A TOUR TO THE CAVES, IN THE ENVIRONS OF INGLEBOROUGH AND SETTLE, IN THE West-Riding of Yorkshire.

WITH

SOME PHILISOPHICAL CONJECTURES ON THE DELUGE, AND THE ALTERATIONS ON THE SURFACE AND INTERIOR PARTS OF THE EARTH OCCASIONED BY THIS GREAT REVOLUTION OF NATURE.

IN A LETTER TO A FRIEND.

Omne tulit punctum, qui miscuit utile dulci. *Horace.*

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1780.

TO

THOMAS PEARSON, Esq;

OF

BURTON IN KENDAL, WESTMORLAND.

SIR,

THE amusement you have received in visiting the natural curiosities in the neighbourhood of *Ingleton* and *Settle*, in company with different parties of gentlemen of approved taste and knowledge, who entertained the same sentiments with yourself, hath induced me to draw up a plain narrative of one of our excursions, by way of an appendix to the *Guide to the Lakes*. This I thought would not be unacceptable to the southern parties, who, for their summer amusement, make the fashionable tour of the lakes. The caves may be visited in their return without inconveniency to most of them; and many new and entertaining scenes of nature, with some large and elegant towns viewed, by taking the *Yorkshire* road through *Settle*, *Skipton*, &c. I undertake this task with the more alacrity, as a great part of my infancy and youth was spent amidst this collection of natural curiosities: The partiality that is acquired by an early acquaintance with

with any objects, excites in us a desire to have their beauties and excellencies seen and admired. I cannot but lament, while I am writing this short account, that I have not your assistance in pointing out to me the several striking traits and peculiarities in these scenes, most deserving the notice of a traveller; which, by their familiarity, are not apt to engage the attention of a native. I have taken, however, the liberty of addressing this short description to yourself, as in some measure entitled to your protection, the originals having engaged so much your attention and admiration. What is admired by a gentleman of refined and approved taste, who has not only seen every natural curiosity in *Great Britain*, but who has visited, oftner than once, every quarter of the globe, should be made as public as possible, for the amusement of the speculative traveller and the natural historian.

If this attempt to inform and amuse fails of its wished for effect, from the writer's inability in the modern descriptive stile, it is hoped the desire to please will claim some indulgence for

Sir, your most obedient,

and humble servant,

J. H.

April 25th, 1780.

A

TOUR

TO THE

CAVES.

SIR,

ACCORDING to promiſe, I ſit down to give you an account of our ſummer's excurſion.—After having made the tour of the lakes, we were induced by an acquaintance we accidentally met with at *Kendal*, to proceed by *Kirkby-Lonſdale*, *Ingleton*, *Chapel in the dale*, *Horton*, and *Settle*, in order to ſee the caves and other natural curioſities in thoſe parts of the *Weſt-riding* of *Yorkſhire*. I muſt own that this appendix, as it were, pleaſed me more, than the whole body of our former journey; being peculiarly adapted to my taſte for natural hiſtory, as alſo for the extraordinary and terrible. Some may be as much entertained with the profound, as others with the lofty; and ſome may be as much amuſed with the

the ſublime, as others with the beautiful. This was the humour of my genius, and here it was abundantly gratified. You have read ſo much already of the beauty and variety to be ſeen amongſt the lakes of *Lancaſhire*, *Weſtmorland*, and *Cumberland*, and heard ſo much in praiſe of them from the reports of travellers, that I can add nothing further to embelliſh their deſcriptions: I ſhall only therefore deſire your patience to attend me three or four days journey through a country, not much explored, or however not yet publicly known.

About ſix o'clock, one morning in June, we ſet off from *Kendal*, and after travelling about a dozen miles, along a good turnpike road over the *Endmoor*, and *Cowbrow*, we arrived at *Kirkby-Lonſdale*, ſoon after eight. About the mid-way we left the little ſteep, white mountain *Farlton-knot*, on the right about a mile. It is all compoſed of ſolid limeſtone, and is three or four hundred yards in depth: Thoſe who have ſeen both, ſay, that on the weſt ſide it is very like the rock at *Gibraltar*. There were ſeveral good manſion houſes by the road ſide, which, at the beginning of this century, were inhabited by a ſubſtantial ſet of yeomanry and country gentlemen, the moſt uſeful members of a community: They are now however moſtly let out to farmers; the deſire of improving their fortunes in trade, or the pleaſures of living in towns, having induced the owners to leave them:—Reverſes of fortune or new attachments, have cauſed many to ſell them, after they had been continued many centuries in their families. *Kirkby-Lonſdale* is a neat, well paved, clean town, ornamented with ſeveral genteel houſes, adjoining to ſome of which are elegant gardens. The houſes are covered with blue ſlate, which has an agreeable effect on the eye of a ſtranger. A ſmall brook runs through the market ſtreet, which is uſeful and commodious to the inhabitants; afterwards it turns ſeveral mills in its ſteep deſcent to the river *Lune*. The church

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is a large and decent ſtructure, covered with lead, and containing three rows of pillars: The ſteeple is a ſquare tower, containing ſix bells; the muſic of which we were entertained with at nine o'clock, they being played on by the chimes. Oppoſite the church gates is the old hall, taken notice of 150 years ago by drunken *Barnaby*, in his *Itinerary*:—It is ſtill an inn, and no doubt keeps up its ancient character.

Veni Lonſdale, *ubi cernam*
Aulam factam in tabernam,
Nitidæ portæ, nivei muri,
Cyathi pleni, paucæ curæ;
Edunt, bibunt, ludunt rident,
Curâ aignum, nihil vident.

Barnaby.

Thence to *Lonſdale*, where I view'd
An hall, which like a tavern ſhew'd;
Neat gates, white walls, nought was ſparing,
Pots brimful, no thought of caring;
They eat, drink, laugh, are ſtill mirth making;
Nought they ſee that's worth care taking.

We walked through the church yard, which is large and ſpacious, along the margin of an high and ſteep bank, to a neat white manſion houſe full in view, about half a mile diſtant, called *Underlay*.—I was never ſo amuſed with any proſpect of the kind I had yet ſeen. At the foot of the ſteep bank on which we walked, being about 40 or 50 yards perpendicular, glided the large, pellucid river *Lune*, amongſt the rocks and pebbles, which amuſed the ear, while the eye was entertaining itſelf with a vaſt variety of agreeable objects. A tranſparent ſheet of ſtill water about a quarter of a mile in length lay ſtretched out before us: At the high end of it was a gro-

teſque

teſque range of impending rocks of red ſtone, about 30 yards in perpendicular height, which had an excellent effect in the ſcene, both by their colour and ſituation. Our guide told us, that in winter this precipice was in ſome parts ſo glazed over with ice, from the trickling water down the ſurface, as to make it appear like a ſheet of alabaſter. From other parts of the impending rocks, hang great and enormous iſicles, which made it appear like an huge organ.

After the eye had traverſed over a rich and fertile vale, variegated with woods and country houſes, the proſpect was terminated with a chain of lofty mountains, which run in a direction from ſouth to north, parallel to the courſe of the river. The neareſt were not above two or three miles off, and looked like the bold and ſurly ſentries of a legion, that ſeemed ſtationed beyond them. On our return, we were amuſed with proſpects of a different nature. The church and town before us enlivened the ſcene: Some mill-wheels between them and the river, added an agreeable variety with their motion. The vale beneath ſeemed to dilate and expand itſelf; the few parts of it, which were viſible, afforded ſufficient ground to the imagination to conceive an aſſemblage of the moſt entertaining objects. *Ingleborough*, whoſe head was wrapt in a cloud, ſtood the fartheſt to the ſouth in the rank of mountains which faced us.

After breakfaſt, we walked by the ſide of the river to the bridge. The channel is deep, the ſtream rapid among rocks, the banks on each ſide covered with trees of various foliage, which ſerve both as a defence and ornament. The bridge is the moſt lofty, ſtrong, ancient, and ſtriking to the eye of a ſtranger, of any I have yet ſeen. It is built with freeſtone, has three arches, two large and one ſmaller; the height from the ſurface of the water to the center arch, is about 12 yards. The arches are of the ribbed ſort, which made the appearance the more groteſque:

teſque. There is no memorial of its foundation; even tradition is ſilent as to its antiquity. We were indeed amuſed with one anecdote of its founder, which ſeemed to be a remnant of the ancient mythology of the north, and one inſtance, among many, of eaſily accounting for any thing that is marvelious. The country people have a tradition, that it was built by the devil one night in windy weather: He had but one apron full of ſtones for the purpoſe, and unfortunately his apron ſtring breaking as he flew with them over *Caſterton-fell*, he loſt many of them out, or the bridge would have been much higher.

From the top of the bridge the proſpect down the river is delightful; the ſides of the deep channel covered with trees, are nearly parallel for a quarter of a mile, and the water one continued ſurface, ſave here and there where a pointed rock lifts up its head into the open day. We walked down by the ſide of the river about a mile, and as we proceeded were continually preſented with new proſpects, while the ſoft murmurs of the river afforded a variety of different notes. When we arrived at *Borough*, we had a full view of all the vale of *Lonſdale*, with the ſeats and villages that adorn it. *Whittington* to the weſt; *Tunſtal*, *Melling*, *Hornby* and its caſtle, to the ſouth; *Leck* to the eaſt; and *Borough-hall*, the ſeat of *Thomas Fenwick* Eſq, and the moſt elegant in the vale, cloſe at hand. The blue mountains of *Clougha*, *Burnmoor*, and *Lyth-fell*, which terminated the view to the ſouth, had an excellent effect upon the eye. On our return we had the bridge full in view moſt of the way: Its antiquity and greatneſs made its preſence venerable and reſpected. About 100 yards before we arrived at the bridge, the town of *Kirkby-Lonſdale* appeared in a point of view peculiarly amuſing. The high walls of a gentleman's garden, which were between us and the town, made it look like a fenced city in miniature; the tower ſteeple of the church riſing proudly eminent above the blue ſlated houſes, on which it was on every ſide ſurrounded.

We mounted our horſes at the bridge about eleven o'clock, having ordered them down thither in order to ſave half an hour in going up to the town for them. We travelled near the bottoms of the mountains, on the ſide of *Lonſdale*, along the turnpike road, about an hour, being in three counties in that ſhort interval, *Weſtmorland*, *Lancaſhire*, and *Yorkſhire*, and amidſt a variety of entertaining proſpects. The number of ſmall carts laden with coals, and each dragged by one ſorry horſe, that we met, was aſtoniſhing. Many of the ſmaller farmers betwixt and *Kendal* earn their bread with carrying coals, during moſt parts of the year, from the pits at *Ingleton* and *Black-Burton* (as the country people call it) to *Kendal*, and the neighbouring places, for fewel, and burning lime in order to manure their land. Theſe beds of coal, we were informed, are ſix or ſeven feet in thickneſs. A fire engine was erecting at *Black-Burton*, more commodiouſly to work their beſt collieries. A ſurvey was lately ſubſcribed for to be made, in order to have a canal from theſe pits to *Lancaſter*, where coals might be exported; as alſo to *Kendal* and *Settle*, which are towns much in want of fewel.

After we had got about ſix miles from *Kirkby Lonſdale*, to a public-houſe called *Thornton-church-ſtile*, we ſtopped to procure a guide, candles, lanthorn, tinder-box, &c. for the purpoſe of ſeeing *Yordas-cave*, in the vale of *Kingsdale*, about four miles off. By the advice of a friend, we alſo took with us a baſket of proviſions, which we found afterwards were of real ſervice. When we had gone a little above a mile, we were entertained with a fine caſcade near ſome ſlate quarries, made by the river out of *Kingsdale*, falling down a precipice about 8 or 10 yards high, which afterwards runs through a deep groteſque glen to *Ingleton*. About a mile higher we came to the head of this river, which iſſues from one fountain, to all appearance, more fluent that St. *Winifreds-well* in *Flintſhire*; though there is a broken, ſerpentine, irregular channel extending

extending to the top of the vale, down which a large ſtream is poured from the mountains in rainy weather. We now found ourſelves in the midſt of a ſmall valley about three miles long, and ſomewhat more than half a mile broad; the moſt extraordinary of any I had yet ſeen; It was ſurrounded on all ſides by high mountains, ſome of them the loftieſt of any in *England*,—*Whernſide* to the ſouth-eaſt, and *Gragareth* to the north. There was no deſcent from this vale, except the deep chaſm where we ſaw the caſcade; we were quite ſecluded from the world, not an habitation for man in view, but a lonely ſhepherd's houſe, with a little wood and a few incloſures near it, called *Breada-garth*: It is on the north ſide of an high mountain, ſeldom viſited by man, and never by the ſun for half a year. The ſoil ſeemed the deepeſt and richeſt in ſome parts of this vale of any I had ever obſerved, and no doubt capable of great improvement. I could not but lament that inſtead of peopling the wilds and deſarts of *North America*, we had not peopled the fertile waſtes of the north of *England*. I have ſince indeed been informed that a plan is in agitation for having it incloſed, when I make no doubt but it will ſupport ſome ſcores of additional families. While I was muſing on the many bad effects of peopling diſtant countries and neglecting our own, we arrived at the object of this excurſion, *Yordas-cave*: It is almoſt at the top of the vale, on the north ſide of it, under the high mountain *Gragareth*. Having never been in a cave before, a thouſand ideas were excited in my imagination on my entrance into this gloomy cavern, which had been for many years dormant: Several paſſages out of *Ovid's Metamorphoſis*, *Virgil*, and other claſſics crowded into my mind together. At one time I thought it like the den where *Cadmus* met the huge ſerpent.

Silva vetus ſtabat, nullâ violata ſecuri;
Eſt ſpecus in medio virgis ac vimine denſus,

Efficiens humilem lapidum compagibus arcum;
Uberibus fœcundus aquis. Hoc conditus antro
Martius anguis erat.

Ovid's Metamor. *B.* 3. *Fab.* 1.

Within this vale there roſe a ſhady wood
Of aged trees; in its dark boſom ſtood
A buſhy thicket, pathleſs and unworn,
O'errun with brambles, and perplex'd with thorn:
Amidſt the brake a hollow den was found,
With rocks and ſhelving arches vaulted round.
Deep in the dreary den, conceal'd from day,
Sacred to *Mars*, a mighty dragon lay.

Addiſon.

When I had entered a little into it, I could not but imagine it like the place where *Diana* and her nymphs were bathing, when intruded on by *Actæon*: And indeed there wanted nothing but an ancient wood, to make one believe that *Ovid*, in each caſe, had taken from hence his lively deſcription.

Vallis erat piceis, & acutâ denſa cupreſſu,
Nomine Gargaphiæ; ſuccinctæ ſacra Dianæ:
Cujus in extremo eſt antrum nemorale receſſu,
Arte laboratum nullâ: ſimulaverat artem
Ingenio natura ſuo: nam pumice vivo,
Et levibus tophis nativum duxerat arcum.
Fons ſonat à dextrâ, tenui pellucidus undâ,
Margine gramineo patulos ſuccinctus hiatus.
Hic Dea ſilvarum venatu feſſa ſolebat
Virgineos artus liquido perfundere rore.

Ovid, *B.* 3. *Fab.* 2.

Down in a vale, with pine and cypreſs clad,
Refreſh'd with gentle winds, and brown with ſhade,
The chaſte *Diana's* private haunt there ſtood,
Full in the centre of a darkſome wood,

A ſpacious

A ſpacious grotto, all around o'ergrown
With hoary moſs, and arch'd with pumice-ſtone.
From out its rocky cleſts the waters flow,
And trickling ſwell into a lake below:
Nature had ev'ry where ſo play'd her part,
That every where ſhe ſeem'd to vie with art.
Here the bright goddeſs, toil'd and chaf'd with heat,
Was wont to bathe her in the cool retreat.

Addiſon.

If I had come a few days ſooner, our guide told me, I moſt probably might have met with the like adventure as *Actæon*, without having his dog-trick put upon me; a few rural beauties having aſſembled there on an occaſion like that of *Diana* and her nymphs.

As we advanced further and the gloom and horror increaſed, the den of *Cacus* and the cave of *Polyphemus* came into my mind. I wanted nothing but a *Sybil* conductreſs with a golden rod, to imagine myſelf like *Æneas* going into the infernal regions.* The roof was ſo high and the bottom and ſides ſo dark, that with all the light we could procure from our candles and torches, we were not able to ſee the dimenſions of this cavern. The light we had ſeemed only like darkneſs viſible, and would ſerve a timid ſtranger alone and ignorant of his ſituation,

To conceive things monſtrous, and worſe,
Than fables yet have feigned or fear conceived,
Gorgons and Hydras and chimeras dire,

Milton.

Having paſſed a ſmall brook which one of the party called the *Stygian* lake, we came to the weſtern ſide of the cave. It is a ſolid perpendicular rock of black marble, embelliſhed with many rude ſketches, and names of perſons

* See *Virgil Æneid*, L. 3. l. 616. and L. 6. l. 205. and L. 6. l. 234.

ſons now long forgotten, the dates of ſome being above 200 years old. After we had proceeded twenty or thirty yards northward, the road divided itſelf into two parts, but not like that of *Æneas's* deſcent;

Hâc iter Elyſium nobis; at læva malorum
Exercet pœnas, et ad impia Tartara mittit.
Virgil Æneid, *L.*. 6. *l.* 542.

'Tis here in different paths the way divides;
The right to Pluto's golden palace guides;
The left to that unhappy region tends,
Which to the depth of Tartarus deſcends;
The ſeat of night profound, and puniſh'd fiends.

No, they both had a divine tendency: On the right was the biſhop's throne, and on the left the chapter-houſe, ſo called from their reſemblance to theſe appendages to a cathedral. Here we could not but lament the devaſtation made in the ornaments of theſe ſacred places; ſome Goths not long ſince, having defaced both throne and chapter-houſe of their pendent petrified works which had been ſome ages in forming. The little caſcades which fell in various places from the roof and ſides, with different trilling notes, ſerved to entertain the ear with their watery muſic; while the eye was buſy in amuſing itſelf with the curious reflections which were made by our lights from the ſtreams and petrifactions which appeared all around us. We were told by our guide, what a great effect the diſcharge of a gun or piſtol would have upon our ears: But not being deſirous to carry our experimental philoſophy ſo far as to endanger or give pain to the organs of hearing, we were not diſappointed in having no apparatus for the purpoſe. We were ſhewn a low and narrow paſſage on one of the ſhelves of the rock in the chapter-houſe, which we were informed led to a wider path, extending itſelf into the heart of the mountain; but our curioſity was ſatisfied without crawling amongſt the rocks beſmeared with ſlime and mud.

While

While we were regaling ourſelves with the proviſions we had brought, we enquired of our guide if he could furniſh us with any curious anecdotes relative to this cave: After informing us that it had been alternately the habitation of giants and fairies, as the different mythology prevailed in the country; he mentioned two circumſtances we paid ſome attention to. About 50 or 60 years ago, a madman eſcaped from his friends at or near *Ingleton*, and lived here a week, in the winter ſeaſon, having had the precaution to take off a cheeſe and ſome other proviſions to his ſubterranean hermitage. As there was ſnow on the ground, he had the cunning of *Cacus*, (ſee *Virgil*, *Æneia*, 8. line 209) to pull the heels off his ſhoes, and ſet them on inverted at the toes, to prevent being traced: An inſtance, among many others, of a madman's reaſoning juſtly on ſome detached part of an abſurd plan or hypotheſis. Since that time, he told us a poor woman big with child, travelling alone up this inhoſpitable vale to that of *Dent*, was taken in labour, and found dead in this cave.

Leaving *Yordas*, we ſhaped our courſe acroſs the vale by *Twiſleton* to *Ingleton*. The rocks on each ſide of *Kingsdale* are black marble, of which, elegant monuments, chimneys, ſlabs, and other pieces of furniture are made by a Mr. *Tomlinſon*, at *Burton in Lonſdale*; when poliſhed, this marble appears to be made up of entrochi and various parts of teſtaceous and piſcaceous reliques. After we had regaled and reſted ourſelves comfortably at *Ingleton*, we took an evening walk about a mile above the town to the ſlate quarries, by the ſide of the river *Weaſe*, or *Greta*, which comes down out of *Chapel in the dale*, and joins the *Kingsdale* river at *Ingleton*. Here we had objects both of art and nature to amuſe ourſelves with: On one hand was a precipice 10 or 12 yards perpendicular, made by the labour of man, being a delve of fine large blue ſlate, affording an uſeful and ornamental cover for the houſes in the adjoining

adjoining parts of *Yorkſhire*, *Lancaſhire*, and *Weſtmorland*: On the other hand was the river rolling down from rock to rock in a narrow deep chaſm, where there was no room for human foot to tread between the ſtream and the rugged, high, ſteep rocks on each ſide. Several pieces of the ſlate were beſpangled with ſmall bits of ſpar, in a cubic form, about as big as a pea, and of the colour of braſs; others were variegated with various foliages in the ſhape of ferns, pines, and different vegetables. We croſſed the river by means of the broken fragments of rocks, which afforded us their rugged backs above the ſurface of the water to tread on, and then returned to our quarters on the other ſide of its channel. Here we met with a fine field for our entertainment as botaniſts. There was the lady's ſlipper, the fly orchis, rarely to be met with elſe where, and many other ſcarce and curious plants.

Early next morning we ſet off for *Ingleton fells*, or *Chapel in the dale*, along the turnpike road leading to *Aſkrigg* and *Richmond*. We had not travelled much above a mile before we came into the dale, which is about three quarters of a mile broad. For near three miles it had ſomething in its appearance very ſtriking to the naturaliſt: There were high precipices of limeſtone rock on each ſide; and the intermediate vale ſeemed once to have been of the ſame height, but ſunk down by the breaking of pillars, which muſt have ſupported the roof of an enormous vault. This hypotheſis does not ſeem ſo very abſurd, when we take into conſideration the vaſt caverns that are found in this and every other limeſtone country. About three miles from *Ingleton* is the head of the river *Weaſe*, or *Greta*, on the left hand ſide of the road, only a few yards diſtant from it. It guſhes out of ſeveral fountains at once, all within 20 or 30 yards of each other; having run about two miles underground, though making its appearance in two or three places within that diſtance. When there are floods it runs alſo above ground, though

not

not in all places, except the rains are extraordinary great. This is the ſubterranean river mentioned by Dr. *Goldſmith* in his entertaining *Natural Hiſtory*, Vol. 1.

When we had gone a'out a mile farther being four miles from *Ingleton*, we turned off the turnpike road to ſome houſes near the chapel, where we left our horſes. At firſt we imagined we had here met with an exception to the maxim of poet *Butler*, the author of *Hudibras*, viz. That no miſſionary ever planted a church in barren land: For the chapelry produced neither wheat, oats, barley, peas, or any other ſort of grain; nor apples, pears, plumbs, cherries, or any kind of fruit: A ripe gooſe-berry was a natural curioſity in the ſummer ſeaſon, in moſt parts of the diſtrict; even their potatoes they had from abroad. Yet though they were deſtitute of theſe productions, they were bleſſed with others as valuable by way of compenſation. They abounded with excellent hay grounds and paſtures, and were rich in large flocks and herds of cattle, which enabled them to purchaſe, not only the produce of other parts of *England*, but alſo the enjoyments and elegancies of foreign climes. Having little intercourſe with the luxurious, vicious, and deſigning part of mankind, they were temperate, ſubſtantial, ſincere, and hoſpitable. We found an intelligent, agreeable, and entertaining companion and guide in the curate, who ſerved them alſo as ſchool-maſter: As Dr. *Goldſmith* obſerves on a like occaſion;

A man he is to all the country dear,
And paſſing rich, with thirty pounds a year.

The firſt curioſity we were conducted to was *Hurtlepot*, about 80 yards above the chapel. It is a round deep hole, between 30 and 40 yards diameter, ſurrounded with rocks almoſt on all ſides, between 30 and 40 feet perpendicular above a deep black water, in a ſubterranean cavity at its bottom. All round the top of this horrid place are

trees, which grow secure from the hatchet; their branches almoſt meet in the centre, and ſpread a gloom over a chaſm dreadful enough of itſelf without being heightened with any additional appendages: It was indeed one of the moſt diſmal proſpects I had yet been preſented with. The deſcent of *Æneas* into the infernal regions came again freſh into my imagination, and the following paſſage out of *Virgil* obtruded itſelf on my memory.

Spelunca alta fuit, vaſtique immanis hiatu,
Scrupea, tuta lacu nigro nemorumque tenebris;
Quam ſuper haud ullæ poterant impunè volantes
Tendere iter pennis: talis ſe halitus atris
Faucibus effundens ſupera ad convexa ferebat;
Unde locum Graii dixerunt nomine Avernum.

Æneid, B. 6. l. 237.

Deep was the cave; and downwards as it went
From the wide mouth, a rocky, rough deſcent;
And here th' acceſs a gloomy grove defends;
And there th' unnavigable lake extends;
O'er whoſe unhappy waters, void of light,
No bird preſumes to steer his airy flight:
From hence the *Grecian* bards their legends make,
And give the name *Avernus* to the lake.

Drydin.

After viewing for ſome time with horror and aſtoniſhment its dreadful aſpect from the top, we were emboldened to deſcend by a ſteep and ſlippery paſſage to the margin of this Avernian lake. What its depth is we could not learn; but from the length of time the ſinking ſtones we threw in continued to ſend up bubbles from the black abyſs, we concluded it to be very profound. How far it extended under the huge pendent rocks we could get no information, a ſubterranean embarkation having never yet been fitted out for diſcoveries. In great floods we were told the pot runs over; ſome traces of it then remained on the graſs. While we ſtood at the bottom the awful

awful silence was broken four or five times in a minute, by drops of water falling into the lake from the rock's above, in different solemn keys. This deep is not without its inhabitants, large black trouts are frequently caught in the night by the neighbouring people.

On our return we found the poet *Virgil's* maxim too true.

——— ——— Facilis descensus Averni:
Noctes atque dies patet atri janua Ditis;
Sed revocare gradum, superasque evadere ad auras,
Hoc opus, hic labor est.

Æneid, B. 6. l. 126.

The gates of hell are open night and day;
Smooth the descent, and easy is the way:
But, to return and view the chearful skies;
In this the task and mighty labour lies.

Dryden.

When we arrived in the superior regions, we pursued our journey about 150 yards farther up a very narrow groteſque glen, over a natural bridge of limeſtone above ten yards thick, having the ſubterranean river *Weaſe*, or *Greta* underneath. When we got to the head of this gill, we were ſtopt by a deep chaſm called *Ginglepot*, at the bottom of a precipice: It is of an oblong and narrow form; an enterprizing perſon with a ſteady head and active heels, regardleſs of the fatal conſequences from a falſe ſtep, might leap over it. It is filled with ſmooth pebbles at the bottom, except in the ſouth corner, where there is deep water, which in floods ſwells up to the top, and iſſues out in a vaſt torrent. The length of this chaſm is about 10 yards, and the perpendicular depth at the north corner about 20 yards. In our way from *Hurtlepot*, we could not help remarking the ruins of two ſmall artificial mounts of earth, which we were told formerly ſerved as butts,

when the inhabitants excerciſed themſelves in the ancient military accompliſhment of archery.

Returning back a little way from *Ginglepot* in order to find a paſſage out of this dreary glen, we proceeded about 120 yards higher when we came to *Weathercoat cave* or *cove*, * the moſt ſurpriſing natural curioſity of the kind in the iſland of *Great Britain*. It is a ſtupendous ſubterranean cataract in a huge cave, whoſe top is on the ſame level with the adjoining lands. On our approach to its brink, our ears and eyes were equally aſtoniſhed with the ſublime and terrible. The margin was ſurrounded with trees and ſhrubs, whoſe foliage was of various ſhapes and colours, which had an excellent effect both in guarding and ornamenting the ſteep and rugged precipices on eve y ſide Where the eye could penetrate through the leaves and branches, there was room for the imagination to conceive this cavern more dreadful and horrible if poſſible, than it was in reality. This cave is of a lozenge form, and divided into two by a rugged and groteſque arch of limeſtone rock: The whole length from ſouth to north is about 60 yards, and the breadth about half its length. At the ſouth end is the entrance down into the little cave; on the right of which is a ſubterranean paſſage under the rocks, and a petrifying well: A ſtranger cannot but take notice of a natural ſeat and table in a corner of this groteſque room, well ſuited for a poet or philoſopher: Here he may be ſecluded from the buſtle of the world, though not from noiſe; the uniform roaring however of the caſcade will exclude from the ear every other ſound, and his retirement will conceal him from every object that might divert the eye. Having deſcended with caution from rock to rock, we paſſed under the arch and came into the great cave, where we ſtood ſometime in ſilent aſtoniſhment to view this amazing caſcade. The perpendicular

* The word *cave* is pronounced by the country people *cove*, or *coave*: This hint may be of ſervice to a ſtranger in his enquiries.

perpendicular height of the north corner of this cave, was found by an exact admeasurement to be 36 yards; about 11 yards from the top issues a torrent of water out of an hole in the rock, about the dimensions of the large door in a church, sufficient to turn several mills, with a curvature which shews that it has had a steep descent before it appears in open day; and falls 15 yards at a single stroke on the rocks at the bottom, with a noise that amazes the most intrepid ear. The water sinks as it falls amongst the rocks and pebbles at the bottom, running by a subterranean passage about a mile, where it appears again by the side of the turnpike road, visiting in its way the other caverns of *Ginglepot* and *Hurtlepot*. The cave is filled with the spray that arises from the water dashing against the bottom, and the sun happening to shine very bright, we had a small vivid rainbow within a few yards of us, for colour, size, and situation, perhaps no where else to be equalled. An huge rock that had sometime been rolled down by the impetuosity of the stream, and was suspended between us and the top of the cascade, like the coffin of *Mahomet* at *Medina*, had an excellent effect in the scene. Though the stream had polished the surfaces of the pebbles on which it fell at the bottom by rolling them against each other; yet its whole force was not able to drive from its native place the long black moss that firmly adhered to the large immoveable rocks. We were tempted to descend into a dark chamber at the very bottom of the cave, covered over with a ceiling of rock above 30 yards thick, and from thence behind the cascade, at the expence of having our cloaths a little wet and dirtied, when the noise became tremendous, and the idea for personal safety awful and alarming. We were informed that in a great drought the divergency of the stream is so small, that we might with safety go quite round the cascade. At the bottom we were shewn a crevice where we might descend to the subterranean channel, which would lead us to *Ginglepot*, and perhaps much further; we were

alſo ſhewn above a ſhallow paſſage between the ſtrata of rocks, along which we might crawl to the orifice out of which the caſcade iſſued, where it was high enough to walk erect, and where we might have the honour of making the firſt expedition for diſcoveries; no creature having yet proceeded in that paſſage out of ſight of day-light: But as we were apprehenſive the pleaſure would not be compenſated by the dangers and difficulties to be encountered in our progreſs, we did not attempt to explore theſe new regions. After a little rain another caſcade ſimilar to the former falls nearly from the ſame height on the weſt ſide of the cave, appearing and diſappearing with great variety amongſt the rocks, as if it fell down the chimney of a ruinous building, where ſeveral holes were made into it in the gable-end. If the rains ſtill encreaſe, a large ſtream ſets in out of the room by the ſide of the little cave; and in great floods a vaſt river falls into the great cave down the precipice on the eaſtern ſide. With their united ſtreams they are ſometimes able to fill the whole capacity of the cavern and make it overflow, the ſubterranean crannies and paſſages of this leaky veſſel not being able with the encreaſed preſſure from above, to carry off the water as faſt as it is poured in; but this happens only once in ſeven or ten years.

Having ſatisfied our curioſity in viewing this wonder of nature, and moralized on the inſignificancy of all human attempts in producing any thing like it, we aſcended into our native regions and proceeded to another, called *Douk-cove*, about a mile ſouth on the other ſide of the turnpike road, towards the foot of *Ingleborough*, whoſe height now appeared to great advantage from the nature of our own elevated ſituation. *Douk-cove* is ſomething ſimilar to that of *Weathercoat*, but not heightened ſo much with the vaſt and terrible: The cavity indeed was longer and wider, but not deeper; the rocks not ſo high and ſteep, except on the eaſt ſide, where the hawks and other birds

birds build their nests, not dreading the approach of human foot. The stream of this cascade did not fall above 8 or 9 yards, and was not so large and fluent as the former; though like it, was immediately absorbed amongst the rocks beneath. The subterranean passage out of which it issued was very curious. By the help of a ladder we ascended and went along it to some distance by means of candles: When we had gone about 40 or 50 yards we came to a chasm 10 or 12 yards in depth from the surface, through which we could see broad day. How far we could have proceeded we know not; we returned after we had been about 100 yards. This would be looked on as a great curiosity in many countries; but after those we had seen, our wonder was not easily excited.

We were now on the base or pediment on which *Ingleborough* * stands, and greatly elevated above all the western country. Our distance from the bottom, where the steep ascent of this high mountain begins, was about a mile in a direct horizontal line over rocks and pits. The fineness and clearness however of the day induced us to ascend its sides and gain its summit: Though we had many a weary and slippery step, we thought ourselves amply repaid when we got to the top, with the amusement we received in viewing the several extensive and diversified prospects, and in making our observations as botanists and natural historians, on its productions and contents. All the country betwixt us and the sea, to the extent of 40, 50, and 60 miles from the north-west, by the west to the south-west, lay stretched out beneath us like a large map with the roads, rivers, villages, towns, seats, hills and vales, capes and bays, in succession. Elevation is

* The word *Ingleborough* seems to be derived from the Saxon word *Ingle*, which signifies *fire*, and *borough* or *burgh*, which comes originally from the Greek word *purgus*, and signifies a *watch-tower*; for here a beacon is erected, on which a fire used to be made as a signal of alarm in time of rebellions or invasions.

is a great leveller; all the hills and little mountains in the country before us, appeared ſunk in our eyes, and in the ſame plane with the adjacent meadows. To the north-weſt, the proſpect was terminated at the diſtance of about 40 or 50 miles, by a chain of rugged mountains in *Weſtmorland*, *Lancaſhire*, and *Cumberland*, which appeared as barriers againſt the fury of the ocean. To the weſt the Iriſh ſea extends as far as the eye can penetrate, except where the uniformity of the watery proſpect is interrupted by the *Iſles of Man* and *Angleſey*. The blue mountains in *Wales* terminated our further progreſs, after we had traced out the winding of the coaſt all the way from *Lancaſter*, by *Preſton*, and *Liverpool*. To the eaſt and north, the proſpect is ſoon terminated by a number of black, irregular chaotic mountains, which, by their indentations and winding ſummits, gave us reaſon to conclude they contained habitable vales between them. Their ſides afford an hardy and wholeſome paſture for ſheep, and their bowels contain rich mines of lead, ſome of which are wrought with great advantage to the proprietors.

The immenſe baſe on which *Ingleborough* ſtands, is between 20 and 30 miles in circumference: The riſe is in ſome places even and gradual, in others, as to the north and weſt, it is rugged and almoſt perpendicular. The top is plain and horizontal, being almoſt a mile round, having the ruins of an old wall about it, from which an ingenious antiquary might prove it had once been a Roman ſtation, and place of great defence, if he could make us believe, that this bleak and barren mountain could ever be thought an object of conſequence by an enemy. Of late years it has never been frequented by any except ſhepherds, and the curious in proſpects, and the neighbouring country people, who reſorted to the horſe races, which were formerly annually held on its top. On the weſtern edge there is the remains of what the country people call the beacon, ſome three or four yards high, and

aſcended by a flight of ſteps. The ruins of a little watch-houſe is alſo adjoining: No doubt in time of wars, inſurrections, and tumults, a fire was made on this beacon to give the alarm to the country round about. The ſoil on the top is ſo dry and barren that it affords little graſs, the rock being barely covered with earth: A ſpongy moſs is all the vegetable that thrives in this lofty region. The ſtones on the ſummit, and for a great way down, are of the ſandy gritty ſort, with freeſtone ſlate amongſt them: Upon the baſe the rocks are all limeſtone to an enormous depth. Near the top indeed, on the eaſt ſide, is a ſtratum of limeſtone like the *Derbyſhire* marble full of entrochi. Several ſprings have their origin near the ſummit, particularly one on the north ſide, of pure and well-taſted water, called *Fair-weather-ſyke*, which runs down by the ſide of a ſheep fence wall into a chaſm, called *Meir-gill*. All the other ſprings, as well as this, when they come to the limeſtone baſe are ſwallowed up, and, after running perhaps a mile underground, make their appearance once again in the ſurrounding villages, and then wind in various courſes to the *Lune* or *Ribble*, which empty themſelves into the Iriſh ſea.

The other ſtones and foſſils on and about *Ingleborough*, are black and brown marbles, abounding with white ſea ſhells, ſparks of ſpar, and flakes of entrochi; ſpars of various ſorts, the ſtalactical and icicle in the caves, ſlates pale and brown, and near *Ingleton* blue; black ſhiver, bloodſtone, and lead ore. The ſoil on the baſe and ſides of *Ingleborough* (where there is any) is chiefly peatmoſs, which the country people get up and burn for fewel: The chief cover is ling or heath: Other vegetables are, ferns of various kinds; reindeer-moſs, and various other moſſes, heleborines white and red; the different ſorts of feeduns; the hurtle-berry or bil-berry, knout-berry, cran-berry, and cow-berry. In the *Foal-foot*, which is in the north-weſt corner of this mountain, is found the viviparous-graſs, and the roſe-of-the-root, which has a yellow flower;

and is like houſe-leek. Near *Ingleton*, as was before obſerved, is the lady's ſlipper, and fly orchis. The chief animals found on and about *Ingleborough* are, grouſe, the ring-ouſle, and wheat-ear; the fox, mountain cat, wild cat, pole cat, and weaſle.

The perpendicular height of this mountain above the level of the ſea is 3987 feet, as taken by a country gentleman, though it is marked 1760 yards, or exactly one mile high, in the new map of *Yorkſhire*. It is agreed on all hands, and is obvious enough to the eye, that *Whernſide*, which is on the north ſide of the vale of *Chapel in the dale*, is the higher, though not ſo well ſituated for extenſive proſpects. If this mountain is one mile high, it may be calculated from the principles of mathematics, that the proſpect along the ſea will extend above 90 miles from the eye. The top of *Ingleborough* is the firſt land however that ſailors deſcry in their voyage from *Dublin* to *Lancaſter*, thongh almoſt 30 miles from the ſea, which ſhews the great elevation of this mountain.

We returned back nearly the way we came, to the turnpike road in a paſture called the *Sleights*, where we had ordered our horſes to be ſtationed. We could not but obſerve in this field, two remarkable large heaps of ſmall round ſtones, at about a quarter of a mile diſtance from each other, called by the country people the *Hurders*; they ſeemed evidently placed there by human hands, and what was moſt extraordinary, there was not one ſtone ſcarce to be ſeen of the kind near them; all the ſtones in the neighbourhood were limeſtones but theſe were round, ſandy, gritty ſtones; moſt probably theſe mounts were tumuli. After we were got between three and four miles from the chapel, we came to an inn, at the bottom of the high mountain *Cam*, called *Gearſtones*, where we left our horſes, and proceeded to another curious cave, about half a mile off, called *Catknot-hole*. The entrance into it was two or three yards wide, and three or four high.

We

We had not gone out of ſight of day, before we were obliged to wade up to the mid-leg a few yards, through a little pool made by the rill, that comes out of this cave. The paſſage grew narrower, but wide enough to walk along with eaſe, except in one or two places, where we were in danger of daubing our cloaths with a red ſlime. We proceeded above a quarter of a mile, when the road grew wider, but the roof was ſo low, that we could not go on with eaſe and pleaſure: Perhaps, if we had muſtered humility and fortitude enough, to have crouched and crawled a little, we might have come to where the roof again would have been as high as we ſhould have deſired. In ſome places there were alleys out of the main ſtreet, but not extending to any great diſtance, ſo as to admit of paſſengers. The rocks jutted out, and were pendent in every groteſque and fantaſtic ſhape; moſt of them were covered over with a fine coating of ſpar, that looked like alabaſter, while iſicles of various ſhapes and colours were pendent from the roof; all generated by the fine particles of ſtone that exiſt in the water, which tranſudes through the roof and ſides, and adhere to the rock in their deſcent to the bottom. The various coloured reflections made by the ſpars and petrifactions that abounded in every part, entertained the eye with the greateſt novelty and variety; while at the ſame time, the different notes made by the rill in its little caſcades, and reverberated from the hollow rocks, amuſed the ear with a new ſort of rude and ſubterranean muſic, but well enough ſuited to our ſlow and gloomy march. This was the longeſt ſubterranean excurſion we had yet made, and if we might have formed our own computation of its extent, from the time we were in going and coming, and not from the real admeaſurement of our guide, we ſhould have thought it two or three times as long as it was, ſo much were we deceived in our eſtimate of a road, unlike any we had ever before travelled. The romantic caſcades, pools, and precipices,

in the channel of the river *Ribble*, that runs by the mouth of this cave, are not unworthy the notice of a ſtranger.

We left one cave as we came hither, about a mile or two off to the north. It is called *Greenſide-cave*, and is at the bottom of the high mountain *Whernſide*, near the road from the village called *Winterſcales*, to the dale of *Dent*: As it had nothing in it very different from this laſt, we were prevailed on to paſs it, and in lieu of ſeeing it, to take the curate's account of it. He told us that *Churchill's* deſcription of the Scottiſh cave in the propheſy of famine, with a little alteration, would give us a compleat idea of it.

This lonely cave (hard tax on Scottiſh pride!)
Shelter at once for man and beaſt ſupply'd:
Their ſnares without, entangling briers ſpread,
And thiſtles, arm'd againſt the invader's head:
Here webs were ſpread of more than common ſize,
And half ſtarv'd ſpiders prey'd on half ſtarv'd flies;
In queſt of food, efts ſtrove in vain to crawl,
Slugs, pinch'd with hunger, ſmear'd the ſlimy wall:—
The cave around with falling rivulets rung,
And on the roof unhealthy vapours hung.

After we had refreſhed ourſelves and horſes at *Gearſtones*, we were for ſome time in ſuſpence, whether we ſhould go to *Horton*, by *Ling-gill*, which is a curious and romantic deep channel through limeſtone rocks for a ſmall brook; or return about a mile, and go by *Alumn-pot*, which is a little above the village of *Selſide*, and about two miles from *Gearſtones*: Our taſte for pits and caves induced us to adopt the latter plan. *Alumn* or *Alan-pot* is a round ſteep hole in the limeſtone rock, about ten yards in diameter, and of a tremendous depth. We ſtood ſome time on its margin, which is fringed round with ſhrubs, in ſilent aſtoniſhment, not thinking it ſafe to venture near enough to its brim to try if we could ſee to its bottom. The profoundity ſeemed vaſt and horrible from the hollow, gingling

gingling, continued noiſe, excited by the ſtones we tumbled in. The rivulet that deſcended into this pit, filled a great part of its cavity with ſpray, which cauſed ſuch a dreadful gloom, as to make us ſhrink back with horror, when we could get a peep into this vaſt abyſs. The waters run from its bottom 300 or 400 yards underground, and then appear again at the little village of *Selſide*. After having excited the ſeveral paſſions of curioſity, dread, and horror, from the negative knowledge we got of the capacity and depth of this huge pot, we proceeded about half a dozen miles farther to the little town of *Horton*, between the river *Ribble* and the lofty well-formed mountain *Penegent*. There were indeed ſeveral more caves and chaſms on the baſe of *Ingleborough*, which we left unexplored, as *Hardraw-kin*, and *Meir-gill*, on the north ſide; *Long-kin*, on the weſt ſide; and *Johnſon's-jacket-hole*, *Gaper-gil*, *Blackſide-cave*, Sir *William's-cave*, *Atkinſon's-chamber*, and ſome others on the ſouth and eaſt ſides. Some of them are dry, and others have water in; but theſe we left for another ſummer's excurſion.

Before we left *Horton* we viſited ſome natural curioſities of the cavern kind on the baſe of *Penegent*.* *Dowgill-ſcar*, a little above *Horton*, is a groteſque amphitheatre of limeſtone rocks compoſing an high precipice, which muſt appear awful and grand in a flood, when a large torrent of water falls from the top, full in view. A ſmall ſubterranean paſſage was able to take all the water, when we were there. A romantic gallery on the north ſide in the rocks, had a good effect in the ſcene. About a mile or two above *Horton*, upon the baſe of *Penegent*, we viſited *Hulpit*, and *Huntpit holes*: The one, if we could have deſcended

* The word *Pen* is of Phænician extraction, and ſignifies *head* or *eminence*. It was firſt introduced into *Cornwall*, where the *Phœnicians* had a colony, who wrought the tin mines. Hence we have many names in *Cornwall* which begin with *pen*. Moſt mountains in *Wales* begin with *pen*. In *Scotland* the label letter *P* is changed into *B*, and *Pen* into *Ben*, as *Benlomond*, *Beneviſh*, &c.

deſcended into it, would have appeared like the inſide of an enormous old Gothic caſtle, whoſe high ruinous walls were left ſtanding after the roof was fallen in. The other was like a deep funnel, and it was dangerous to come near its edges. *Horton-beck* or *brook* runs through the one, and *Branſil-beck* through the other of theſe pits, but through which I cannot remember; they each run underground near a mile; *Horton beck* appearing again at *Dowgil-ſcar*, and *Branſil-beck* at a place called *Branſil head*. But what is moſt extraordinary, theſe ſubterranean brooks croſs each other underground without mixing waters, the bed of one being on a ſtratum above the other: This was diſcovered by the muddy water after a ſheep waſhing, going down the one paſſage, and the ſeeds or huſks of oats that were ſent down the other. About a couple of miles from *Horton*, on the right hand ſide of the road to *Settle*, is a curious ſtone quarry, at a place called *Culms* or *Coums*; they are of a blue kind like ſlate, from one to three inches thick: Some are two or three yards broad, and five or ſix yards long; they are made uſe of for floors in houſes, being ſometimes laid over cellars on joiſts; they are alſo uſed for gate-poſts, foot-bridges, and partitions between the ſtalls in ſtables and cowhouſes.

At *Stainforth*, which is about three miles from *Horton*, and two from *Settle*, we were entertained with two caſcades, one in the *Ribble*, near the road, about 6 or 8 yards high, and another a little above the village, perhaps 20 or thirty yards perpendicular.

About a quarter of a mile before we arrived at *Settle*, we turned to the right, along the road towards *Kirkby-Lonſdale*, about a mile, under the high and romantic rocks called *Giggleſwick-ſcar*; in order to ſee the well by the way ſide, which ebbs and flows. We were in luck, ſeeing it reciprocate ſeveral times while we were there, and not ſtaying above an hour. We could not however learn

learn, with any degree of certainty, by what intervals of time, and to what heights and depths, the reciprocation was carried on. We were informed that if the weather was either very droughty or very wet, the phænomenon ceased. I have seen some philosophical attempts to solve this extraordinary curiosity on the principle of the syphon, but in vain; as on that hypothesis, if the syphon is filled by the spring, it will flow on uniformly for ever. We are told by drunken *Barnaby* almost 200 years ago, that it puzzled the wits of his age.

Veni Giggleswick, *parum frugis*
Profert tellus, clausa jugis:
Ibi vena prope viæ
Fluit, refluit, nocte, die;
Neque norunt unde venâ,
An a sale vel arenâ.

Thence to *Giggleswick* most sterile,
Hem'd with shelves and rocks of peril,
Near to th' way, as a traveller goes,
A fine fresh spring both ebbs and flows;
Neither know the learn'd that travel,
What procures it, salt or gravel. *Barnaby.*

Two country gentlemen, about 30 or 40 years ago, promised something more successful in the issue of a paper war that was carried on between them, to the great amusement of the neighbourhood: Nothing however was determined or contended for about this well, so famous in history, but whether it was a natural curiosity or not.

As we approached towards *Settle*, in our return, a white rock like a tower, called *Castleber*, immediately above the town, and about 20 or 30 yards in perpendicular height, engaged our attention. We were told a curious anecdote of this rocky mount. As limestone was daily got there to supply a kiln at the bottom, the inhabitants had the lime-burner presented at the court of the lord of the manour, fearing that if any more was dug out, the

the rock might fall and bury the whole town in ruins, a ſtone having once tumbled down and broken through a garden wall beneath, in its impetuous courſe towards the houſes. Twelve wiſe and juſt men were impannelled as jurors, and ſent to view this impending nuiſance; the verdict they returned was, that if ever it fell, it would tumble not towards the town, but the direct contrary way. On the other ſide, it reſts againſt the baſe of an high mountain. The hills and mountains all round were lime-ſtone to a prodigious depth; yet, ſtrange to tell, we were informed there was a monopoly of this commodity, one lime-burner or one company of lime-burners having engroſſed the whole of it.

Settle is irregularly built, has a large and ſpacious market-place, but not many good houſes in it: Though by no means an inconſiderable town either for trade, riches, or number of inhabitants, it has no church or chapel. The church is at *Giggleſwick*, about a mile off, which appeared to be the court end of the pariſh

From *Settle* we proceeded eaſtward over the moors and mountains about half a dozen miles, to *Malham* or *Maum*, in order to ſee ſome other natural curioſities of the precipice and cataract kind. We had already indeed ſeen ſo many, that our wonder could not eaſily be excited, except they were more great and terrible: As ſuch we had them repreſented at *Settle*, or elſe we ſhould ſcarce have left the turnpike road; and when we ſaw them we were not diſappointed for great and terrible they are. The firſt was *Malham-cave* (or vulgarly *Maum-cove*) though it has properly nothing of the cave about it. It is a fine amphitheatre of perpendicular limeſtone rock on the ſide of the moor, at leaſt 100 yards high in the middle. The rocks lie ſtratum upon ſtratum, and on ſome there are *ſaxa ſedilia* or ſhelves, ſo that a perſon of great ſpirit and agility, but of ſmall and ſlender body, might almoſt walk round. A ſmall brook ſprings out at the bottom of the rocks;

rocks; but in floods the narrow ſubterranean paſſage is not able to give vent to all the water, when there pours down a ſtupendous cataract, in height almoſt double that of *Niagara*. This is the higheſt perpendicular precipice I have ever ſeen, and I think not enough known or admired by travellers for its greatneſs and regularity. After purſuing our journey near a mile, by the ſide of the deep and romantic channel of the river *Air*, which waſhes the baſe of many a rugged and high precipice in its impetuous courſe to the vale beneath, we came to *Gordal*, the higheſt and moſt ſtupendous of them all. The proſpect of it from the ſide of the oppoſite weſtern bank is awful, great, and grand. After viewing for ſome time its horrid front with wonder and aſtoniſhment, we were tempted to deſcend with care and circumſpection down the ſteep bank on the weſt ſide of this river, which being interſperſed with trees and ſhrubs, enabled us to rely on our hands, where we could find no ſure foot hold. The water being low we met with no difficulty in ſtepping from one broken fragment of the rocks to another, till we got on the other ſide, when we found ourſelves underneath this huge impending block of ſolid limeſtone, near 100 yards high. The idea for perſonal ſafety excited ſome awful ſenſations accompanied with a tremor. The mind is not always able to diveſt itſelf of prejudices and unpleaſing aſſociations of ideas: Reaſon told us that this rock could not be moved out of its place by human force, blind chance, or the eſtabliſhed laws of nature. We ſtood too far under its margin to be affected by any crumbled deſcending fragment, and a very ſmall one would have cruſhed us to atoms, if it had fallen upon us; yet, in ſpite of reaſon and judgment, the ſame unpleaſing ſenſations of terror ran coldly through our veins, which we ſhould have felt, if we had looked down, though ſecure, from its lofty top. Nothing however fell upon us but a few large drops, which ſweat from out its horrid prominent front. A little higher up is a fine caſ-

cade, where the river ſtriving for an eaſier and gentler deſcent, has forced a way through the rocks, leaving a rude natural arch remaining above. If a painter wanted to have embelliſhed his drawing of this romantic ſcene with ſome groteſque object, he could have added nothing which would have ſuited his purpoſe better, if nature had not done the work for him.

* From *Gordal* we proceeded to a curious lake called *Maum* or *Malham tarn*, abounding with fine trout, upon the top of the moor; and from thence by *Kilſey-crag*, to *Graſſington*, on the banks of the river *Wharf*. Having not been apprized of the crags of *Kilſey*, I was a good deal amazed at the proſpect. They are by the ſide of the vale along which deſcends the river *Wharf*: Like thoſe at *Giggleſwick*, they extend in a line to ſome diſtance, but are higher and more prominent. The road we came along winded down amongſt theſe crags, ſo that we were preſented with a full view of them on a ſudden, which cauſed the greater ſurpriſe. After having refreſhed ourſelves at *Graſſington*, we travelled about nine miles further and came to *Skipton*. The country all round is uneven and rugged; the vales are rich on the ſurface, and the mountains beneath it abound with rich mines of lead. After we had viſited the caſtle (which belongs to the Earl of *Thanet*) and the curious canal behind it, above the mills, which leads to the limeſtone quarry, by the ſide of a romantic deep glen, we left *Skipton*. Before our departure we were for ſome time in doubt, whether we ſhould aſcend the ſteep and black hill of *Romaldſmoor*, and ſo proceed down the vale of *Whardale*, one of the pleaſanteſt in *England*, to *Otley*, and ſo to *Leeds*,—or go by *Keighley*, *Bingley*, and *Bradford*, along the ſide of the new canal, and view the locks and other contrivances on this new and uſeful work of

* If *Kilſey-crag* ſhould not be thought an object worth going ſix or ſeven miles round to ſee, the beſt way from *Gordal* to *Skipton* will be by *Kirkby*, *Malhamdale*, and *Gargrave*.

of art. Moſt of us having been the former road, and this with its objects being quite new, we were induced to proceed along it. At *Kilwick*, about four miles from *Skipton*, we paſſed under this aquæduct, where it was banked up a great height above the adjoining lands at a vaſt labour and expence: There have been ſome violent ſtruggles between the elements of earth and water; the mounds have not always been able to keep the water within its proper limits, they having, oftner than once, been broke through by the preſſure on their ſides. About a mile further, at *Stetton*, we could not but obſerve the ſteep aſcent and deſcent of the road over an hill, when a level path might have been made almoſt equally near along the ſide of the river. The inconveniences that muſt attend carriage in carts and waggons, from ſuch ill concerted roads, perhaps might ſuggeſt the expediency of a canal. The uſe and practicability of ſuch an undertaking in a mountainous country, one would imagine might give the inhabitants a hint to make their roads wind with eaſy aſcents and deſcents along the ſides of the vale. From *Skipton* to *Otley* the road is carried up and down the corner of the ſteep mountain *Romaldſmoor*, when as near a one might have been conducted along the vale beneath. The inhabitants might have carried to the market the produce of their lands, and brought coals and manure at a little expence, if this plan had been adopted; but the prejudices againſt improvements and innovations are not eaſily removed. At *Bingley* we were entertained with the locks; there are five or ſix of them together, where the barges aſcend or deſcend 80 or 90 feet perpendicular, in the diſtance of about 100 yards. They are elegant and well finiſhed, but ſeem too deep not to leak and be frequently out of repair. The act was procured ſome eight or ten years ago, to make a navigable canal from *Leeds* up to *Skipton*, and *Colne*, and from thence by *Whalley*, *Leland*, and *Ormſkirk*, to *Liverpool*, being quite acroſs the kingdom. As in moſt works of this nature, which

are extenſive and of a new kind, the eſtimate fell far ſhort of the expence. Only the two extremities are finiſhed at preſent, from *Leeds* about four miles above *Skipton*, at one end, and from *Liverpool* to *Wigan* on the other. If the whole was compleated, no doubt but it would prove of great public and national advantage. Like that of the new river to *London*, undertakings of this ſort often ruin the firſt adventurers, and make the fortunes of thoſe who are able to complete and extend the original plan.

About four miles before we arrived at *Leeds*, in our way from *Bradford*, we were ſuddenly preſented with the grand and venerable ruins of *Kirkſtal* abbey, full in view from the road: We ſtood ſome minutes looking with ſilent reſpect and reverence on the havock which had been made by time on this ſacred edifice. How much ſoever we might condemn the miſtaken notions of monkiſh piety, that induced the devotees to a lethargic ſupineneſs, and to forſake all the ſocial duties of life in order to be good men; yet we ſecretly revered that holy zeal which inſpirited them to exert every power in erecting ſtructures, whoſe magnitude and beauty might excite ideas worthy of the Deity to whom they were dedicated; and alſo to reprobate that fanatic bigotry which ſuffered them to decay and go to ruin, becauſe they were once inhabited by a ſet of chriſtians, whoſe manner of worſhip was not orthodox. While we were moralizing thus on religious prejudices, the inſtability of the works of men's hands, and the fading glories of this world, we came to *Leeds*.

As the largeneſs and extent of this thriving manufacturing town, with all its elegant buildings in and about it, are well known to you, and, as you have alſo ſeen every thing worth notice in and near the road from thence, I ſhall here take my leave of you, and no longer tire you with a relation of the adventures and curioſities I met with in my ſummer's journey.

Before

Before I finish my letter, however, I cannot but lay before you a few conclusions of a philosophic nature, which, I think, I was able to draw with some degree of exactness, from the data or natural principles I met with amongst the mountains.

I. It appears to me obvious enough, that all the marbles and limestone we saw were made up of testaceous and piscaceous relicts, or of the shells and other parts of fish. There were visible in all the rocks, whether of the higher or lower strata, shells of all the different species, and in every stage of existence; some small or young, others full grown; some in a state of decay, broken and eat through in holes by worms to get at the fish; others bivalve, with both their valves entire. The teeth and bones of various sorts of fish are discernible in the midst of the solid rocks. The shells found at the bottom of the sea, and in the limestone, have the same properties and effects, whether analysed chemically, or made use of in medicine or agriculture. It has been contended for by some, that they are nothing else but the sportings of nature, or the effects of crystallization, when the soft pulpy matter in which they inhered, became fixed and solid. But the laws of crystallization seem exceeding different to these; the crystals in any one salt or composition are all similar and homogeneous, and not diversified thus with imitations of all the animals, or separate parts of animals, in the most prolific and inhabited element. The nitrous acid, and fosil alcali, crystilize always in cubes; some calxes of metals united with acids, shoot into stars, and every new generated composition has its parts formed by its own peculiar rule. If a person had never seen a hay-stack before, he would have no doubt, after a little examination, but that its contents were once in a state of vegetation. I believe no proposition in natural history is more obvious, than that all the calcarious stones, viz. chalks, marbles,

marbles, gypsums, and limestone, in this kingdom; are made up of shells and other parts of marine animals. *

II. From every appearance we saw, it was obvious that the marbles and limestone had been once in a soft pulpy state approaching nearly to fluidity. † Upon the bases of *Ingleborough*, *Penegant*, and *Maum-moor*, the tops of the rocks were channelled and scalloped in different directions. The excavations were narrowest and shallowest in the higher parts, and encreased in depth and wideness down to the edges of the rocks: They had the same appearance as those little channels upon the banks of the sea sands, made by the tide draining off near the course of some stream; or those that are formed by heavy rains running down the sides of roads in a sandy or miry country. There is no possibility of their being worn by all the rain since the creation, if the rocks were still in their present hard and durable state. The rocks were not ever continued entire above a few yards, but were broken into chasms and fissures from one, to two, or three yards deep: No doubt this was the effect of the soft matter of which they originally consisted, being dried by the rays of the sun, and of consequence being made to shrink up into less dimensions. Something similar to this, though in an inferior degree, we perceive on the mud in the bottom of a pool, when the water is exhaled by the sun and the bottom dried up. Wherever the waters of an adjoining spring were diffused and spread on the surface of the rocks, so as always to keep them moist, they were the

* The rock at *Gibralter*, and several mountains in *Dalmatia*, and no doubt, many others in different parts of the world, are made up of bones, not only of every animal extant in nature, but particularly of those of the human species.

† This proposition follows indeed without any further proof from the preceeding. For if these rocks be made up of shells, they must have been dissolved in some menstruum, or mixed up in some mucilage, like plumbs in a pudding.

the moſt free from chinks and crevices. The under ſtrata of rocks, and thoſe beneath the ſoil, are found to be much more compact than thoſe expoſed to the ſun and air. From theſe principles we accounted for the channels of the rivers being worn ſo deep in a limeſtone country, where the bed was originally ſo ſoft; and alſo for the caves and ſubterranean rivers. If a ſmall ſtream at firſt found a paſſage between the ſtrata or fiſſures of the rocks, it would ſoon waſh itſelf a wider paſſage amongſt matter that had ſo little tenacity. The deeper below the ſurface of the ground the vein might lay, the longer it would continue to waſte the body of ſtone through which it paſſed, as it would be a ſeries of years before the ſun and air would produce any conſiderable rigeſcent effects, ſo far out of their eaſy reach. Why the parts of which marbles and limeſtone are compoſed cohere ſo firmly, and become ſo hard by being expoſed to the ſun and air, I leave the chymiſts to determine. Perhaps it may be in a great meaſure, if not entirely, owing to the fixt air they contain; for when it is expelled by fire and they are expoſed to the open atmoſphere, they crumble and diſſolve into particles ſmaller than ſand; after this duſt has again imbibed the particles of fixt air it becomes a ſecond time marble or limeſtone.

III. To account for theſe marine productions being elevated ſo far above the bottom of the ſea, is a taſk more difficult than the ſolution of either of the former propoſitions. It appears to me that no other ſecondary cauſe can ſolve this phænomenon, but an alteration in the diurnal rotation of the earth round its axis. This principle indeed would not only account for marine exuviæ being found on the higheſt mountains in the interior parts of large continents, but for a variety of other phænomena, which appear inexplicable on any other hypotheſis. Let us ſuppoſe ſuch an alteration to take place, either by the

the impact of a comet,* or any other cauſe in nature, or by the immediate agency of the creator; and inveſtigate the conſequences that would of neceſſity follow from ſuch a change. If the world was originally all in a fluid ſtate, or, however, if the matter of which it was compoſed was very ſoft and pliant as is the ſuppoſition of Sir *Iſaac Newton*, and ſome other great philoſophers, it would be perfectly round if it had no motion round its axis. The different ſtrata would be diffuſed in concentric ſhells round it at different depths according to their ſpecific gravities: Land, moſt probably, would ſoon be accumulated in various parts, by the tides and waves excited by the winds and ſtorms, driving the earthly parts at the bottom of the ocean into great banks and iſlands. Their greateſt altitude however above the ſurface of the adjoining ſeas could never be many yards from this cauſe. If the earth was from this ſtate, made to revolve round its axis, as it does at preſent, once almoſt in 24 hours, the moſt violent commotions would enſue amongſt all the different elements. 1ſt, There would be a violent eaſt wind from the earth's revolving from weſt to eaſt, till it had communicated its motion to the atmoſphere.† Impetuous rains and great winds and ſtorms are always concomitant, "Thus would the windows of heaven be opened." 2d, As the velocity of the earth's rotation encreaſed, it would become more and more an oblate ſpheroid

* Mr. *Whiſton*, in his *Theory of the Earth*, endeavours to account for the deluge and the irregularities on the ſurface of the globe by the approach of a comet very near to it, not however by altering its diurnal rotation by impact or otherwiſe, but by the great tides and other ſurpriziug effects that would follow from its attraction, and the vapour which would fall from its tail.---The comet obſerved by Sir *Iſaac Newton* in 1680, whoſe period that great philoſopher computes to be 575 years Mr. *Whiſton* thinks came near the earth at the deluge.

† This circumſtance is mentioned in the 8th chapter of *Geneſis*, verſe 1ſt.

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ſpheroid from the encreaſed centrifugal force at the equator. * The waters would firſt conform to this new ſhape, as moſt eaſily put in motion: In their courſe towards the equator they would flow over all the lands; for the parts about it are at preſent at leaſt 17 miles farther from the center of the earth, than thoſe near the poles. 2d, As the force in the equatorial regions to fly off from the center increaſed, the terrene parts themſelves would begin to aſcend, for we cannot ſuppoſe their tenacity ſo great as not to be broken by a force equal to the weight of a column of earth and water 17 miles high. The ocean no doubt would find many a ſubterranean paſſage, and by its preſſure upwards, heave up the ſuperincumbent ſtrata, and make its way through various chaſms to the ſurface. Thus would all the fountains of the great deep be broken up, as mentioned in the 7th chapter of *Geneſis*. The ſtrata alſo would be torn up and thrown one upon another in the moſt rude and irregular manner, with every poſſible inclination and direction, ſince there would be ſuch a great variety in their ſpecific gravities, and ſtrength of coheſion, as would render it impoſſible to reduce them to any certain laws.

IV. But this is not all, the waters would be admitted to the burning ſtrata and ſubterranean fires, which would cauſe the greateſt convulſions in the bowels of this globe. Earths, ſtones, and foſſils, of various ſorts, would have their natures changed by heat and all the different degrees of vitrifaction and calcination; large mountains would be heaved up above the irregular maſſes of rocks and

 different

* The earth revolves round its axis once in 23 hours, 56 minutes, and 4 ſeconds. At the equator, the centrifugal force, is to the whole force of gravity, as 1:289; ſo that each body loſes $\frac{1}{289}$ part of its weight. The equatorial diameter of the earth, is to its polar diameter 230:229.---Hence, if the diameter of the earth, according to the admeaſurement of *Picart*, be 7846 miles; the equatorial regions will be higher than the polar by $17\frac{1}{10}$ miles. See Sir *Iſaac Newton's Principia*, book 3d, page 19.

different ſtrata that were laid in confuſion by the globe's centrifugal force; and vaſt quantities of looſe earth and ſtones would be thrown and diſperſed in every direction to a vaſt diſtance and depth, by the burſting and exploſion of volcanos.

As ſome new principles are advanced in this fourth article, it may not be improper to explain and prove them a little more particularly. Few naturaliſts make any doubt of burning ſtrata, to a vaſt extent, at all different depths below the ſurface of the globe: Several of them emerge in conſequence of their elevated direction into open day, and ſpread terror around them in volcanos and burning mountains. The ſteam ariſing from boiling water is the moſt elaſtic vapour of any we are acquainted with in nature: It is at leaſt 30 times ſtronger than fired gunpowder; and according to Mr. *Michell's* computation (in his excellent *Treatiſe on Earthquakes*, publiſhed in the *Philoſophical Tranſactions*, about the year 1757) ſufficient to heave up the ground at the depth of ten miles. Whenever water is poured on one of theſe burning ſtrata, it will be immediately converted into ſteam, and proceed with an undulatory motion under the ground, ſhaking every thing above (like the air under a carpet, when the edge is taken up and ſuddenly let down) till it either get vent at the ſurface in ſome volcano, or till it arrive at the extremities of the ignited matter, where it will of conſequence be condenſed by the cold and deprived of its elaſticity and force. On the 1ſt of November, 1755, when *Liſbon* was deſtroyed, the ſea and land were agitated to an extent of above 3000 miles; the burning ſtratum which was the cauſe of this dreadful calamity, muſt have been at leaſt of the like dimenſions.

Hiſtory abounds with a variety of examples of iſlands raiſed from the bottom of the ſea, and mountains upon land, by earthquakes. *Delos* and *Rhodes*, are recorded to have grown out of the ſea; *Thera* alſo and *Hiera*, in the ſame

ſame neighbourhood, are mentioned by *Pliny* to have a like origin. In later times we have many ſuch accounts: In 1628, one of the *Azores* near the iſland of *St. Michael*, roſe out of the bottom of the ſea, which before was 160 fathom deep. The iſles of *St. Helena*, and *Aſcenſion*, in the *Atlantic ocean*; thoſe of *Otahaite*, &c. in the *Pacific* and the *Moluccas*, in the *Indian* ſea, afford great room for conjecture, from their contents, to have had a like original.

For a further account of iſlands and mountains thus raiſed, ſee Mr. *Michell's* conjectures on earthquakes, before alluded to. No doubt but *Ætna*, the *Pike of Teneriffe*, and the *Andes* in *South America*, the higheſt mountains in the world, were originally cauſed by volcanos, as they are annually augmented by this cauſe. When the thickneſs and coheſions of the ſuperincumbent ſtrata, in any place becomes ſmall, in compariſon of the elaſticity of the vapour, and the weight above in every other direction, there is great reaſon to ſuppoſe the vapour will there force its way to the ſurface, elevating the earth in its eruption.

We have a variety of caſes on record, where aſhes, ſand, looſe earth, ſtones, and cinders, were diſperſed in vaſt quantities in all directions, by the eruptions and exploſions of volcanos, covering the earth to a great depth. In the year 79, the eruption of *Veſuvius* overwhelmed the two famous cities of *Herculaneum* and *Pompeia*, four and ſix miles diſtant, and totally covered them many feet deep, as the people were ſitting at the theatre. In the year 1600, a volcano in *Peru* threw out a ſhower of aſhes, ſand, ſtones, &c. which covered all the land 30 leagues one way, and 40 leagues another, from 8 or 9 inches, to 6 feet deep: Whence it appears that an area of ground above 34,000 ſquare miles was thus covered. From this principle we may eaſily account for detached pieces of limeſtone, freeſtone, or any other ſort of ſtone being

found at a great depth, a long way distant from the strata and rocks from which they were originally separated.

If such strange alterations have been made on the surface of the globe by earthquakes, since the commencement of history, nay, even in our own times, what terrible effects must have been produced when the whole world was shaken to its centre, when fire and water were admitted to each other in every region and at every depth? It may be observed, that it is not necessary for the establishing this theory, to suppose that the earth before the deluge had no rotation round its axis: The same consequences would follow, though in a different degree, if the earth had a less or greater velocity round the axis than at present. If the density of any planet remain the same, the spheroidity, that is, the difference between the diameter of the equator, and the polar diameter divided by the diameter of the equator, will vary in an inverse duplicate ratio of the time of rotation round its axis. See *Newton's Principia*, book 3d, p. 19. But to return from these great and general principles to the solution of the few and inconsiderable phænomena, that came under our observation, while among the mountains and caves.

On the sides and tops of *Ingleborough*, *Whernside*, *Penegant*, and the other mountains in that quarter, there were visible marks of the effects of fire, as vitrifications, calcinations, &c. As the mountains rose up, the soft matter of which the limestone originally consisted, appeared as if it had slipt down and been shoved by its own weight to their bases and vales beneath. A thin stratum that was still left on the level top of the fell, on the east side of *Ingleborough*, seemed to favour this supposition. To account for the prodigious thickness of the limestone strata about *Ingleborough*, and indeed in every other part of *Great Britain* where it is found, may perhaps be thought a task of some difficulty: Amongst the mountains above recited, there appears to be, not only the quantity, which

covered

covered the same area at the bottom of the ocean, as that on which it rests; but also what has been on the bases beneath them, which has rolled down their sides as they were raised above their first height. Might not also matter of the same specific gravity, and of an homogeneous kind, be driven to one place, and a number of strata accumulated one above another?

Mr. *Michell*, in order to solve this apparent difficulty, in a treatise he wrote on this subject, and published in the *Philosophical Transactions*, about 15 or 20 years ago, supposes the waters were occupied by shell fish and other marine animals for a long duration, before the world was habitable for man. This he thinks was the case during the earth's chaotic state, "when it was without form, and void, and when darkness was upon the face of the deep," *Genesis* chap. 1st, v. 2. But, if what Mr *Whitehurst* tells us in his enquiry be true, we have no occasion to have recourse to this hypothesis: He says, the increase of shell fish is so great, that it is not uncommon to take away a bed of them several fathoms in thickness, so that none are left remaining, and yet the next year there will be as many found in the same places as before; nor does he remember to have heard, that any place whence they were taken, had been entirely exhausted. See page 36.

It is a received opinion amongst many naturalists, that coal was originally peatmoss, this fossil having been found in every intermediate state, nay sometimes with wood in it. To this doctrine we are made proselytes, being presented with some pieces of coal that were got near the top of *Whernside* and the other mountains, that seemed more like dry clods of peatmoss than coal, though distinguishable enough to belong to the latter class. The principal difference in their composition is, that coals abound with the vitriolic, and peatmoss with the vegetable acid. The vitriolic acid is diffused through every subterranean stratum; hence if a quantity of earth should be superinduced

ſuperinduced above a ſtratum of peatmoſs, the vitriolic acid that would ouſe through, muſt in time change its nature and turn it into coal: The deeper it lay below the ſurface of the ground, the more it would be impregnated with this foſſil acid, and conſequently be the more inflamable. If a ſtratum ſhould lie near the top of a mountain, there is the leſs chance that it ſhould be well fed.

In all the deep winding vales which we viſited, it was curious enough to obſerve the regular deſcent of ſome river out of them. It might have been expected, that at the deluge, many of them would have been left full of water as high as the mountains on each ſide, which would have remained imbanked till now. But when we conſider that the force which a fluid exerts by its preſſure to overthrow any mound, is as the cube of the depth, and the ſtrength of the mound to oppoſe it, only as the ſquare of the horizontal breadth, the ſurprize vaniſhes. * For if the depth of a vale was half a mile, or only a quarter, the preſſure would be able to remove any mountain that we ſaw oppoſed againſt it. It is here ſuppoſed that the banks are ſo compact as not to admit any water within them; if that was the caſe, the force to overturn them will encreaſe in a ſtill higher ratio, from the preſſure downward of the banks being leſſened by the water partly buoying them up. *Windermere-water*, *Ulls-water*, *Derwent-water*, and the other lakes, are undoubtedly in the cavities of vales, but then the height of their ſurfaces above the level of the ſea is but a few yards and therefore their preſſure ſmall. We

* If the ſide of a bank next the water is perpendicular, and ſo contrived, that there is as much probability that it ſhall be broke down by the preſſure of the fluid it oppoſes in one part as ſoon as another, the perpendicular ſection will be a parabola; the cube of whoſe abſciſs or depth will every where be as the ſquare of the ordinate or breadth, ſo that the bank muſt be hollow outward, and encreaſe very faſt in breadth, to be ſupported from being overthrown by the preſſure of the incloſed fluid.

We have no great reaſon to conclude, that there are many empty cavities, of any great magnitude, below the level of the ſea: They are moſt frequent in limeſtone countries, or thoſe abounding with a calcareous ſtone, and ſeem to be worn by the currents of water running among the ſtrata, while in their original ſoft ſtate; but below the level of the ſea we can have no ſuch currents, and conſequently no cavities formed by this cauſe. The calculations to aſcertain the denſity of the earth, which were made by Mr. *C. Hutton*, of *Woolwich*, from the obſervations of Dr. *Maſkalane*, the Royal Aſtronomer, on the mountain *Benſhechallien*, in *Perthſhire*, prove beyond a doubt, that the earth is much more compact and denſe in its interior parts, than near its ſurface. By ſome nice obſervations theſe ingenious gentlemen were able to aſcertain the force of attraction of this mountain, when compared with that of the whole earth, and conſequently the quantities of matter they each contained. And from an exact admeaſurement of the magnitude of the mountain, and of the earth alſo, they could compare their bulks; from which principles they could eaſily find the ratio of their denſities, which is, as the quantities of matter directly and bulks inverſely. The mean denſity of the whole globe of the earth, is found to be to the denſity of this mountain in the highlands of *Scotland*, nearly as 9:5. This mountain is compoſed of firm rock, whoſe denſity is to that of the water as 5:2. Hence the mean denſity of the whole earth is to that of water, as 9:2, or as $4\frac{1}{2}:1$. It is moſt probable then, that the heavieſt and richeſt ores lie in the greateſt quantities at a vaſt depth below the ſurface of the globe. The ſolution of this curious problem does the greateſt honour to the philoſophers and mathematicians of the preſent age. By means of this diſcovery, and of the horizontal parallax of the ſun by the tranſit of *Venus*, a few years ago, we can, not only compare the denſity of common water with that of the earth, but alſo with that of the ſun, and of almoſt all the planets.

Before

Before I take my leave, ſome apology ſhould be made for troubling you with my philoſophical ſpeculations on my ſummer's tour. The amuſement from travelling is very languid and tranſitory, when it is purſued only for pleaſing the eye: Recreations of this ſort will produce a more ſincere and laſting pleaſure, if we are at the ſame time able to improve the underſtanding, to benefit ſociety, and diſplay the wiſdom and goodneſs of the creator, by an inveſtigation into the operations of his providence. How far I am right in my obſervations and conjectures on the ſeveral parts of natural hiſtory I have touched on, I leave to your own opinion. It would argue great ſelf-ſufficiency to be poſitive on a ſubject, where our data are uncertain, and every manner of reaſoning doubtful, except where we can introduce the mathematics. This I think I may ſay without preſumption, that my theory is conformable to events, as related by *Moſes*; and my reaſoning agreeable to the philoſophical principles of Sir *Iſaac Newton*. Whatever is publiſhed to the world that is inconſiſtent with either of their doctrines, will be of no benefit to mankind, and of ſhort duration itſelf. When productions of the laſt ſort make their appearance in public, like meteors in the ſky, for a little while they puzzle the learned and make the ignorant wonder, but they ſoon diſappear, no body knowing from whence they came, nor enquiring what is become of them. But theſe two prodigies of the human race, like the great luminaries of heaven, by their wiſdom and knowledge, diſpenſe an uniform, regular, and beneficial light to mankind.

A TABLE

A TABLE OF THE ROADS AND DISTANCES OF PLACES FROM EACH OTHER.

Miles.

Kendal.
12 Kirkby-Lonſdale.
6 Thornton-church-ſtile.
4 Yordas-cave.
4 Ingleton.
4 Chapel in the dale.
3 To the top of Ingleborough.
3 Back again to Chapel in the dale.
3½ Gearſtones.
2 Alan-pot.
5 Horton.
6 Settle.
5 Malham-cave.
6 Kilnſey-crag.
3 Graſſington.
9 Skipton.
9 Keighley.
4 Bingley.
6 Bradford.
7 Kirkſtal-abbey.
3 Leeds.

104 ½ from Kendale to Leeds, by this Circuit.

FINIS.