II.—*On the occurrence of Celestine in the Keuper marls, and its influence on the composition of plants.*

By W. W. Stoddart, F.C.S., F.G.S., &c.

THE origin of the large deposits of Celestine that abound in certain beds of Triassic age has long been a puzzle to Geologists. At Bristol, Celestine is found only on the lowest beds of the Keuper marls resting on the solid red sandstone rock, and may be collected by the ton.

It occurs in large masses, in veins and in geodes, accompanied by Selenite. In many of the concretions the crystals are long and acicular, radiating from the centre. In other places they seem to be a simple aggregation of crystals so loosely bound together that they may be easily rubbed asunder by the slightest pressure of the fingers. The most beautiful forms, however, are those in the interior of the geodes. They are very large tabular prisms with the angles, edges and planes clearly defined. Their colour is white with a delicate bluish tint, and tolerably transparent, having a diameter frequently as much as an inch.

In the concretions the colour of the Crystals varies from a pure porcellanous white to a light red, caused by the combined Ferric Oxide.

An analysis of some of the concretionary Celestine found at Clifton gave,

Strontium Sulphate	99·13
Barium Sulphate	·46
Calcium Sulphate	·25
Ferric Oxide	·02
Manganesium	trace.
Silica, Alumina, and loss	·14
	100·00

At the well known Aust Cliff, the Keuper marls are well exposed, and form a section many feet thick. Here the deposits of Celestine are comparatively small, while the veins of Gypsum (or Alabaster as it is locally termed) are very large.

An analysis of the Celestine bearing marls at Cotham, chosen from those places where the Celestine was most equally distributed in small crystals, gave

Strontium Sulphate	22·18
Calcium Sulphate	5·23
Ferric Oxide	3·44
Ferric Disulphate	·08
Alumina	16·31
Magnesium Sulphate	3·11
Silica	44·76
Potassium and Sodium Salts	1·62
Moisture, &c.	3·27
	100·00

The blue colour of the large crystals, before mentioned as found in the geodes is said to be caused by the presence of Ferroso-ferric Phosphate $2\ Fe''_3\ P_2\ O_8\ (Fe''_2\ O_3\ 2\ Fe'''\ PO_4)\ 16\ H_2\ O$, but I have repeatedly tested them, carefully broken off at some distance from the point of their attachment to the geode, and carefully washed with pure distilled water, without finding any trace of Iron by subsequent analysis, so that if any iron is present it must be very small in quantity.

In most works on Mineralogy, Celestine is said to be found in the Carboniferous Limestone of Bristol. This, strictly speaking, is an error. The limestone itself never yields any at all, but the *fissures* and *crevices* of the Clifton and Durdham Down beds of Limestone are often filled up with Triassic marls and rocks which contain Strontium. Through these water has infiltrated, and holding these minerals in solution has carried them between the beds until stopped by some clay band, and deposited the Celestine at some distance from the surface. This is well seen in what is called "The Great Quarry" where minute crystals of Celestine are collected with others of Fluor Spar.

The same explanation holds good at Aust Cliff. There Celestine is only found in the marls, but is absent from the Carboniferous limestone below, and the Rhætic and Liassic limestone above.

The occurrence of some of our rarest minerals has frequently been detected in the ashes of vegetables. They cannot be essential to the nutrition or growth of the plant, because the same species growing only a few yards distant will often not show the least trace. The subject of the present paper is strong evidence that the roots of a vegetable cannot always restrict their solvent powers to the minerals actually necessary to its welfare, and cannot perfectly separate those that are unnecessary to its existence.

Lithium has been detected in *Gentiana lutea, Atropa belladonna, Nicotiana tabacum, Triticum vulgare* and *Vitis vinifera.* Rubidium in *Beta maritima, Quercus robur, Thea viridis* and *Coffea arabica.* Manganesium in *Betula alba* and *Fagus sylvatica.*

While making similar experiments on plants growing in the neighbourhood of Bristol with the Spectroscope, I met with many growing on the variegated Keuper marls on the North Eastern side of Cotham Hill in front of Nugent place, which are well known to contain very large masses of Celestine or Sulphate of Strontium. The following genera were analysed, and all shewed abundant evidence of the presence of Strontium, viz:

Taraxacum dens leonis.	Cardamine hirsuta.
Arabis hirsuta.	Poa rigida.
Capsella bursa pastoris.	Senebiera didyma.
Senecio vulgaris.	Cytisus scoparius.

The method used for detecting the metal Strontium in the plants was to well burn them in a muffle furnace, moisten the ash with Hydrochloric acid, and well dry the residue. A platinum wire armed in the usual manner with the ash, placed in a Bunsen flame and viewed by a Spectroscope, showed the Strontium lines of Red Orange and Blue very distinctly.

If the ash be not *strongly* ignited before the addition of Hydrochloric acid, the Sulphate is not sufficiently deoxydised for the Chloride to be fully formed, and then the lines will not be easily visible.

A large number of experiments were made on plants growing on Lias and Rhætic clays in close proximity to the Celestine marls without the detection of a trace of Strontium, but wherever they were gathered on the latter, the spectrum of that metal was plainly apparent.

Garreau (Ann Sc. Nat. 4·13) states "that *young* plants abound "in Alkalies, while *old ones* contain a large quantity of the earthy "and metallic oxides." In the present case, however, so far as Spectroscopic analysis can give quantitative results, the amount of Strontium was the same in both old and young plants. All that were tested were growing on the roadside, but had an opportunity occurred, those growing in the adjoining gardens would doubtlessly have behaved the same.