

duce the same number of animalcules. The ancients knew them to be insects, for Pliny says, “*Coccum ilicis celerrime in vermiculum se mutans.*” Lib. 24. sect. 4. When observed with the microscope in July or August, we find that what appeared as dust, are so many eggs, or open capsules, as white as snow, out of each of which, issues a gold coloured animalcule, of the shape of a cock-roche, with two horns, six feet, and a forked tail.

Mr. De Reaumur has placed the kermes in the class of gall insects, on account of the analogy in their mode of propagation, and immoveable form, continuing even after death, like the other species of this class, found upon different trees, appearing only like galls, or excrescences, to the most accurate naturalists: Therefore they could not be more properly named, than gall insects. There are of them of different shapes and sizes, but that of the *coscoxa* or *carrasca* (the kermes) is of a spherical figure, about the size of a juniper berry. It is found most plentifully on the oldest and lowest trees, and when the kermes are gathered near the sea, they are larger and give a brighter colour than those in any other places.

There are several species of galls discovered on different trees, and plants of Spain, though they only make use of those gathered on oaks, either for dying, or any other purposes; such are those, from the Levant
called

called Aleppo galls, which were generally made use of, till it was discovered by frequent experiments, that the new ingredient called dividivi was preferable, being a fruit from the province of Carracas, and Maracaybo, in South America.

The great mystery which hitherto had not been discovered, by those naturalists who knew how to distinguish the gall insect, from the galls, was to investigate their mode of propagation: Mr. de Reaumur assures us, that from frequent observations it appeared to him, that there are both male and female, but that some which are extremely small, transform themselves into gnats, while others, growing larger, deposit their eggs, without any transformation; from which, and their analogy with the others, he concluded, that the small gnats with wings, though large in comparison with their body, and striped with a beautiful crimson, were the males of the gall insect, which he observed with the help of a microscope, seeing how they fecundate the females, before they assume a globular form towards March; but this happens when it is scarcely ever noticed, and in so singular a manner, that a common observer would never imagine such an event to have happened, or, even suppose, that the males which he saw frisking about, had the least connection with the females; but on the contrary, were small gnats which accidentally light upon the same

boughs ; if to this observation we add, that as the new kermes which come forth in June, remain small without engaging our attention till March ensuing, when they begin to swell without any appearance of animal life, it will not be thought so extraordinary, that they have been generally held as a vegetable production. In Languedoc, and Provence, the poor are employed to gather the kermes, the women letting their nails grow for that purpose, in order to pick them off with greater facility.

The custom of lopping off the boughs is very injudicious, as by this means they destroy the next year's harvest. Some women will gather two or three pounds a day, the great point being to know the places where they are most likely to be found in any quantity, and to gather them early with the morning dew, as the leaves are more pliable and tender at that time, than after they have been dried and parched by the rays of the sun: strong dews will occasionally make them fall from the trees sooner than usual: when the proper season passes, they fall off of themselves, and become food for birds, particularly doves. Sometimes there will be a second production, which is commonly of a less size with a fainter tinge. The first is generally found adhering to the bark, as well as on the branches and stalks; the second is principally on the leaves, as the worms choose
that

that part where the nutritious juice preserves itself the longest, is most abundant, and can be most easily devoured in the short time that remains of their existence, the bark being then drier and harder than the leaves.

Those who buy the kermes to send to foreign parts, spread it on linnen, taking care to sprinkle it with vinegar, to kill the worms that are within, which produces a red dust which in Spain is separated from the husk. Then they let it dry, passing it through a searce, and make it up into bags. In the middle of each its proportion of red dust put in a little leather bag also belongs to the buyer, and then it is ready for exportation, being always in demand on the African coast.

The people of Hinojos, Bonares, Villalba, and other parts of the kingdom of Seville, dry it on mats in the sun, stirring it about, and separating the red dust, which is the finest part, and being mixed with vinegar, goes by the name of *Pastel*. The same is done with the husks; but these have but half the value of the dust.

There is no doubt, but if this branch of industry was more closely attended to, there is yet room for improvement, and the kermes would give a brighter colour, similar to that obtained from the cochineal, likewise an insect found in the Mexican woods on a plant called nopal

by

by the Americans, and *tuna* by the Spaniards; being the *opuntia maxima folio obtuso rotundo* of Sir Hans Sloane, and the *cactus opuntia* of Linneus.

It is remarked that those plants which are cultivated by art, give a much finer cochineal, known by the name of *mestica*, so called from the quantities collected of it in the district of Meteca, in the province of Honduras (a).

But neither the cochineal, the kermes, or any similar production, would afford that beautiful colour, were it not for the salts employed in the lye by the dyers, to bring it to perfection. Mr. Maquer in his art of dying silks, assures us, that the white tartar employed for crimson colours, gives by means of its acidity, that brilliancy to cochineal, and that though other acids might produce the same effect, it would not be with so much success. Mr. Goguet, in his "origin of laws, arts and sciences," tells us, the ancients used a great deal of salt, to make their dyes solid, and permanent, supplying the place of our chemical preparations by other secrets unknown to us. Plutarch, in the life of Alexander the Great, mentions, that conqueror having found in the treasures of the king of Persia, a prodigious quantity of purple stuffs, which though they had lain by above one hundred and

(a) See second memoir of Mr. de Reaumur, tom 4.

ninety years, still preserved their lustre, because they had been prepared with honey; behold, says Mr. Goquet, a secret unknown to us! but if we reflect for a moment, that honey is a vegetable salt, like sugar, we shall find it to be the same as tartar, which is no more than an essential salt of wine; so that the salts employed by the ancients, were equivalent to those used at present in the dye-house. Probably the salts of fruits have the same effect in the manner they are used in Persia for dying of silk, where, instead of tartar and honey, they use the pulp of red melons, well dried, mixed with allum, barilla, and other salts.

The kermes of Spain is preferred on the coast of Barbary, on account of its goodness. The people of Tunis mix it with that of Tetuan, for dying those scarlet caps so much used in the Levant. The Tunifians export every year above one hundred and fifty thousand dozen of these caps, which yields to the Dey a revenue of one hundred and fifty thousand hard dollars, (£33.750--) per annum for duties; so that, exclusive of the uses and advantages of kermes in medicine, it appears to be a very valuable branch of commerce in Spain, and there is still sufficient encouragement to use every effort for its improvement.

LETTER

L E T T E R IV.

The method of making Saltpetre in Spain.

IN the year 1754, I received orders (*a*) from the ministry to inspect into several saltpetre works, as well as into the making of gunpowder, which having complied with, the following reflections occurred to my mind.

All the professors of chemistry I had conversed with, either in France or in Germany, laid down as a fixed principle, that there are three mineral acids in nature : that the vitriolic, is the universal one, belonging to metals, from whence the other two arise. That the nitrous is second in activity, and belongs to the vegetable kingdom, and the marine being the weakest of all, is homogeneous to fish. They do not include the animal acid, which united with the phlogiston (*b*), forms the phosphorus. I was further taught, that the fixed alkali of salt-

(*a*) Don Guillermo Bowles.

(*b*) By phlogiston, chemists mean the most pure and simple inflammable principle, concerning which there are a great variety of opinions and doctrines, supported on the one hand, and controverted on the other with equal ingenuity, by chemical writers.

petre,

petre, did not exist purely, and simply in nature, but was generated by fire, and when they found saltpetre, to be dug out of the earth naturally in the East Indies, they thought to save the difficulty, by saying it proceeded from the incineration of woods, which had impregnated the earth, with this fixed alkali, the basis of saltpetre; so that I had been led to believe, it was formed by certain combinations, that took place in the act of combustion; but I soon found my error, when I had had seen the method of making saltpetre in the different provinces of Spain. I have now evident proofs that the basis of nitre really exists in the earth and in plants, the same as in the *Soda* of Alicant. Let these learned gentlemen come to Spain, they may convince themselves of this truth, and see saltpetre with its alkaline basis, in the manufactures of Castile, Aragon, Navarre, Valencia, Murcia, and Andalusia, where it is made without the assistance of vegetable matter; sometimes throwing in a handful of ashes of matweed, merely to filter the lye of earth, and though they often meet with gypseous stone in the neighbourhood of their works, yet they make excellent saltpetre by boiling the lixivium of their lands only, in which they do not find an atom of gypsum; consequently they have gunpowder in Spain, without being indebted for its fixed alkali, to the vegetable kingdom, and without the visible or sensible conversion of the vitriolic acid of gypsum into the nitrous.



Having thus discovered in Spain a perfect fixed alkali in the earth, I pursued my observations on other salts, and vegetable productions, and after many reflections and experiments, I discovered that similar fixed alkalies, many oils, and neutral salts, proceed from different combinations of the air, earth, and water, with such matters as the air conveys in a dissolved state, and that these three elements, rising, falling, and meeting, combine together, and form new bodies in the organs of vegetation.

Those who are versed in physics, agree, that all the substances of the very globe we inhabit, consist of the combinations of fire, water, earth, and air; why then deny them the power of combining, in the living organs of plants? when we so often perceive in them, the faculty of changing, and transforming productions in the kingdom of nature. In proof of it, we find that many cruciformed plants give by analysis, the same volatile alkali as animals, notwithstanding that their tubes are similar to the eye, with those that give acids.

Some plants have their roots so small, and yet their branches, leaves and fruit so ponderous, that it appears impossible, so inconsiderable a root should draw sufficient nurture out of the earth for such various purposes. It seems therefore, that the ambient air, containing many dissolved

dissolved bodies, penetrates into the plants, and combines in the vegetative tubes, forming those substances discovered by analyfation.

I have frequently seen water melons in Spain weigh from twenty to thirty pounds, with a stem of only two or three ounces, so great was the increase of the fibrous and tubulous substance of those plants, owing to the watery particles they imbibed from the air. It should seem then, that many plants draw their principal support from the air, water, and a small portion of earth, combined by the imperceptible labour of the vegetative tubes, and vessels of air, which convert those matters into the products we contemplate, and taste; many plants producing all these effects in water only, and we find that mint, and other odoriferous plants whose roots grow in water, and in the air, give the same spiritus rector, and oils, as those that grow in the earth.

Botanists know very well that those aquatic plants that spring up from the bottom of waters have with a very trifling deviation, the same properties and qualities in the frozen regions, as in sultry and parching climates, and, that their acrimony, causticity, insipidity, and coolness, are invariable.

The experiments made by Van Helmont on the willow tree, making it grow in water, and a small portion of dried

earth, shew how much air, and water, added to the internal labour of plants, contribute to vegetation.

In the memoirs of the French academy of sciences, we find experiments of a celebrated chemist, to prove the existence of three neutral salts, in the extract of borragé. If he had gone further, and proved that one of these three salts, existed in the earth, which produced the borragé, he would have illustrated the system of physics, and cleared up the point I am speaking of. The same memoirs mention another academician, who reared an oak for many years, only with water, the consequences of which speak for themselves.

There are millions of firs about Valladolid, and Tortosa, replete with turpentine, and growing in a small portion of earth, and great quantity of sand, in which it would be difficult to prove that the thousandth part of the turpentine, so plentifully produced by these trees, had existed; of course, it must be owing to channels of air, connected with the tubes of vegetation.

The conductory vessels of the wormwood of Granada, convey a bitterness to the very juice of the sugar cane, which grows by its side: the soil of the king's botanic garden at Madrid, is of one equal kind, for all the different plants that are reared there, yet some produce a wholesome fruit, while others near them, are poisonous; and

and one, with fixed alkali, will thrive close to another, full of volatile alkali. (a).

The mountains and vallies of Spain, as well as the gardens, are full of aromatic plants, yet I do not know that any body has ever extracted by analyfis, any aromatic water, or volatile oil, from any uncultivated land.

The variation of foil, or culture, may alter the form of plants, change the lustre of their drapery, or give additional flavour to their fruit, but it can never change their effence, and nature. In proof of this, it is known, there is only one indigenous tulip in Europe, (I found it in flower near Almaden,) it is small, yellow, and ugly, appearing only in the spring. Gardeners may invent modes of cultivation, try all the climates of Europe, they may produce larger tulips with brighter colours, but they all will be inodorous, and the little tulip of Spain, will give by analyfis, the very same product as the most superb of the east, whose beautiful garment in common with other gay flowers, is owing to the phlogiston in the organs of vegetation, and not to iron as

(a) Just as Shakespear has emphatically said :

The strawberry grows underneath the nettle,

And wholesome berries, thrive and ripen best

Neighbour'd by fruits of baser quality.

Hen. 5th.

has

has been thought. This phlogiston is manifest by analysis in the leaves, where the least atom of iron has never been discovered.

There are many lands in Spain which naturally produce salt-petre, sea-salt, and vitriolic salts; but the plants which grow spontaneously in those soils, give by analysis the same product as those of their species in gardens, where there never was any appearance of salt-petre, sea-salt, or vitriolic acid.

Analyze as often as you please, those plants so numerous near iron mines, whose roots penetrate into the very ore, or those that grow in ferruginous and superficial earth. I am sure you will not collect from their roots, branches, ashes, extracts, or oils, more iron, than what is found in the same species of plants that spring up in places without the least communication with any such minerals.

Whatever efficacy there may be in culture, and manure, to remove, absorb, and open the pores of the earth, enriching the watery particles, that rise in the vegetative tubes, conveying new substances which contribute to that perfection, we observe, from the soil, and which they lose when transplanted, yet they still attain

tain various substances of vegetation from the air, which chemists may look for in vain in the earth (*a*).

Many plants are emollient in the spring and summer, and astringent in autumn and winter. Their mucilaginous quality admits of alteration in the tubes, and the combination of earth, air, and water, engenders a vitriolic acid (*b*), just as the alkali and the leaves receive colour from the phlogiston; from whence I conceive the reason of the nitrous soil in Spain, abounding with such a prodigious quantity of fixed natural alkali; which calls to my mind what is fondly advanced by the adepts, “That some lands have the natural properties of loadstone to attract peculiar substances from the air.”

It is certain then, that plants have proper tubes to attract the elements, and form a natural fixed alkali, and have peculiar separate principles which only combine by the means of fire in the act of combustion to form that artificial fixed alkali I had been taught to believe was the only one that existed in nature.

(*a*) The ingenious author of this reasoning does not seem to be aware, that it would be equally fruitless to look for these substances in the water, or in the air. It is true that we cannot extract turpentine from the sand, or from the earth, in which the fir trees of Vallidolid and Tortosa grow; but it is equally true, that we cannot extract it either from the air, or from the water of those countries.

(*b*) The existence of vitriolic acid in vegetables has not yet been proved.

Perhaps

Perhaps the soda and salicornia may thrive better when nurtured by salt water, but it is no less certain that the alkaline basis of common salt is found formed in these two plants, and in many others as well as in the barilla, which is sowed in many parts of Spain, where they make as good soap as that famous sort at Alicante made with soda and salicornia. With respect to neutral salts, there are at least five substances, in which they are found, viz. earth, plants, salt water, mineral, and artificial substances.

After this digression, let us now see how saltpetre is generally made in France and in Spain, I say nothing of England or Holland, because they make none, importing what they want from the East Indies, where it is found naturally in the earth, as in Spain, where I have seen saltpetre made with the lixivium of nitrous earth, collected in places where perhaps there never was a tree nor a plant.

In Paris they have seventeen saltpetre works: every thing that is carried on there, as well as in other parts of the kingdom, is done according to royal ordinances, in the manner I am going to relate: The rubbish and filth of old houses is carried to the works, and pounded with hammers; the dust is then put into casks, perforated at bottom, the aperture covered with straw, to
give

give a free passage to the liquor. Water is then poured on this dust, which in its passage carries away all the saline matter. This impregnated matter is called a lye, which if they were at that period to boil, would produce saltpetre of a greasy nature; to remedy this, they purchase the ashes of all the wood fires in Paris, from which they also draw a lye that is mixed with the former, then boil up the whole (a). In proportion as the water evaporates, the common salt which crystallizes when hot, soon falls to the bottom of the cauldron, and the saltpetre, which only crystallizes when cool, remains dissolved in the water. They draw off this water, loaded with saltpetre, into other vessels, and place it in the shade, where the nitre crystallizes. This is called saltpetre of the first boiling, having still some remains of common salt, earth, and greasy matter, incorporated with it; it is conveyed to the arsenal to be properly refined, being boiled over again, and left to crystallize two or three times, or more if found necessary; by which means it is cleared of all its impurities, and becomes perfectly adapted to the making of gunpowder and the other uses to which it is applied in the arts; but for medical purposes, it must undergo another purification. Those who

(a) The salt seems to be this; the salt they obtain from the lye of the rubbish, is a nitre with an earthy basis, the fixed vegetable alkali procured from the wood ashes is then added; this alkali precipitates the earth from the nitrous acid, and taking its place, forms true saltpetre.

are curious of being more exactly informed, may find a very accurate account of these works in the memoirs of the academy of sciences by Mr. Petit, to which I refer them.

In Spain, where a third part of all the lands, and the very dust on the roads in the eastern and southern parts of the kingdom, contain natural saltpetre, I have seen them prepare it in the following manner.

They plough the ground two or three times in winter, and spring, near the villages. In August they pile it up in heaps of twenty and thirty feet high: then fill with this earth a range of vessels, of a conic shape, perforated at bottom, observing to cover the aperture with matweed and a few ashes, two or three fingers deep, that the water may just filter through. They then pour on the water, (sometimes without putting any ashes); the lye that results from this operation is put into a boiler. The common salt, which as we said before precipitates, and crystalizes when warm, falls to the bottom of the cauldron in a proportion of 40 lb. to a quintal of materials (a); then the liquor is poured into buckets placed in the shade, where it shoots, and crystalizes into salt-

(a) The Spanish quintal is 100 lb. weight, and about 97 lb. English. The arroba of Madrid is 25 lb. Spanish, and four arrobas make one quintal.

petre. The great quantity of common salt which accompanies the nitre, makes me think, that the marine acid with its basis, is converted into nitre. The same earth, deprived of its nitrous quality by this process, is again carried back to the fields, and exposed to the elements, by which means in the course of a twelvemonth, assisted by the all-powerful and invisible hand of nature, it again becomes impregnated with a fresh supply of nitre, and what is still more surprising, and cannot be observed without admiring the wonderful works of the omnipotent creator, the same lands have produced time immemorial an equal quantity of saltpetre; so that if the supreme power was to annihilate all the factitious saltpetre of France, and Germany, Spain alone could supply the rest of the world, without the aid of a fixed alkali, ashes or vegetables, if public œconomy joined hands with industry, and assisted in bringing these great points to perfection. I once asked one of these people the reason of that constant production of saltpetre, but his only answer was, “I have two fields, I sow one with corn, and have a crop, I plough the other, and it furnishes me saltpetre.”

This saltpetre thus crystalized is similar to that of Paris of the first boiling. In Spain they only boil it once more, and it becomes perfect, and proper for making of gun-powder, aqua fortis, and other purposes of the

shops. Its basis placed in a cellar, attracts the dampness of the air, loses its activity, and forms a fixed alkali, which mixed with the vitriolic acid, forms a vitriolated tartar, a certain proof that the nitrous air of Spain is natural and perfect in itself, without the assistance of any fixed alkali whatever^(a.)

I shall not dwell upon the proportion of saltpetre, sulphur, and coal, used in the making of gunpowder; as it depends upon experience, and is generally known. I was present at the proofs made by the king's officers in Granada, to ascertain whether the powder had the qualities required, in order to be admitted or refused, but I do not think those proofs were to the purpose, as new made powder perhaps may throw a ball to the distance required; yet to form a true judgment of its real quality and goodness, it should be tried in different places and climates, and at various seasons of the year; for I am convinced that the gunpowder which would come up to the strength required by the king in the dry and warm climate of Andalusia, would be found deficient in the damp and moist air of Galicia, which shews how little.

(a) However incredible this account of Mr. Bowles may appear to an English chemist, it would be rather rash to deny the truth of it, particularly as he observes that the basis of the nitre thus produced is a fixed alkali, and united with the vitriolic acid, forms vitriolated tartar. But if there is no deception in the case, the spontaneous production of the vegetable fixed alkali in a place where no vegetables grow, is a fact altogether new, and worthy of a further examination.

such experiments are to be depended upon. Of all the inventions I know of for this purpose, the least imperfect is that of Mr. Darcy, a design of which may be seen in the first volume of Mr. Beaume's treatise on chemistry.

When the Count de Aranda was director of the engineers, I remember an old officer of artillery informed me that in the last wars in Italy, he had seen barrels of gunpowder, that were good in the morning, and bad the next night: This did not surprize me, knowing the variations of weather, and the effects of dampness piercing through the casks and damaging the powder, so as to render it unfit for service, for which reason every precaution should be taken to guard against these inconveniences (*a*).

(*a*) This is the substance of Mr. Bowles's discourse. Some observations of his relating to the qualities of salts are omitted, as those subjects are treated of with greater exactness by modern chemists, to which the reader is referred.

It is likewise unnecessary to expatiate upon, or point out the properest methods of preserving gunpowder, so well known in this country, and with respect to the force of fired gunpowder, a late publication gives us the most curious and ample information, viz. "The force of fired gunpowder and the initial velocity of cannon ball, determined by experiments, from which is also deduced the relation of the initial velocity, to the weight of the shot and quantity of powder. By Charles Hutton, master of the military academy of Woolwich, which gained the prize medal of the Royal Society." Phil. transact. for 1778, vol. lxxviii.

L E T T E R V.

Of the Merino Sheep.

THE wools of Spain form a considerable branch of our commerce with that country. It has even been said that their fine quality was originally owing to a few English sheep sent into Spain, as a present by our Henry the second, or according to others, by Edward the fourth, in 1465, but without entering into fruitless investigations of an event so remote, and of so little consequence, I shall confine myself to speak of those remarkable sheep known in Spain by the name of *Ganado Merino*, “The Merino flocks,” and describe the constant method of conducting those numerous tribes from the northern to the southern provinces, to which they attribute that peculiar fine quality of the wool, which has rendered it so famous all over Europe (a.)

(a) Though this account of Spanish sheep appeared in the gentleman’s magazine for 1764, and in other publications, yet as I am informed it came originally from Mr. Bowles, I have again inserted the substance of his discourse, in justice to its original author, with some further illustrations relating to the wool of Spain, not mentioned by that writer.

There are two sorts of sheep in Spain, some that have coarse wool, and are never removed out of the province to which they belong, and others, that after spending the summer in the northern mountains, descend in the winter to the milder provinces of Estremadura, and Andalusia, and are distributed into districts, which go by the name of *Merindades*. These are the Merino sheep, of which it is computed there are between four and five million in the kingdom (a). The word Merino, signifies a governor of a province. The Merino mayor is always a person of rank and appointed by the king. They have a separate jurisdiction over the flocks in Estremadura,

	Sheep.
(a) The duke of Infantado's flock about - - - - -	40.000
Countess Campo de Alense Negretti - - - - -	30.000
Paular, and Escorial convents, 30.000 each - - - - -	60.000
Convent of Guadalupe - - - - -	30.000
Marquis Perales - - - - -	30.000
Duke of Bejar - - - - -	30.000
Several flocks of about 20.000 each - - - - -	200.000
All the other flocks in the kingdom together, on an average about	3.800.000
	4.220.000

In 1778, the wool of Infantado was 9285 arrobes in the grease, and Negretti nearly the same. Washed wool coarse and fine together, worth at an average, eight and a half rials vellon per lb. (about 2s) exclusive of duties which are 20 per cent. on exportation.

There is a curious discourse on the wools of Spain in the second volume of the Spanish correspondence of lord Sandwich, lord Sunderland, and sir William Godolphin, in a book entitled, *Hispania illustrata*. London, 1702.

which

which is called The *Mesta*, and there the king in person is Merino mayor (a).

Each flock consists generally of ten thousand sheep, with a *Mayoral* or head shepherd, who must be an active man well versed in the nature of pasture, as well as the diseases incident to his flock. This person has under him fifty inferior shepherds, and as many dogs, five of each to a tribe. The principal shepherd has a hundred pistoles (about £75.) and a horse every year. The other servants have 150 rials for the first class (£1. 13s. 9d.) 100 rials for the second class (£1. 2s. 6d.) 60 rials for the third class (13s. 6d.) and 40 rials, or nine shillings for the other attendants. Each of these has an allowance of two pounds of bread a day, with the same quantity of an inferior sort for the dogs. They are likewise permitted to keep goats, and a few sheep, of which they have the meat, and the lambs, provided the wool remains for the master. They may do what they please with the milk, of which they seldom make any advantage. In the months of April and October, each shepherd has 12 rials given him (about 2s. 9d.) as a perquisite previous to his journey.

Though these flocks divide and separate themselves over several provinces of Spain, it will be unnecessary to

(a) There is a supreme council at Madrid called *Consejo de Mesta* which takes cognizance of all matters relating to sheep, wool, shepherds, pastures, woods, and all concerns that belong to royal seats and parks.

relate what passes in each, their government being similar and uniform. The places where they are to be seen in the greatest numbers are in the Montana and Molina de Aragon in the summer, and in the province of Estremadura in the winter. Molina is to the eastward of Estremadura, the Montana is to the north, and the most elevated part of Spain; Estremadura abounds with aromatic plants, but the Montana is entirely without them.

The first care of the shepherd in coming to the spot where they are to spend the summer, is to give to the ewes as much salt as they will eat; for this purpose they are provided with 25 quintals of salt for every thousand head, which is consumed in less than five months; but they eat none on their journey, or in winter. The method of giving it to them is as follows. The shepherd places fifty or sixty flat stones about five steps distance from each other; he strews salt upon each stone, then leads his flock slowly through the stones, and every sheep eats at pleasure. This is frequently repeated, observing not to let them feed on those days in any spot where there is lime-stone. When they have eaten the salt, they are led to some argillaceous spots, where from the craving they have acquired, they devour every thing they meet with, and return again to the salt with redoubled ardour (*a*).

(*a*) Mr. Bowles observes, that if the district is limy or marly, the sheep eat less salt in proportion to the lime they find, and asking the reason of one of the shepherds, was told, it pro-

At the end of July each shepherd distributes the rams amongst the ewes, five or six rams being sufficient for an hundred ewes. These are taken out of flocks where they are kept apart, and after a proper time are again separated from the ewes.

The rams give a greater quantity of wool, though not so fine as the ewes, for the fleeces of the rams will weigh twenty-five pounds, and it requires five fleeces of the ewes to give the like weight. The disproportion in their age is known by their teeth, those of the rams not falling before the eighth year, while the ewes, from their delicacy of frame or other causes, lose theirs after five years.

About the middle of September they are marked, which is done by rubbing their loins with ocre diluted in water; some say this earth incorporates with the grease of the wool, and forms a kind of varnish, which protects them from the inclemencies of the weather; others pretend that the pressure of the ocre keeps the

ceeded from their grazing in cornfields, on which occasion the illiterate shepherd seemed to relate the fact though ignorant of the cause, which was, according to Mr. Bowles, "from the salt all limy matter abounds with, and partaken of by cattle, either in licking the stones, or communicated by vegetation to grass; for which reason, their appetite is not so keen for any salt that is offered them:" however we cannot admit this to be the true cause, as chemists are now well assured that lime does not contain any salt whatever.

wool short, and prevents it from becoming of an ordinary quality; others again imagine, that the ocre acts in the nature of an absorbent, and sucks up the excess of transpiration, which would render the wool ordinary and coarse.

Towards the end of September these Merino flocks begin their march to a warmer climate; the whole of their route has been regulated by the laws and customs, time immemorial. They have a free passage through pastures, and commons belonging to villages, but as they must go over such cultivated lands as lie in their way, the inhabitants are obliged to leave them an opening ninety paces wide, through which these flocks are obliged to pass rapidly, going sometimes six or seven leagues a day, in order to reach open spots less inconvenient, where they may find good pasture, and enjoy some repose. In such open places they seldom exceed two leagues a day, following the shepherd and grazing as they move on. Their whole journey from the Montana, to the interior parts of Estremadura may be about one hundred and fifty leagues, which they perform in about forty days.

The first care of the shepherd is to lead them to the same pasture where they have been the winter before, and where the greatest part of them were reared; this is no difficult task, for if they were not led there, they will

discover the ground, by the great sensibility of their olfactory organs, to be different from that which is contiguous; or were the shepherds so inclined, they would find it no easy matter to make them go further. The next business is to order the folds, which are made by fixing stakes, fastened with ropes one to the other, to prevent their escape, and being devoured by the wolves, for which purpose the dogs are stationed without. The shepherds build themselves huts with stakes and boughs, for the raising of which as well as for fuel, they are allowed to lop off a branch from every tree. This law is the cause of so many trees being rotten and hollow, which grow in those places frequented by these flocks.

A little before the ewes arrive at their winter quarters, it is the time of their eaning, at which period the shepherds must be particularly careful. The barren ones are separated from the others, and placed in a less advantageous spot, reserving the best pasture for those that are fruitful, removing them in proportion to their forwardness: the last lambs are put into the richest pasture, that they may improve the sooner, and acquire sufficient strength to perform the journey, along with the early ones.

In March the shepherds have four different operations to perform with the lambs, that were eaned in the winter; the first is to cut off their tails, five fingers below
the

the rump for cleanliness; the second is to mark them on the nose with a hot iron; next they saw off the tips of their horns, that they may not hurt one another in their frolicks; finally they castrate such lambs as are doomed for bell-wethers, to walk at the head of the tribe; which is not done by any incision, but merely by squeezing the scrotum with the hand, till the spermatic vessels are twisted like a rope, and decay without further danger.

In April the time comes for their return to the Montana, which the flock expresses with great eagerness, by various movements and restlessness, for which reason the shepherds must be very watchful, lest they make their escape, which often happens when proper care is not taken, and whole flocks have sometimes strayed two or three leagues while the shepherd was asleep, as on these occasions they generally take the straightest road to the place which they came from.

The first of May they begin to shear, unless the weather is unfavourable; for the fleeces being piled one above the other, would ferment in case of dampness, and rot; to avoid which, the sheep are kept in covered places to shear them more conveniently; for this purpose they have buildings that will hold twenty thousand at a time, which is the more necessary, as the ewes are so delicate, that

that if immediately after shearing they were exposed to the chilling air of the night, they would certainly perish.

One hundred and fifty men are employed to shear each thousand sheep. Each person is reckoned to shear eight sheep a day, but if rams, only five, not merely on account of their bulk, and greater quantity of wool, but from their fickleness of temper, and difficulty to keep them quiet, the ram being so exasperated, that he is ready to strangle himself, when he finds he is tied; to avoid which, they endeavour by fair means and careffes to keep him in temper, and with much soothing, and having ewes near him, they at last engage him to stand quiet, and voluntarily suffer them to proceed.

On the shearing day the ewes are shut up in a large court, and from thence conducted into a sudatory, which is a narrow place, where they are kept as close as possible, that they may perspire freely, in order to soften the wool, and make it yield with more ease to the shears. This is particularly useful with respect to the rams, whose wool is more stubborn. The fleece is divided into three sorts; the back, and belly, give the superfine, the neck and sides give the fine, and the breasts, shoulders and thighs, give the coarse wool.

The sheep are then brought into another place and marked, examining those without teeth, which are defined

tined for the slaughter-house ; the healthy are led to graze, if the weather permits, if not, they are kept within doors, till by degrees they are accustomed to the air. When they are permitted to graze without being hurried, they select and prefer the finest grass, never touching the aromatic plants, though they find them in plenty, and if the wild thyme is entangled with the grass they separate it with great dexterity, avoiding it on every occasion, moving eagerly to such spots as they can find that are without it.

When the shepherd thinks there is a likelihood of rain, he makes proper signals to the dogs to collect the flock, and leads them towards shelter ; on these occasions the sheep not having time to chuse their pasture, pick up every thing they meet, thyme, rosemary, and every herb indiscriminately, even poisonous ones ; such as henbane, poppy, and hemlock, particularly soon after they are sheared. Were they to take a fancy and give a preference to aromatic plants, it would be a great misfortune to the owners of beehives, as they would destroy the food of the bees, and occasion a disappointment in the honey and wax. They are never suffered to move out of their folds till the beams of the sun have exhaled the night dews, nor do they let them drink out of brooks, or standing waters, where hail has fallen, experience having taught them, that on such occasions they

they are in danger of losing them all. The wool of Andalusia is coarse, because their sheep never change climate like the Merino flocks, whose wool would likewise degenerate, if they were kept at home; and that of Andalusia would improve, were they accustomed to emigrate.

Between fifty and sixty thousand bags of washed wool are annually exported out of Spain. A bag generally weighs eight arrobes or 194 pounds English. About twenty thousand bags of this wool are sent annually to London and Bristol worth from £30. to £35. each; so that we have one third of the produce, and of the best sort. The wool of Poular, which is the largest, though not the best, is reserved for the king of Spain's manufactures. The common and shooting dresses of the royal family of Spain and their attendants, are made of the cloth of Segovia, from whence our English nobility, in Henry the VIIth's time were supplied with fine cloth (a).

The crown of Spain receives annually, by all duties together on exported wool, near sixty millions of reals vellon per annum. (£675,000.)

(a) Breadth of Spanish cloth made at Segovia $1\frac{3}{4}$ ths vara, or $57\frac{3}{4}$ ths inches English.

L E T T E R VI.

Inconveniencies arising from the emigrations of the Merino sheep, and the partial laws of the Mesta.

YOU desire my opinion (a) concerning the Mesta, but I have nothing to add to what I have frequently mentioned to you, on a subject not easily reduced into the compass of a letter; however I shall once more lay before you those observations that have engaged me to entertain the notions I have formed to myself concerning the Mesta.

This appellation has corruptly crept into our language, and been applied to sheep, when in reality it had no other signification, than a mixture of grain, and seed, such as barley, beans, oats, lentils, &c. nor was any such name as the Mesta flocks known in Spain before the days of king Alfonso El Ultimo, when English sheep were first

(a) This letter was written by the late ingenious Padre Sarmiento, to Don Antonio Ponz, and is dated Madrid, 12th Sept. 1765, and published by Ponz, in his eighth volume of Viage de Espana, Madrid, 1778. It shews how far the spirit of improvement has extended, and reached even within the gloomy walls of convents, and as it gives a lively idea of the spirit of the times, I thought it would perhaps be more acceptable to preserve it in its original form.

brought into Spain in the Spanish caracks. It was then that the office of judge of the Mesta had its rise according to the Bachelor Fernan Gomez de Ciudad Real, in his 73d epistle. The aforesaid king Alfonso introduced these foreign valuable sheep called Marinas, and not Merinas, according to the vulgar opinion; in the same manner as his present majesty, Charles the third, has lately introduced at the Casa del Campo^(a), some goats from Angora, so valued for their hair of a fine white, almost like silk, the breed of which might easily be propagated, as the district they come from, is in a parallel latitude with Spain.

A few years after this event relating to the English sheep, our kingdom was desolated by an universal pestilence, which in 1348 ruined Spain and part of Asia; and in 1350 carried off king Alfonso. The dominions of Spain suffered infinitely on this dismal occasion, inasmuch that since the universal deluge, there is no instance of an equal calamity, for it wasted the country, and swept away two-thirds of the inhabitants. Spain became depopulated, and husbandry seemed to be lost. The many rural churches in the centre of the kingdom, are proofs of this terrible havock, that ruined whole villages, of which *Etiam periire ruinae*. Thus four or five villages, perhaps of two hundred families, were destroyed, and

(a) A royal seat near Madrid.

the country changed into a swamp or a heath, open to any invader, and free to the first comer, who was willing to take possession. The whole territory was afterwards claimed by the adjacent more fortunate villages, from whence we may account for the present amazing jurisdiction of some villages, which includes a space of fourteen leagues in circumference; infomuch that in places where before this fatal event, there were three or four populous parishes, there is now only one lonely parish thinly inhabited by people in distress; others were totally destroyed, nothing remaining but the steeples which are called rural churches.

These churches, or at least these steeples, seem still to be crying out like Æacus in Ovid to Jove his fire, on a similar event, "*Aut mihi redde meos, aut me quoque conde Sepulchro.*" The doleful condition of these miserable wretches will strictly bear the comparison. The pestilence it is true lasted only a few years, but their misery has continued above four centuries.

It is to this calamitous time we must attribute the origin of the Mesta. The English sheep were first brought into the mountains of Segovia, without the least ideas of the Mesta or of Estremadura. It was the great space of uncultivated land and the want of husbandmen that encouraged both shepherds and cattle to stray beyond their

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boundaries,

boundaries, and to wander into districts where no impediments occurred to their progress, making a casual use of the lands without the least thought of proper cultivation, as that would require more hands than they were able to furnish; and on this occasion they first introduced that barbarous method of ploughing with mules, by which they only just scratched up the ground.

Thus what was so imperfectly tilled, and much more left entirely uncultivated, remained for the purpose of grazing for foreign cattle, to the great prejudice of agriculture. Estremadura is a province of Leon, and not of Castile; the natural remedy for these misfortunes was immediately perceived by the Portuguese, though the Castilians would not understand it, some being warped by their avarice, under a fond notion of having large tracts of land although barren, and others by the flattering idea of possessing numerous flocks, as if agriculture had been lost. The laws therefore that were made by Ferdinand King of Portugal deserve to be written in letters of gold, one of which was; "That no person who was not an husbandman or his servant, should keep sheep either for himself, or for others; and if any other persons were desirous of having them, they must oblige themselves to cultivate a certain portion of land, under the penalty of losing their cattle if the regulation was not exactly complied with." By this singular and
most

most excellent law, many defects of the Mesta could be remedied, both in respect to the sheep, and the shepherds, who without cultivating a foot of land usurped so considerable a district, in a manner so prejudicial, to the industry of the farmer.

It is shameful to observe in Spain, a continuation of the barbarous customs of the Saracens, who totally neglectful of agriculture, wander with their cattle over the depopulated plains of Arabia and Lybia. When the industrious Moors possessed Estremadura, they turned the whole province into a garden, replete with inhabitants, as appears by the numerous armies they brought into the field against the Christians. They did not send their flocks to Castile, nor the Spaniards come with theirs into Estremadura, for the Mesta was unknown.

This expression therefore is not circumscribed to the sole mixture, or variety of cultivation, but comprehends grazing, united with farming, since the practice of both properly combined, constitutes the true farmer, who without some cattle, will ever be poor. The method observed by the Romans, in allotting a certain number of head of cattle of the larger and smaller sort, in proportion to a given quantity of land, evinces the propriety of similar laws in Portugal, as well as the indispensable connection of these branches of rural œconomy.

Some

Some perhaps will not believe, that the depopulation of Spain proceeds from the Mesta, as there are waste provinces to be found where the Mesta is unknown. But I must answer them in general terms, that where there is no Mesta, every part is populous, as for instance, Galicia, Asturias, the Montana, and Biscay; to which may be added, Navarre, Catalonia, and Valencia. The Mesta not only depopulates Estremadura, but also the kingdoms of Leon, and Castile, where the sheep destroy the country in their passage, preventing the farmers from inclosing their lands, according to their natural rights, as well as the civil and national laws, which permit those inclosures where happily the Mesta does not prevail.

To return to the state of population. The Roman empire, according to Riciolus, was supposed to contain four hundred and ten millions of people. In the days of Tertullian not a foot of land was uncultivated. Solinus says of Spain, "*nihil otiosum, nihil sterile est.*" Estremadura contains two thousand square leagues of land. The most moderate calculation admits of a thousand persons to each square league; then Estremadura would admit of two millions of inhabitants, which allowing four persons to a family, would make five hundred thousand families; but Ustariz (*a*) only allows to Estremadura sixty

(*a*) *Theoria y practica de commercio y marina*, por Don Geronimo de Ustariz, Madrid, 1742. This curious book has been translated into English. See Ustariz's theory and practice of commerce, by Kippax. London, 1751.

thousand families; and the number is now thought to be less. Consider then the disproportion, and what prejudice the country receives from the Mesta. Galicia, where there is no Mesta, and only sixteen hundred square leagues, has above a million of inhabitants. So much concerning population, the life of a state, when idleness is banished, and industry encouraged. With respect to cattle, Galicia has more than Estremadura. Ustariz says that about four millions of sheep go into Estremadura: In Galicia they have not flocks of thirty and forty thousand head, possessed by one person contributing nothing towards agriculture; he that has forty or fifty sheep is a Cræsus, but the poorest of farmers have at least five and twenty head of different kinds. Few reflect, that in a state, a great many small portions are of much more consequence than a few large divisions, though consisting of infinite numbers.

Other advocates for the Mesta extol the value of the wool, and tell us it is an active commerce, but Ustariz shews, that foreigners only pay us at par, for the wool in the fleece, and have a profit of four to one in vending their manufactures. The way to form an active commerce of our wool, and our silk, of which we have such plenty, would be to work it ourselves, and prohibit all foreign importations.

The culture of silk is of no prejudice to agriculture like the Mesta; a manufacture of silk would be of more advantage to Estremadura, than all the flocks of the Mesta together. Ustariz computes the Mesta to employ forty thousand people, destined by nature for agriculture; therefore, as each person could till land enough to produce 50 fanegas of corn^(a), would they not be better employed in raising two millions of fanegas of corn, either at home or in Estremadura, than in leading such a wandering life in idleness and poverty? In Galicia they are not burthened with such swarms of vagabond strollers with their dogs, nor are they pestered with wolves; one little girl while she is spinning can overlook the domestic œconomy, and have an eye to the whole flock of the family, when the plains of Estremadura are ravaged, and laid waste by the locust. Ask these partisans of the Mesta, whether their sheep ever go into battle, or render any public service to their country? I know you have read the memorial of complaints made by the province of Estremadura against the Mesta; though they still suffer this inconvenience in the interior parts of the kingdom, they ought to be more cautious on the frontiers towards Portugal, to prevent bad

(a) Fanega is a corn measure in Spain, five of which make an English quarter of eight bushels.

consequences

consequences in case of a sudden invasion. I should be glad to know how many head of cattle are maintained in Madrid, for I know their provision is not brought from the mountains, or pastures, but from cultivated plains. Finally, I shall always be of opinion that except some spots reserved for the royal chace, and the diversion of our sovereigns and their illustrious line, all the rest should be cultivated, as in the days of Tertulian, that each farmer should inclose his lands, and that the same should be allotted to them for tillage, in proportion to their abilities, allowing a certain number of cattle, corresponding to the extent of the farm. Then, for the greater advancement of agriculture, the cultivators of land should form a body politic, with power to enact wholesome laws, and regulations, for the encouragement and benefit of husbandry. The Mefta people did so and had a confirmation of their laws from Charles 5th, in 1544, but with this condition, of their not being prejudicial to a third person. Let Estremadura answer, whether this is the case? and let the farmers then give their opinions. But I must insist with Solinus, that in Spain, no part where there is a possibility of avoiding it, should remain *otiosum neque sterile* (a).

(a) Ever since the accession of the house of Bourbon to the throne of Spain, the extension of commerce, and the improvement of agriculture have been primary objects. The Real Junta de Comercio, or Board of Trade, was first erected by Philip the 5th, on the 15th of May, 1707. Many new regulations have been made for the benefit of commerce and agriculture,

L E T T E R VII.

Miscellaneous observations made at Madrid, with some account of the royal cabinet of Natural History.

THE town of Madrid is now become the capital of the monarchs of Spain, situated in the center of their dominions, and from one of the filthiest places imaginable, is at present on a par for cleanliness with fe-

since his present majesty's arrival from Naples at Madrid, which was on the 9th of December 1759. For the greater encouragement of agriculture, all the old laws relative to corn were repealed in 1765, and the embarrassments with which they were clogged, totally removed: new laws more favourable to industry, were enacted, and a spirit of freedom and liberty introduced in the commerce of grain, in order to give every encouragement to the farmer. To improve the minds of the people, Academies were erected in Madrid, Valladolid, Seville, Valencia, and Barcelona, besides many literary societies in different parts of the kingdom, particularly one at Madrid, with the noblest of titles "Los Amigos del pais," The Friends of their country, in which every subject is to be considered, tending to the advancement of arts, manufactures, and commerce; and the better to convey these ideas to the public, the art of printing has been particularly attended to, and brought to very great perfection: however as all these literary establishments are still in their infancy, time only will discover their intended effects. The new roads through the kingdom form a principal branch of modern improvement, and for the better completing the same, they have been again put under the direction of the general post office, by a royal decree of the 8th October, 1778, with new revenues assigned for the purpose; but with respect to the want of inns, and conveniencies for travellers, Don Antonio Ponz, in his last volume insists, that every thing that has, or can be said, on the subject, is still short of the truth. "La verdad es, que en quanto a la penuria que se padece en esta materia, qualquiera se quedara corto por mucho que diga." *Viage de Espana*, tom. 8. folio 212. Madrid 1778.

veral principal cities of Europe, being likewise well paved and lighted, but in respect to population, it is far inferior to London, Paris, or Naples. (a) Madrid is in a high situation, all the rivers and brooks in its neighbourhood fall into the Tagus, whose waters roll down to the ocean. The Guadarama mountains, to the north west of the town, are covered with snow several months of the year, which added to the piercing north

(a) The following table published at Madrid for the year 1778, will shew the present state of population in that town.

Parishes.	Marriages.	Births.	Deaths.
St. Mary	13	41	28
St. Martin	343	930	338
St. Gines	74	308	108
St. Lewis	107	239	79
St. Joseph	114	212	121
St. Nicholas	7	12	15
St. Saviour	9	11	15
St. John	2	17	15
Holy Cross	86	208	108
St. Peter	13	30	24
St. Andrew	108	341	109
St. Michael	18	87	50
St. Just	213	723	248
St. Sebastian	341	801	277
St. Iago	18	71	42
	<u>1466</u>	<u>4031</u>	<u>1577</u>

There died this year in the parishes and in the three hospitals 3483 persons, without reckoning infants, and those who died in communities, nunneries, and the other hospitals of the court; and there have been 4372 births, including the foundlings baptised in St. Gines.

This year 611 infants have been brought to the royal foundation of *La Inclusa* for foundlings, of which 341 have been baptised in the parish of St. Gines. *Kalendario manual, y Guia de forasteros en Madrid para el ano de 1778.*

winds, that reign in the winter, renders it excessively cold, while in summer the southern and westerly blasts are generally attended with dampness and rain. Travellers have told us, the air is so subtle that if a dead dog was thrown into the streets over night, he would not have a bit of flesh on his bones in the morning, but this is a fable, as it is a known fact, that dead dogs and cats lie in the streets continually, as well as dead mules, close to the road side, for days together, without any such effect.

Historians relate that King John 2d being in Madrid, in 1434, it began to rain and snow on the 29th of October, and never ceased till the 7th January following, insomuch that several houses were destroyed, and the inhabitants reduced to the greatest distress for want of provisions; a report having been spread that the King intended to alienate the town, the inhabitants petitioned the King not to desert them, which finally terminated in a royal edict of the 30th of May 1442, by which it was ordained that neither the town or its jurisdiction, could ever be alienated.

The principal streets of Madrid are paved with cut flint, the others with pebbles, found in the neighbourhood, the cut flint on account of its sharpness is very inconvenient to foot passengers, and the flat pavement near the houses is too narrow. The town is well supplied

plied with water, and there are conduits in the principal streets; that called del berro, in the neighbourhood of the town, is constantly drank by the royal family wherever they are. The bread is white and good, and when the barrenness of the country all round is considered, the *plaza mayor* or principal square, where the market is kept, is extremely well supplied with all manner of provisions.

Mr. Bowles has observed that if that celebrated professor Mr. Henckel, had come to Madrid, he would soon have been convinced of his error, in saying that “ flint was not to be found in strata and only in detached lumps, or in masses, for here he would find all the environs replete with strata of flint; and moreover not a house or a building, but what has been constructed with lime made from flint (*a*), which serves also for fire arms, as well as for the pavement. In some places pieces are

(*a*) It is allowed that nature by some process unknown to us, seems to change limestone into flint, but this change once made, we cannot by calcination or any other known means convert flint into lime: it is true that flint may be calcined, and then it loses its flinty appearance, becomes white and may by a superficial observer be mistaken for lime, but it will not unite with an acid, it will not dissolve in water, it will not make a cement; in short it does not possess any of the distinguishing properties of lime. There are in this island beds of limestone stratified with layers of flint, and it is probably the case with these hills near Madrid; so that they get flint and limestone from the same quarry.

I am indebted to an ingenious friend since my return to England for this observation, and as I had not an opportunity of ascertaining the point to satisfaction with respect to those places near Madrid, I have related the circumstance as stated by Mr. Bowles, with hopes that some future traveller in Spain may be inclined to examine that ground more minutely.

found of it full of a species of agate, streaked with red, blue, white, green, and black, that take a very good polish, but these colours are accidental, and disappear by calcination. No acid will dissolve it, or cause any effervescence; when calcined, it burns in the water with more violence than true limestone, and mixed with the pebble or coarse sand near Madrid, makes an excellent material for building, though it does not answer so well with the fine sand of the river. It is impossible to fuse this flint alone, or any other found in limy or argillaceous earths, no more than the different kinds of agates, cornelians and rock crystal, but they calcine by themselves; that is are turned into lime and fuse very well mixed with the fixed alkali of *Barilla*, or with lead, the easiest to fuse of all metals, and change into the English flint glass, which is by far the best hitherto known. Many naturalists, according to Mr. Bowles have followed this erroneous opinion respecting flint, and amongst the rest Mr. de Reaumur. Linneus in his *Systema Naturæ*, says, “*Silex nascitur in montium cretaceorum rimis, uti quarzum in rimis Saxorum,*” but we have only to open our eyes, to be fully convinced of the fallacy of this assertion, when we contemplate the numerous beds of flint near Madrid, and in different parts of Spain, and Italy, separated from all cretaceous matter. The abate Fortis, in his late travels into Dalmatia, found the flint there, quite different from the descriptions of former naturalists,

naturalists, and adds, "I have often seen the flint in the very act as I may say of passing from the calcareous state to the siliceous, and particularly I have often found flint enveloped in volcanic matter. I have formed a series of these progresses, which I have shewn to some of my friends (a)."

In the environs of Madrid there are above two hundred villages, but few can be seen on account of the inequality of the ground, the country being broken up by continual gullies, and various changes of aspect, occasioned by torrents, and other casual accidents, in a country little cultivated, and abandoned to every vicissitude of season. Near the town they chiefly sow barley, and here and there have some trifling vineyards. Their tillage is much the same as in Old Castile, that is, just to scratch up the earth and scatter the seed at random, then to cover it over with a similar indifference, and wait for the coming of the poor labourers from Galicia, to get in their harvest. The farmers pretend that if they were to make use of a stronger plough, they should have less corn. Mr. Bowles next reproaches the Spaniards for passing over in silence their countryman Don Joseph Lucadelo, a gentleman of Aragon, who had invented a curious plough much esteemed by foreign nations, who had taken the merit of the invention to

(a) Travels into Dalmatia by the abate Fortis, translated into English. London, 1778.

themselves,