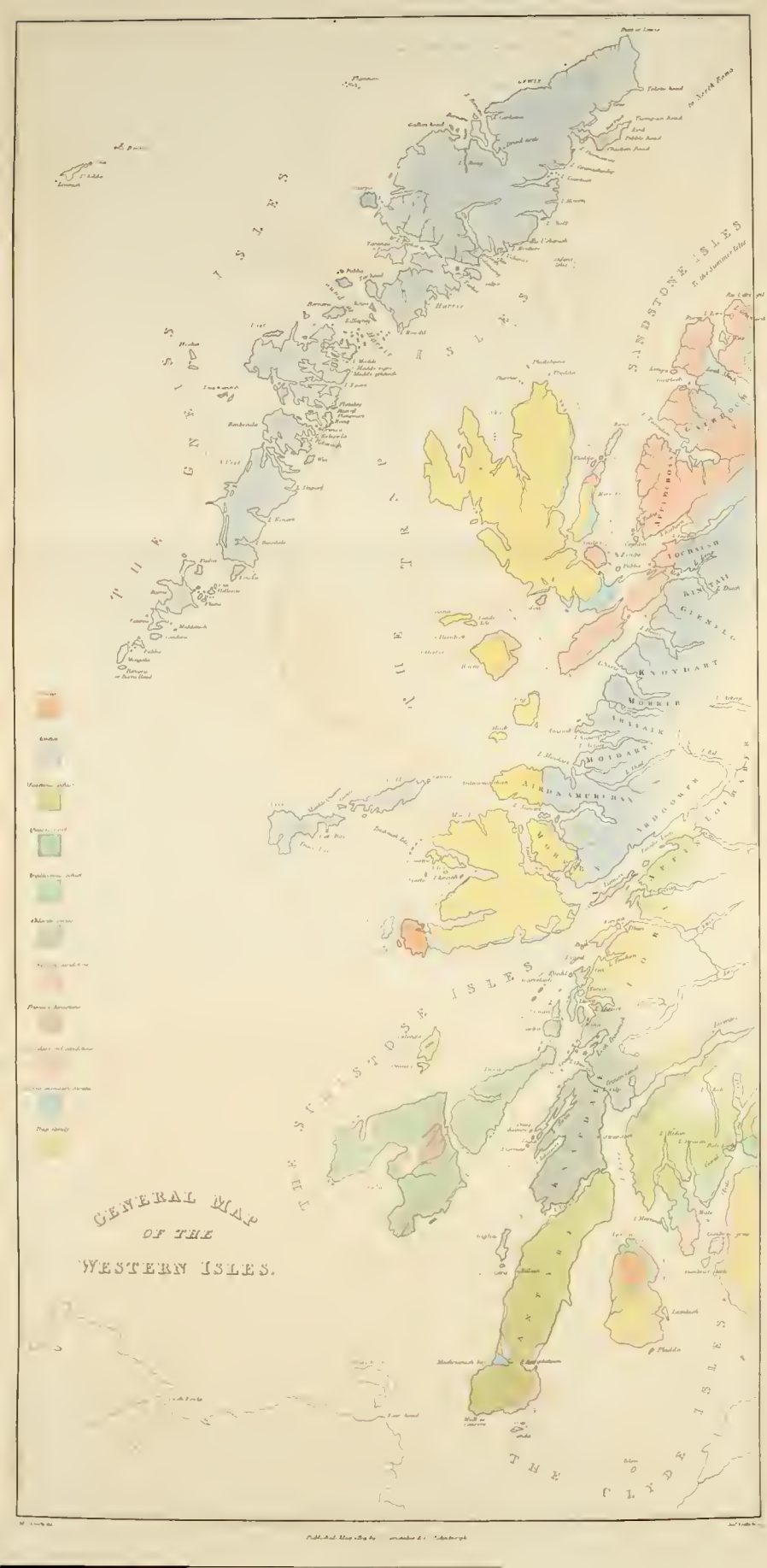
The leading causes of this difficulty are the imperfections of geographical details, and the minuteness of the scale on which maps are usually drawn. Through most of the places described in this Work, the Author would have found no difficulty in staking out the boundary of every rock described. But it became impossible to transfer them to the map, unless that map had contained every

creek, every hillock, every stream, and every house, and unless it had been drawn on a scale of inadmissible and extravagant dimensions. Such details are in fact only applicable to local surveys of small tracts. To be thus in possession of knowledge which cannot be communicated, is not a little vexatious; nor does a practical geologist ever experience greater disappointment than in finding that he is unable, for want of adequate means, to record the observations through which he has laboured.

It may be added to this, that the difficulty resulting from an attempt to describe, by local colours, all the rocks which occur in nature, often in an intricate state of admixture, and in every possible mode of juxtaposition, is unsurmountable; particularly on a confined scale. However distinguishable a number of tints may be in peculiar circumstances of contrast, or in large masses, they are often confounded by approximation or by minuteness; nor can any expedient be adopted in an intricately formed country, which will not leave the defect somewhere. If it is removed from one point, it is transferred to another.

Under all these defects, it is hoped that the following maps will serve the purposes for which they were intended; and that by their aid, and that of the descriptions which have preceded, the structure of the Western islands will be comprehended by the reader as far as it is known to the writer.

The rising multiplicity of observers, and the rapid progress of the science, will probably ere long supply all the defects, and correct all the errors which are doubtless still to be found in many parts of this Work.


GENERAL MAP
OF THE
WESTERN ISLES.

GENERAL MAP OF THE WESTERN ISLES.

The General Map has been copied from that of the Commissioners for Highland roads and bridges, with a few slight alterations that were necessary. It is still imperfect in some essential circumstances, which were not perceived till it was engraved and it had become too late to amend these errors. The result of them is a degree of irregularity in the bearings of the strata on some parts of the coast and in some of the islands, which appears a little at variance with the observations already made in the narrative. As they will however be corrected by the descriptions, they are of the less moment.

Each of the several groups has here been included by a line and denoted by a title; to enable the reader to find them more readily, and at the same time to point out more distinctly their geographical connexions.

This outline also serves the purpose of a particular geological map for the whole of the Long island; the details of which are so little varied as not to have required a separate map for that purpose. The places where the schist and the sandstone occur among the gneiss have thus, it is true, become nearly invisible; but these rocks present no peculiar topographic details that are not sufficiently intelligible from the descriptions.

The limits to which this map was necessarily restrained, prevented the introduction of Barra and Rona, of the Summer isles, of Handa, and of Garvh isle, but geological maps of these are unnecessary. For the geographical department of this subject, it will often be so convenient to consult Arrowsmith's large Map of Scotland, that the present want will be the less felt.

In colouring this general Map, the object has been to indicate the leading classes of rock only, in the manner in which they are described in the different summaries of the several groups. The minuter details have therefore been suppressed in some of the divisions; while the topographic part has also been simplified by generalizing the local positions. The limited scale indeed of the draught, would at any rate have compelled me to adopt this plan; but a greater degree of accuracy was unnecessary for the present purpose.

As frequent reference is made to the structure of the adjoining coast, for the purpose of extending the connexions of the different groups with each other and with the mainland, it has been judged expedient to colour all that part of the latter which bore any useful reference to the islands, and it is hoped that the structure of the whole will thus be placed in a more luminous and interesting point of view. It must be remarked however, that the different rocks are discriminated, only where they approach to the coast, and were required for the present purpose. The reader must not imagine that he is viewing a geological map of the mainland; as the colours of some of the rocks are extended over spaces occupied by others. Even where they are precisely marked, topographic accuracy was impossible, as the interior geographic details have every where

been left blank for the purpose of rendering the colours in such minute portions more distinct. It is proper however for the reader to know, that the parts which are here indicated, are taken from a minute geological survey of this coast, all the more intricate tracts of which have been drawn on a scale of two inches to a mile, and the most simple on one of half an inch.

Published May 1819 by A Constable & Co Edinburgh

SKY. RASAY. FLODDA. SCALPA. LONGA. PABBA. SCUIR DEARG. GUILLEMON. THE CROULIN ISLES. SOA.

This map includes Sky and the islands immediately connected with it, together with those portions of the adjoining mainland which are most intimately associated with this group in geological structure and in geographical position. By their being thus approximated, the reader is the more easily enabled to trace their geological connexions and mutual dependence. The scale has been made as large as the convenience of the work permitted, for the purpose of giving some of the more interesting details. It has still been necessary to exclude some of the most minute; these being of such a nature that no map of an admissible size could have shown them.

The outline of Sky is taken, with some alterations, from Arrowsmith's map; founded on a variety of documents. The most accurate of these is a survey of Lord Macdonald's estate, which lies to the eastward of a line drawn from near Snizort to Loch Slapin. There is much less dependence to be placed on that portion which lies to the west of this line. This is, fortunately, of little importance in the present case, from the uniformity of the geological structure throughout this tract. The interior country has all been re-drawn, that having been found necessary for illus-

trating the geological description; yet not with any pretensions to geographical accuracy. Loch Coruisk and Loch Creich have been added, as nearly in their places as it was possible to determine these from a mere eye view; and the positions of the hills in this tract have been restored to something more conformable to their true places. The original survey is however here so imperfect that it was found impossible to retain their dimensions and places at the same time. That difficulty was materially increased by the great deviation of the magnetic needle which occurs throughout all this island; the time admitting of no mode of surveying more accurate. Imperfect as the whole is, it is sufficient for the purposes in view.

The original draught of Rasay is extremely inaccurate, having been apparently taken from Mackenzie's chart, in which the form, position, and dimensions of the land are every where systematically neglected, for certain nautical reasons which seem only calculated to defeat their own ends. A few alterations have been made for the purpose of elucidating the geological history; and the form of the land in the interior has been supplied in a broad and general manner.

The same remarks apply to Scalpa; and it is unnecessary to notice the remaining islands, since their geography, as far as relates to the present object, is not important.

The reader will perceive that here, as in the following maps, wherever it appeared useful or practicable, the directions of the strata are indicated by lines, and their dips by a numbered index.

In colouring the map of Sky, an attempt has been made to distinguish the most important varieties of the overlying rocks.

To have distinguished the whole, or even to have marked the boundaries of those here indicated, would have been impracticable, as the reader who has attended to the description will easily perceive.

A similar attempt has been made to distinguish the stratified and irregular limestones, rather for the purpose of illustrating the fact generally, than with any pretensions to topographic accuracy: that would, in fact, have been impossible, except on the very extended scale on which the original drawings were planned.

RUM, EGG, and MUCK.

Lias &c
Red sandstone
Syenite
Mount rock
Pitchstone porphyry
Basalt & amygdaloid

1 2 3 4 5
Scale of Miles.

M.Culloch delt.

Published May 1819 by A. Constable & Co. Edinburgh

J. Cross Sculpt.

RUM. EGG. MUCK.

The outline of Rum, is, like many others, taken from the sea chart, and is far from being accurate. As I found it impossible to convey a notion of the geological structure of the island, for want of points of reference and of an interior survey, I have made an attempt to give the names, rather than the true positions of the hills, and to convey some idea of their relative altitudes. Should a new survey of this island be executed, it will not be difficult, by means of this map, to modify the geological boundaries in such a manner as to assign more true places to the rocks hereafter. The usual difficulty, which occurs every where, of distinguishing by a definite boundary the several varieties of the overlying rocks, has here been such as to render that impossible. It has been done, as far as was practicable, in the leading features; perhaps to a greater nicety than may be thought necessary; but it will be found useful by those who may be induced to examine this singular island.

The map of Egg is in all its parts sufficiently accurate; and as far at least as respects the geological details, leaves nothing to be wished for.

The same observation applies to Muck, the simplicity of its structure requiring nothing but a position for the bay of Camusmore.

J.M^c Culloch del

Published May 1819. by A Constable & C^o Edinburgh.

MULL. IONA. ULVA. GOMETRA. INCH KENNETH. THE TRESHINISH ISLES. STAFFA. COLONSA. EORSA.

Mull and its dependencies have been introduced into one sheet together with an interesting portion of the adjoining mainland, for the purpose of rendering the connexions of the whole, in a geological view, more apparent.

The outline of Mull appears to have been determined with considerable accuracy, but it has been necessary to lay down the interior ground anew: this has been done in a slight manner, but with as much regard to the peculiar characters of the several hills as was possible within the assigned space. It will thus be sufficiently easy to distinguish the mountain from the stratified trap, and both of these from the gneiss and granite.

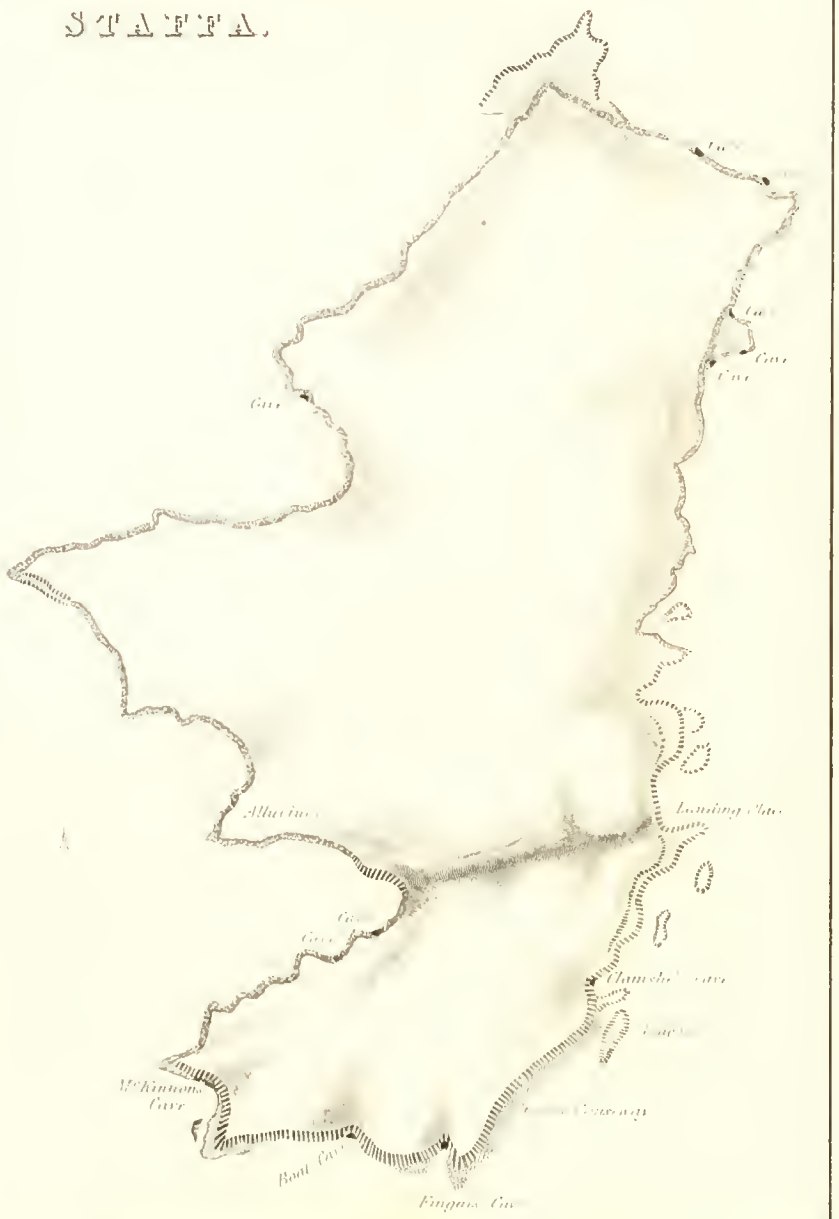
For the purpose of illustrating the structure of Mull, the rocks on the adjoining shore of Morven have also been marked, and thus the details contained in the general summary of the Trap isles, will be more easily followed. The colouring of the secondary strata on the southern shore has, as in Sky, been caused to occupy a greater horizontal space than it possesses; without which it could not have been rendered visible. It will not mislead the reader who attends to the description.

The most doubtful part of the topographic colouring, is the syenite, the real boundaries of which could not be ascertained. That indeed is seldom practicable, but it was preferable to distinguish it even imperfectly, than to lay the whole down as one modification of trap. To distinguish the others by colour would have been impracticable. For those distinctions the reader must consult the description.

The scale of Iona is too small to admit of any delineation of the rocks, nor indeed is there any map of the island in existence. The principal division between the gneiss and argillaceous schist has been indicated in a general manner and the places of the other most remarkable rocks are pointed out by words.

It is doubtful if the indications of the strata in Inch Kenneth are correct, from a cause mentioned in the description of Mull.

STAFFA.



St KILDA.

J M^c Culloch del

Josh Cooke Sculp

Published May 18th by A Constable & C^o Edinburgh

STAFFA. ST. KILDA.

These two maps are rather intended for the gratification of general curiosity, than for any geological purposes, although in the latter the mutual boundary of the syenite and trap is assigned in a general manner.

The map of Staffa was drawn under every unfavourable circumstance, and cannot fail to be inaccurate; having been merely paced with the assistance of a pocket compass in a severe gale of wind and rain. It will nevertheless serve the purpose of assisting the reader in understanding the general description.

That of St. Kilda will, besides conveying a general notion of the form of the island, serve to illustrate the hydrographical details in the narrative.

J. McCulloch del.

Lizars sculpt.

Published May 1819 by A. Constable & Co. Edinburgh

INISH CAPEL. KERRERA. SEIL. EYSDILL. LUING. TORSA. SHUNA. GARVELOCH ISLES. LUNGA. SCARBA. &c.

An attempt has been made to rectify these islands according to the bearings of the strata as indicated by the compass; yet their geography still remains doubtful. The form of the ground being highly illustrative of the geological structure of the whole, it has also been endeavoured to lay that down as nearly as the map permitted. A portion of the adjoining mainland has also been introduced, and the nature of the rocks marked on it; as that was found peculiarly necessary for connecting the geological relations of the whole group.

The minute and confused manner in which the several rocks are intermixed in Kerrera, rendered it impossible to give a detail of them in the very limited space which that island here occupies. These details are not however particularly important, as they result from the irregular positions of the overlying rocks. The stratified rocks are marked only on the shores, where alone their true positions can be ascertained.

In Seil, Luing, and Torsa, they are as accurately laid down as the size of the draught permitted.

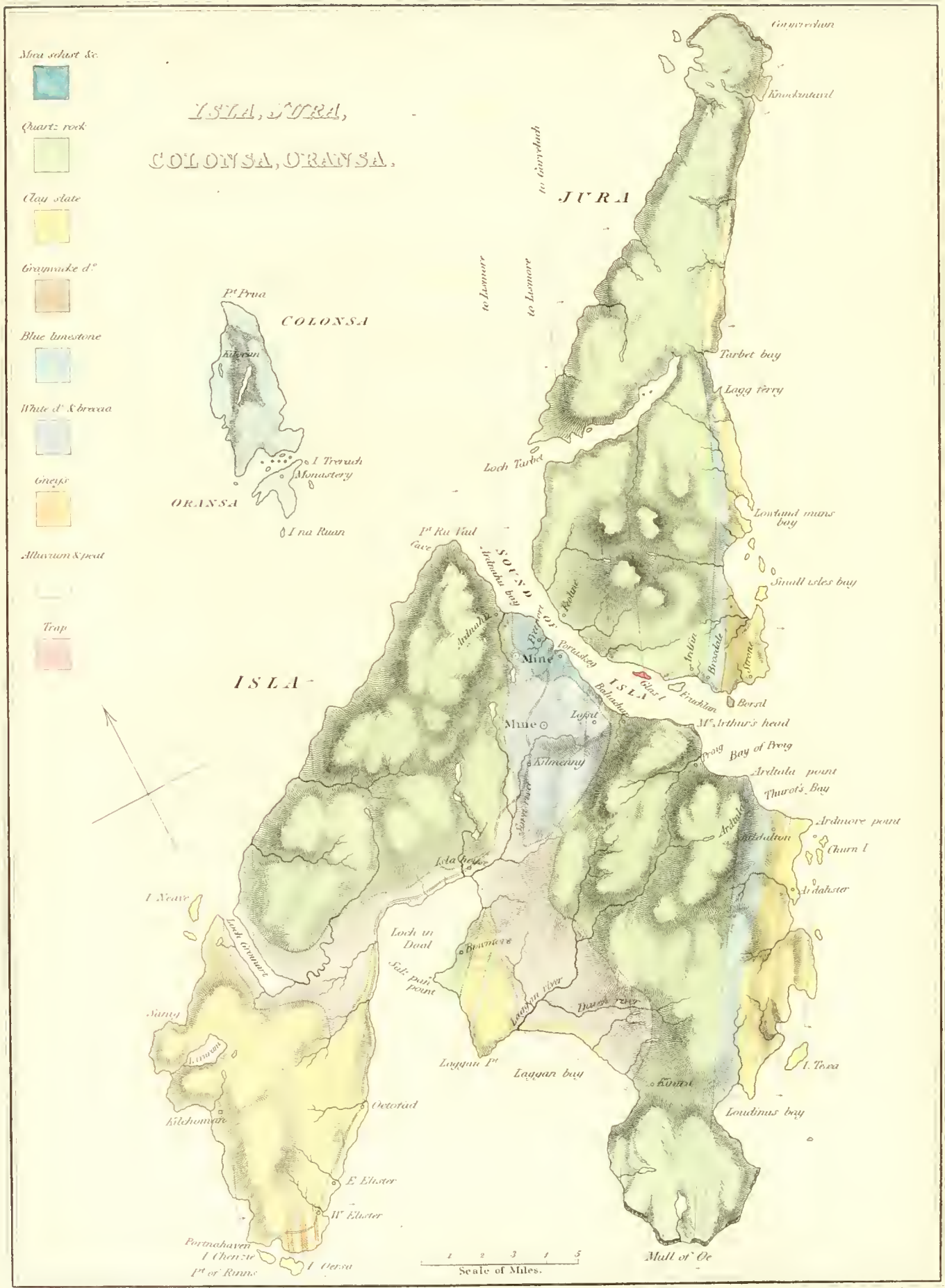
In Shuna, an attempt has been made to convey a general idea of the alternations in the chlorite series of which it is formed: a

more minute detail would have been impossible, as the colours would have become undistinguishable. Neither is such minuteness necessary, as the real nature of the series will be sufficiently understood from the description.

In the descriptions of Lunga and Scarba, it will also be found that there is no regular and definite boundary between the quartz rock and the argillaceous schist, but that numerous alternations, between these and between other schistose substances, take place. These could not be represented without inextricable confusion, and it has therefore been held sufficient to mark the general boundary between the two principal rocks, and to indicate the occurrence of micaceous schist between the clay slate and the quartz rock.

In the Garveloch isles, for the same reason, the limestone, and the schists in general, have been separated by corresponding colours.

By bringing the whole of these within one sheet the general connexion of the group is rendered more apparent.



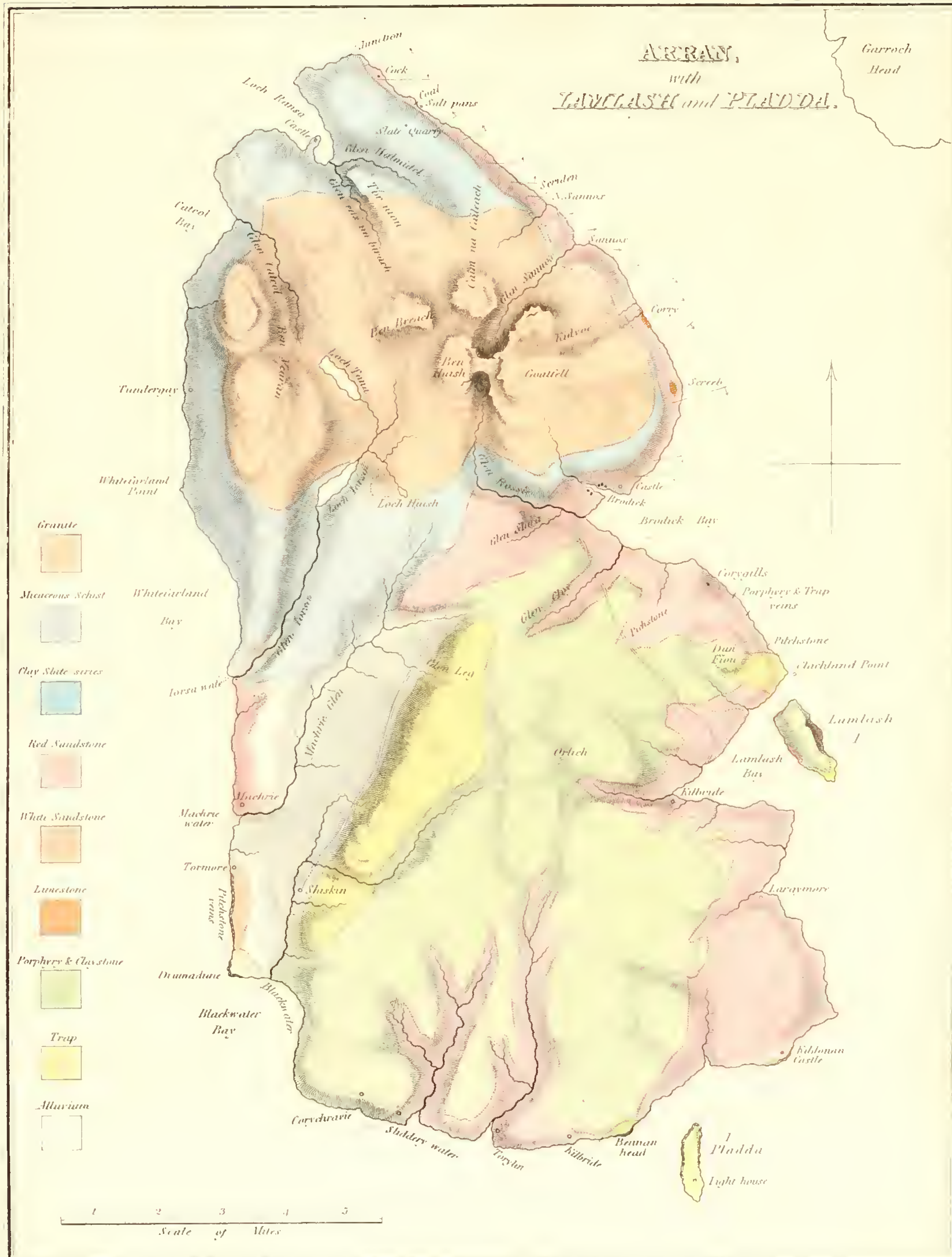
J. M° Culloch del
Jos^h Cross. Sculp^r
Published May 1819 by A Constable & C° Edinburgh

ISLA. JURA. COLONSA. ORANSA.

It is to be suspected that there are material inaccuracies in the geography of all these islands, and in some particulars they will probably be found of bad effect, by interfering with certain deductions respecting the bearings of the strata which are drawn from the geological investigation. At present they cannot be corrected, and must therefore remain for the future accomplishment of a new geographical survey.

It has been found necessary in all, and more particularly in Isla, to draw the interior country in a more accurate and characteristic manner. The rivers here afforded an useful guide. In Jura, where there is no such assistance, the positions of the principal mountains remain nearly as faulty as before; but fortunately that error does not interfere with the geological details, as they are all composed of the same rock.

In attempting to distinguish the strata by colours, it has been found necessary to omit all the minor details; as the frequency of alternation between the several schists and the quartz rock, rendered them impracticable on any map of moderate dimensions. The whole have therefore unavoidably been reduced to certain general masses; all the minute facts which had been entered in



J. M'Culloch del.

Josh Cross sculp

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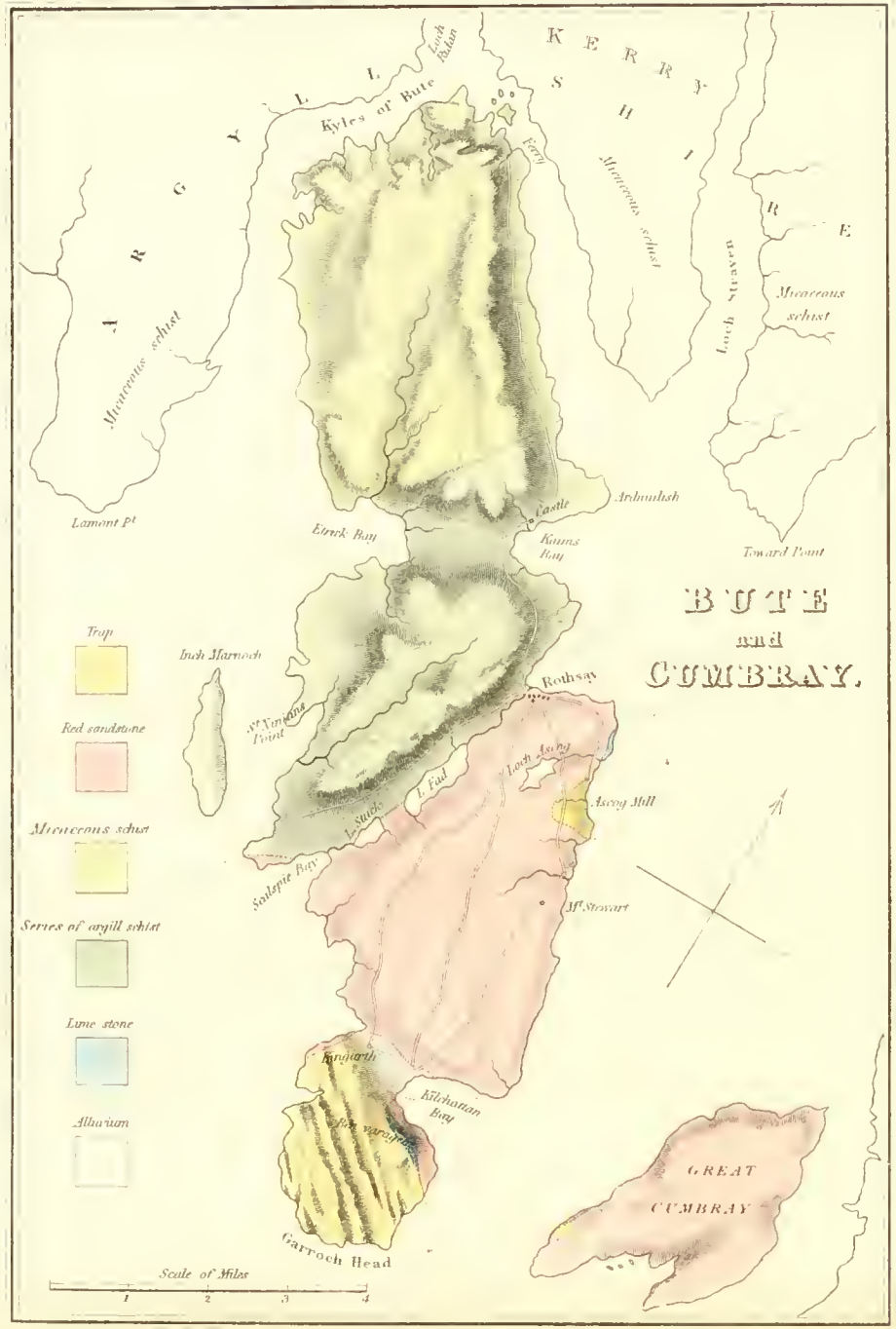
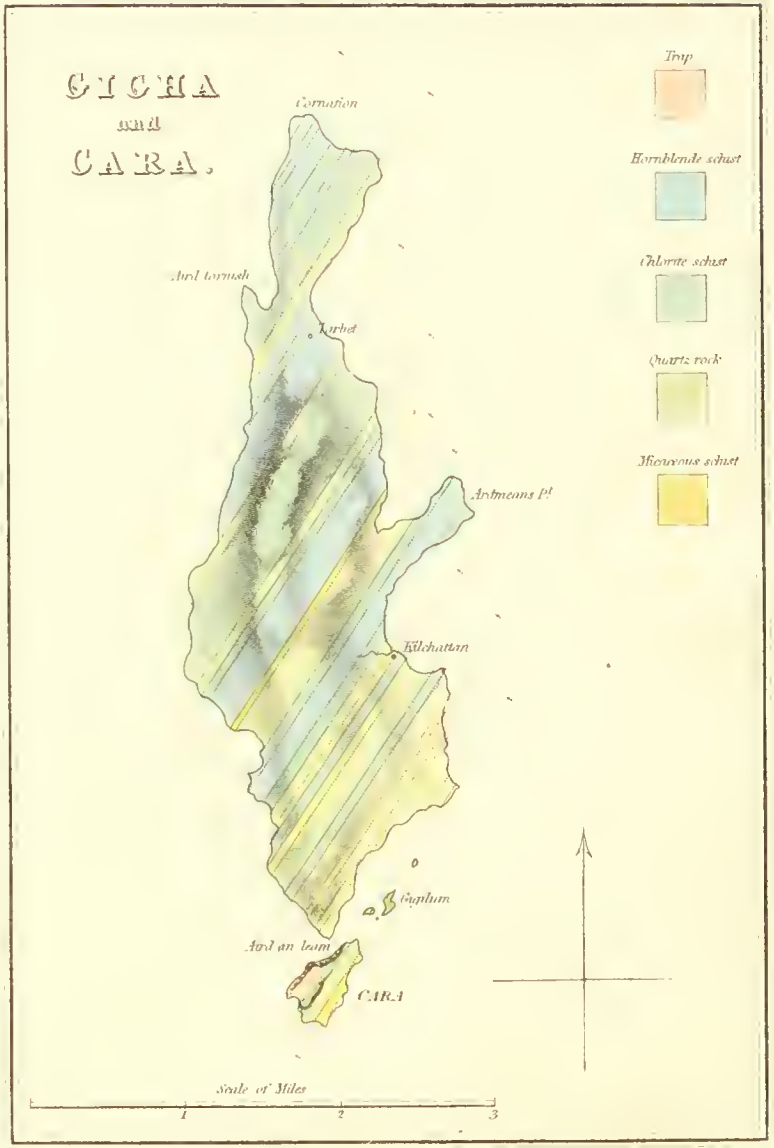
ARRAN. PLADDA. LAMLASH.

The present outline of Arran is from a very imperfect survey, in which remark nearly the whole of the Clyde may be included; this being one of the least accurate parts of the geography of the western coast of Scotland. The interior country, as it is laid down in the same maps, is something worse than a blank; a circumstance much to be regretted here, as it thus became impossible to ascertain the geographic positions of the several rocks and the places of their very intricate boundaries. In consequence of this deficiency, the true position of these boundaries in the interior could not be assigned, and an approximation has therefore necessarily been substituted. On the shores, the defect is less sensible; as the marks for reference are somewhat more distinct. Owing to the peculiarly intricate manner in which the proper trap rocks are intermixed with the claystones and porphyries, and the blank slate of the tract in which they occur, presenting no houses or other geographical references, it has become utterly impossible to distinguish their relative places. That difficulty, even in a greater degree, attends the sandstone in the southern division of the island: it is, in fact, to be seen almost every where, but in very small portions. The larger parts alone have been noticed, and in a general manner; as they are chiefly found near the water

courses, where the ground is cut to a certain depth, so as to expose them as they lie below the trap or claystone rocks. They are actually visible however, under similar circumstances, in many parts where they are not indicated. The attempt to distinguish the series of micaceous schist from the argillaceous series is imperfect, as there is no positive boundary, but it will serve to convey a general notion of their relative places.

It has here been endeavoured to convey a notion somewhat more accurate than that formerly given, of the general characters of the ground and of the positions of the hills; but that part of the draught must, for the most obvious reasons, be necessarily imperfect. It is to be hoped that an accurate geographical survey of Arran is not far distant.





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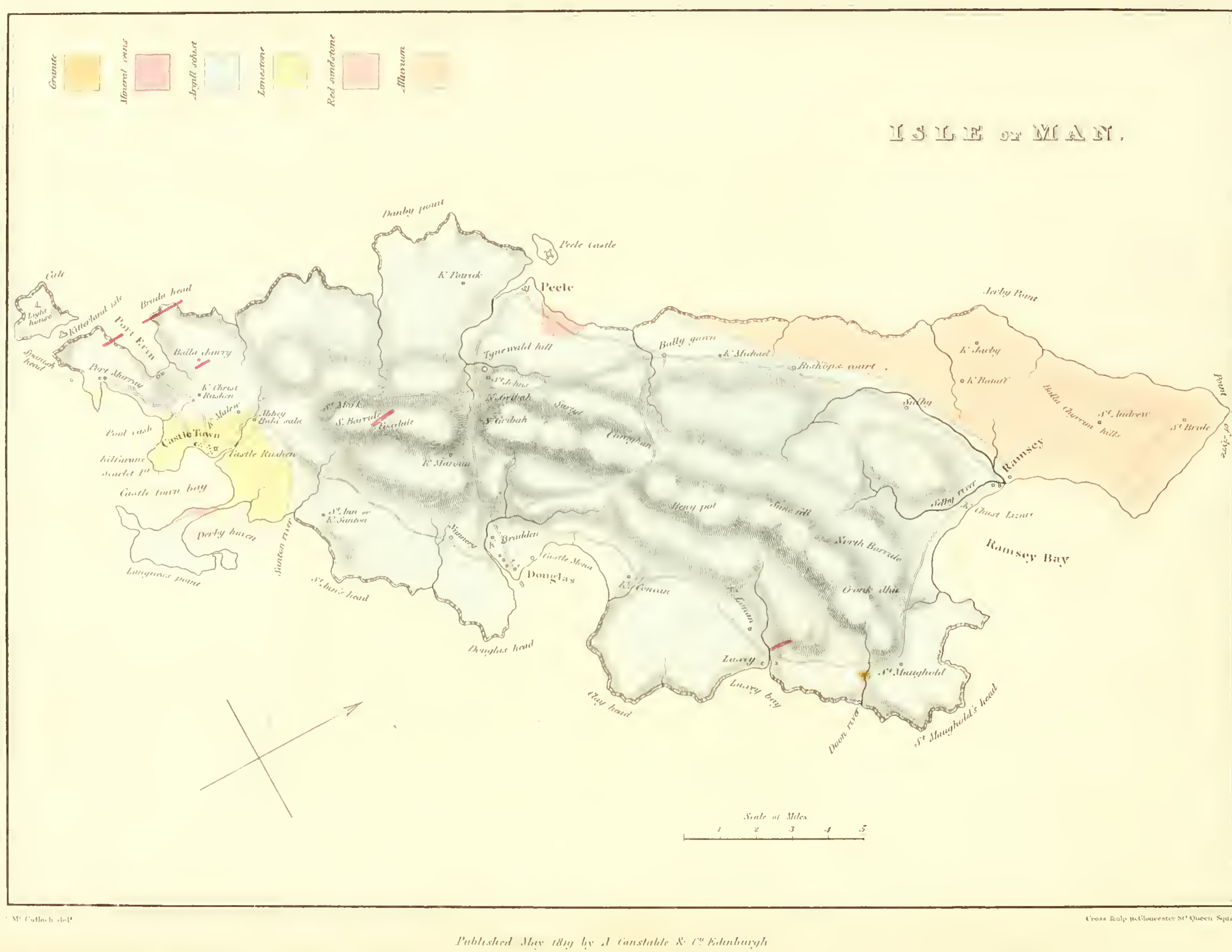
BUTE. CUMBRAY (GREAT.)

The outline of Bute which has been adopted for this map, is tolerably accurate in a geographical view, and abundantly so for the present purpose, except in that part which regulates the position of the trap near Ascog. From some inaccuracies in the geographical details, the exact position and extent of that mass could not be assigned. But it is not material.

An attempt has been made to distinguish the different characters of the rocks, in the draught of the hills, throughout the three divisions of the island. To have done that completely would have required a regular geographical survey and a considerably larger space: even imperfect as it is, it will prove a useful guide in consulting the map. I may be permitted to suggest to geologists that many advantages would be derived from thus attending to the forms and characters of the ground in their draughts; and to surveyors, that the same attention would often prove a valuable guide to geologists in a country of which the structure was unknown. As the map of the great Cumbray happened to come within the limits of this space, it has been coloured to show the small portion of trap which that island contains; it might otherwise have been spared. The same remark may be made on Inchmarnoch.

GIGHA AND CARA.

An attempt has been made in the present map to convey an idea of the general manner in which the numerous strata of the chlorite series alternate, although it must be apparent that no particular detail was possible, as the beds amount to, perhaps, hundreds. The geographical outline is here of little moment.


ISLE of MAN.
Granite
Mineral veins
Argill schist
Limestone
Red sandstone
Alluvium
Peele
Peele castle
Ramsey
Ramsey Bay
Douglas
Castle Town
Port Erin
Calf
Light house
Kitterland isle
Bradu head
Balla chairy
Spanish head
Port Marray
Poolvash
Castle Rushen
Castle town bay
Derby haven
Langness point
Santon river
Douglas head
Clay head
Laxey
Laxey bay
Doon river
St Maughold's head
St Maughold
North Barrule
Cronk ullin
Snafell
Heavy pot
Tynewald hill
St Johns
K Patrick
Danby point
Jerby Point
Bally gawn
K Michael
Bishops court
K Jarby
K Bauol
Balla Chyrran hills
St Andrew
St Bride
Point of Ayre
Sulby
Sulby river
K Christ Lezaire
Scale of Miles
1 2 3 4 5
M Culloch delt
Cross sculp 10 Gloucester St Queen Square
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ISLE OF MAN.

The outline of this map is borrowed from a sea chart, and is obviously very inaccurate; but there was only a choice between the present and two others equally unworthy of confidence. Fortunately the errors are not material in the present case, as, from the predominant simplicity of the structure of the island, they do not disturb the geological details. The interior ridge has been laid down in a conjectural manner, from an eye view; but it will serve to convey a sufficient notion, for the present purpose, of the disposition of the ground. The only part of the island in which a minuter detail would have been desirable, is the tract from St. Ann's river through Bala sala to Port la Marie; the geological structure of this portion being the most intricate and interesting part of the whole. But a larger draught could not have been introduced without an inconvenience that would scarcely have been compensated by the advantages; even if an accurate survey could have been procured.

LIST OF THE PLATES

INTENDED TO ILLUSTRATE

THE DESCRIPTION OF THE WESTERN ISLANDS.

I. View of a rock of curved gneiss on the north eastern shore of Lewis.
II. View of Brochel Castle in Rasay.
III. View of the rocks called Macleod's Maidens, on the west coast of Sky.
IV. View of the caves near the point of Duin in Sky.
V. View of the Scuir of Egg.
VI. View of Staffa from the south-west.
VII. View of the entrance of Fingal's cave in Staffa.
VIII. View at the Storr in Sky.
IX. View of Dunvegan Castle and Loch in Sky.
X. View of the cave and the columnar cliffs of Ailsa.
XI. Granite veins traversing gneiss: contortion of limestone in Iona: sketch of a trap vein in Lunga.
XII. Various flexures of gneiss in Lewis.
XIII. Various sections of the islands connected with Sky.
XIV. Various sections in Sky.
XV. Comparative sections of Sky and the neighbouring islands.
XVI. The trap veins of Strathaird: position of the siliceous schist at Duntulm: section of the Garveloch isles: remarkable specimens of gneiss.

XVII. Various parts of the Eastern shore of Trotternish, showing the interference of the trap with the secondary strata.

XVIII. Peculiar trap vein in Sky: schistose sandstone of Strathaird: transitions between the crystalline and stratified limestone: diagrams to illustrate the relation of trap to the stratified rocks.

XIX. Section of Egg: alternation of the rocks in Sandy isle: position of the conglomerate in Dun feoulan: rock near Canna: section of Rum.

XX. Various sections illustrating Mull.

XXI. Carbonized wood of Mull: three trap veins exhibiting interesting peculiarities.

XXII. Sections of Seil, of Bute, of Arran, and of Isla: contortions of argillaceous schist: fissile tendency of the schist of Sanig in Isla.

XXIII. Section of Scarba: diagram of the elevation of strata: section from Jura to Lunga: section of basin-shaped strata: section of Egg: measurement of the Scuir of Egg.

XXIV. Veins of trap and claystone in Arran: sketch of Lamlash: curved vein of claystone: relation of the overlying rocks to the strata.

XXV. Various sections illustrating the sandstone on the north-east shore of Arran.

XXVI. Curved gneiss in Coll: junction of the granite and gneiss in Mull: two remarkable trap veins.

XXVII. Peculiar appearances of the limestone in the Isle of Man.

XXVIII. Alternations of graywacké and clay slate in the Isle of Man: decomposition of granite in the same island.

XXIX. Drawings of Petromyzon Juræ, Salpa moniliformis, and Ulva montana.

XXX. Plan of the Druidical structure in Lewis: an agate nodule: progress of the arch from the pointed to the circular form: the caschrom: shoulder-of-mutton sail: ancient boat in Iona.

XXXI. Granite veins and gneiss at Cape Wrath: alternations of gneiss and red sandstone: sandstone mountains on the coast of Ross-shire.

XXXII. Section through Diurness and Loch Eribol: section of Muck: section from the Shiant isles to Sky: convergence of strata: sections of the Isle of Man: sections illustrating the red sandstone of Ross-shire.

XXXIII. Trap veins at Airdnamurchan point: sections illustrating the islands of the Clyde.

MAPS.

General map of the Western islands.
Sky, Rasay, and the adjoining islands.
Rum, Egg, and Muck.
Mull, and the adjoining islands.
Staffa and St. Kilda.
The Slate isles, &c.
Isla, Jura, Colonsa, and Oransa.
Arran, and Lamlash.
Bute and Gigha.
The Isle of Man.

THE END.

J. MOYES, GREVILLE STREET, LONDON.