

tendency of aluminous, or argillaceous soils, as they are more generally termed, (because argyl, which I shall soon particularize more fully, contains so much alumine) or clay soils, as they are commonly called, to imbibe and hold moisture, is well known to you.

Silex, in its pure state, is quartz or flint, but powdered, and combined as it is with the other ingredients of the soil, it is a sandy substance, and the soil of which it forms a part is more or less silicious according as it contains more or less of silex. It is found in larger quantities, and more generally in the soil, than the other elements, in which respects aluminous ranks next to it.

By the bounty of Providence Silex, which is indispensable to the support of all the grain crops, and grasses, more particularly, is in some measure a portion of every soil; yet, neither this nor any of the earths is fertile of itself alone, it must be always combined with others in order to sustain vegetable life in a state of health.

Lime is a most important ingredient, and is also found in almost every soil; the most fertile are those which contain it abundantly; it enters into the constitution of plants and into the organization of all animals which have skeletons, of whose frameworks it constitutes the bulk, in the form of bone-earth, called phosphate of lime.\*

In Ireland, lime abounds in the state of rock and gravel and also in that of marl, which is a combination of lime and argyl, more or less calcareous according as the lime or clay prevails in it.

In England, and in the northern counties of Ireland, lime is found in the form of gypsum (sulphate of lime),† and abundantly in many districts of Great Britain.

Some gypsum analysed in Germany, has been found to contain 33 parts in 100 of lime, the remaining parts being sulphuric acid and water of crystallization, like chalk, it may be burnt as limestone is calcined, but as calcination has not been found to alter its nature as a manure, it is useless to incur the trouble and expense of the operation. Gypsum is beneficial to clover, sainfoin, lucerne, and all grasses. It was found in the ashes of clover and rye grass by Sir H. Davy, who therefore concluded that it is an element necessary to their organization; but this appears to me unproved, because a plant may casually take up with its food matter with which it could dispense altogether, or do much better without. If the clovers and rye-grasses of Ireland, generally, and of most parts of Great Britain, absolutely required gypsum for their organization, how could there be

such fine crops of them as we constantly see in soils entirely destitute of it?

But the chalk soils of England, by their remarkable suitability to lucerne and sainfoin, and other plants of the same nature, prove that lime, in some form, is one of the chief elements of their food.

But lime, whether burnt, and mixed with the soil in a caustic state, or cold after having lost its caustic powers, or in the natural carbonate and mild state of marl or chalk, &c., must be reduced to a state of solution in the soil before it can be taken up by any plants.\*

Magnesia is less frequently met with than those other substances just noticed, and it is never found in its pure state, being always mixed with other earths, and combined with acids.

It is supposed by some writers to be prejudicial to vegetation, but this is very doubtful; as we find it blended with other substances by Him who makes nothing in vain, we may be sure that it has its uses, though we may not have distinguished them.

Of the four first earths, silex and alumine are the most marked in their qualities, and the most important.

There are also several mineral substances found in the soil, of which iron is the chief. United with alumine and silex, it forms argyl, and is the substance which chiefly gives the shades of colour to the soil, according as it is in the form of black or red rust, that is, according as it is oxidized in a low or high degree.

In large proportions it is injurious, but beneficial in the small quantities in which it is usually found. In the excess and highly oxidized state in which it is so commonly mixed with argillaceous clay beneath peat soil, which it tends to harden, (because water does not dissolve it in such state,) it is so injurious to plants as to poison the roots of trees when they enter into the soil which so largely contains it.

Sulphur is another important mineral ingredient, which is found in the cabbage tribe of plants, and in those which are distinguished by the term cruciferous.†

The last substance to be noticed is humus, (commonly called vegetable mould,) which though not properly an original earth, constitutes the richness of a soil. It is the earthy-looking fixed product of decayed vegetable and animal matter, and is most rich when it is chiefly composed of the latter, from which it receives nitrogen, sulphur, and phosphorus; old burial-grounds are full of it. The mould of old gardens shows by the blackness of its colour that it contains much of it.—Peat is chiefly composed of the remains of vegetable substances, in different degrees of decay.

Clay soils, on an average, are composed of nearly equal parts of pure argyl (of which the component parts are alu-

mine, silex, and iron,) and sand; and as the sand is increased or diminished, the clay is comparatively loose or adhesive. If the proportion of sand be less than 40 parts in 100, where the argyl is 60, the soil is called an argillaceous clay; and if the sand does not exceed 20 per cent., the clay is stiff, unmanageable, and unproductive.

Generally the quality of land diminishes as the quantity of sand increases above the measure contained in a good barley loam, unless there be much lime or a good deal of humus in it.

But you will inquire what is a loam? A loam has been defined by Professor Kirwan to be a soil moderately cohesive, less so than clay, and more so than sand. Manure and cultivation have given to many clays or very sandy soils the nature of loams, but no art, at least without too much labour and expense, can convert a naturally stiff, cold clay into a rich loam, with sand as fine as meal blended perfectly with the clay, nor render a very sandy soil a fertile loam of high quality, by combining argyl with it, because no repetitions of ploughing and harrowing can blend them together as the Creator intermingles them; yet the deficiencies of either may be much corrected by intermixture with other substances.

The soils which may be considered loamy, are, according to Sir John Sinclair's arrangement, six in number; 1st, sandy; 2nd, gravelley; 3rd, clayey; 4th, calcareous; 5th, peaty; and 6th, that mixture of soil called hazel loam.

A sandy soil differs from a sandy loam in being always in a crumbling state; "whereas a sandy loam, owing to the clay that is mixed with it, will not crumble down suddenly of itself after wetness or drought."\*

A shallow soil, if it abound in humus, is for immediate productiveness more beneficial than a deep one with little of it. The depth of vegetable mould (that which contains much humus) is the chief consideration for any man looking to a present crop; but, for ultimate benefit, if he tills it and manures it properly, a deep soil though at first infertile from wanting the elements of vegetable food, being impenetrable to the influence of the sun and air, is decidedly more desirable than a shallow one, however good its actual condition.

A thin gravelly soil not calcareous, is certainly most discouraging to the holder of it. The roundness of the stones permits moisture to evaporate quickly, and the water that filters through them carries away with it nutritious matter; but, on the other hand, such soil has the advantage of more quickly absorbing heat than a closer texture, and is, therefore, productive of quicker growth. Light porous soils have also the advantage of requiring but little labour, while stiff open demand much. Besides, light, dry, and hungry soils, if they contain a sufficiency,

\* Phosphate of lime is the union of phosphorus and oxygen forming phosphoric acid, with calcium and oxygen forming lime.

† Similar in its composition to the phosphate of lime, being a compound of sulphur and oxygen (forming sulphuric acid) with calcium and oxygen forming lime.

\* The distinct properties of caustic and mild lime I shall notice when I come to treat of manures.

† From the cross-like form of their flower.

\* Brown on rural affairs.