Note on the Occurrence of Celestite containing nearly fourteen per cent. of Free Sulphur.

By H. J. Johnston-Lavis, M.D., F.G.S., &c.
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THE mechanical inclusion of foreign substances in crystals during their formation is of such common occurrence that it might appear superfluous to record further examples, were it not that the present case is a somewhat unique one. All mineralogists are acquainted with the inclusion of sand and clay in selenite, celestite, and calcite, of which the Fontainebleau limestone is a striking example. Delesse found the crystals of calcite from that locality to contain 57 per cent. of sand, and to have a sp. gr. of 2·84, whilst the sp. gr. of pure calcite is given by Beudant as 2·721 to 2·723, which demonstrates that the inclusion of the heavier quartz grains raises the sp. gr. of the impure crystals.

The specimen of celestite to be described comes from one of the mines across the valley and railway close to Girgenti, Sicily. When I collected it search was made for more examples, but without success, and as at the time I was not quite clear as to the cause of the yellow colour of the crystals, my search was not perhaps quite as careful and prolonged as it might have been. Since the autumn of 1882, when the specimen was found, up to the present time, I have written to various friends in Sicily who are interested in mineralogy, but without being able to obtain further examples.

The specimen is about two-thirds the size of one's hand. The matrix is the common dark grey limestone of the sulphur mines. This is coated with a layer of compact crystalline sulphur of deep orange colour, which becomes opaque and granular towards one side. The sulphur is in part covered with small scalenohedrons of calcite. Upon the sulphur and calcite are implanted the celestite crystals, which vary from one to two centimetres long and from one to three millimetres broad. The crystals are thus particularly long and thin, tending to become acicular, but they are remarkably well formed and terminated. The prismatic faces e^1 are very well developed, almost, and in many cases entirely, to the exclusion of p. The pyramidal faces m predominate and often exclude a^2. Other planes I have been unable to detect. A long prism may be in part perfectly transparent and limpid, and another part may be quite opaque and of a dirty

lemon-yellow colour, with the line of demarcation well defined between the two parts. The surface of the prism, both of the pure and the impure parts, is equally brilliant, and on examination with a goniometer no difference of inclination of one face upon another can be detected.

Three different yellow-coloured crystals were very finely pulverised in an agate mortar, and transferred to a small covered porcelain crucible previously heated to redness and weighed. The powder was dried over sulphuric acid for 48 hours and then weighed. Heat was carefully applied and gradually raised until all the sulphur was driven off. After cooling, the capsule and contents were again weighed, and gave the following result:—

Sulphur (and loss)	13·69
Celestite	86·31
	100·00

The loss in heating is counted as sulphur, but possibly, though improbably, may have in small part consisted of some other substance.

These three crystals were previously used for the determination of their sp. gr. by weighing in air and distilled water. The average of various trials was 3·739, with insignificant differences between the observations. The average of seven data of different authors places the sp. gr. of celestite at 3·9539, the lowest of these seven being 3·92. These facts afford us evidence that the included sulphur lowers the sp. gr. of its host in the same way that the denser quartz grains raise that of the impure crystals of calcite.

The next point was to examine the crystals microscopically, an investigation that presented two important difficulties. Celestite, from its great fragility and possibly from internal tension, does not permit one to obtain a smooth (microscopical) face, and next it is necessary to mount and examine the sections immediately, as the Canada balsam soon dissolves out all the sulphur. This latter substance occurs as minute octahedral crystals enveloped in the celestite their distribution being independent of planes of crystalline growth, as they adopt an arborescent or dendritic arrangement. This may be well seen at the limit of the pure and impure celestite by employing reflected light.

It would appear that part of the sulphur crystals and celestite formed simultaneously, and that the latter was compelled to include the sulphur grains as its crystals grew in size. This is further indicated by the fact that where clear parts of the prism occur is where it projects some considerable distance from the surface, and where the sulphur has been covered with calcite; there the celestite is as clear as crystal.