

VI. *Remarks on Stones of a regular Figure found near Bagneres in Gascony: With other Observations, communicated by Monsieur Secondat de Montesquieu, of the Academy of Sciences of Bordeaux, in a Letter to Martin Folkes, Esq; Pr. R. S.*

Read Mar. 8. 1743-4. **T**HOUGH the Spring called *La Fontaine du Salut* is at a good Distance from the Town of *Bagneres*, it is, nevertheless, as much frequented as any in that Country; and, besides its admirable Effects in curing a great Number of Distempers, it likewise offers, to the Eyes of the Lovers of Natural History, a very remarkable Singularity.

In the first Bath, through which the largest of the Two Branches of the Spring flows, there are found, from time to time, small Stones, of the Colour of Iron-rust, and of a regular Figure; being either Parallelopipedes with oblique Angles, of which the Sides are unequal; or small solid Bodies with Six Sides, only differing from Cubes or Dice in this, that the Surfaces are not perfectly perpendicular one to another, but a little inclined; as also commonly longer than they are broad, and broader than they are high.

The largest which I have seen were but 11 Lines in Length, $9\frac{1}{2}$ in Breadth, and 6 in Height: They are mostly a great deal smaller. I have one which is very odd, being a Parcel of an hundred in one Lump.

Lump. There are some on which one may observe shining *Striae*, that seem to be of a metallic Substance.

I have heard, that a great many Stones like these are also found on the Sides of a Brook in *Spain*; from whence, without Doubt, they got the Name they are commonly called by, of *Ferreles d'Espagne*.

About Two Months ago, happening to take a Walk in the Road newly made between *Bagneres* and the *Fontaine de Salut*, I perceived, that, in digging the Ditch on the Side of the Road, the Workmen had laid open a Rock of a Sort of imperfect Slate, but softer, and of a lighter Colour, than Slate commonly is. The Rock itself is composed of Layers or Beds lying almost parallel one over the other: The Substance of the Slate seems to be a Composition of Fibres or Strings, placed on the Sides of each other, and equally inclined to their Beds or Layers; whence it comes, that, upon breaking them with a Hammer, the Pieces, sometimes, are pretty like the Figure of a regular Parallelopiped with oblique Angles.

Upon a narrower Examination of this Sort of Slate, I found a great Number of Parallelopiped Stones, like those before spoken of, only smaller: I have seen them of all Sizes, from those in which the largest Side is but of Two or Three Lines. I observed also, after having broken to pieces several little Bits of Slate, certain black Spots; which, by the Help of a Microscope, I found to be real figured Stones.

Besides this, I took notice, that every one of these Stones, as long as it remains in the Rock, is always found between Two Bundles or Clusters of transparent Fibres, of which, generally, one is placed on

the one, and the other on the opposite Side. These Bundles are larger in great Stones: Those which seem, to the naked Eye, to be but small black Spots, are, nevertheless, accompanied by their Bundles.

I have some of these Stones, where the transparent Fibres, of which every Bundle is composed, had left a Vacancy in the Middle of their *Axes*: This sort of Conduit being coloured with a Matter of a rusty Colour, one finds likewise, sometimes, between the Fibres a little of this rusty-coloured Matter; and now and then metallic and shining Veins. One might say, that the Use of these transparent Fibres is the same as of Strainers; which (let the Matter be of a metallic Nature or not) suffer nothing to pass thro' them to the little Stones, but such Particles as are proper to advance their Growth, and so to serve them as it were for Roots. In Bits of imperfect Slate, tho' harder, and of a bluer Colour, than the Sort I before mentioned, are found small Stones, of a like Figure, but different in this, that they are of a fine and shining brass Colour. They are, as well as the others, accompanied by transparent Lumps.

One meets likewise with large Stones of the Colour of iron Rust in several Rocks thereabout. It is probable, that the *Fontaine de Salut* passes thro' one like that I have described; and, if it meets with any of these figured Stones in the Sides of the Conduits thro' which it passes, it easily loosens them, and carries them along with it. The Bundles of transparent Fibres stick pretty fast to the Slate or Rock, but are slightly fastened to the little Stone, from which they are very easily separated. Hence it comes, that all those which fall into the Bath, or
Fontaine

Fontaine de Salut, are got thither without their Bundles.

The Formation of these Stones deserves to be examined: If it was carefully studied, it might, perhaps, give Light to the Formation of other figured Stones. It even seems, that, by beginning with this Figure, which is the most simple that one can imagine, one may the rather hope for Success in the like Inquiry.

This Parallelopiped Figure with oblique Angles is common to many Stones in the Country of *Bagneres*, and the neighbouring Mountains. Several Crystallizations of the Grotto of *Campan* break into Fragments of this Figure: Those which hang down from the Top of the Vault of that Grotto, are, originally, small hollow Pipes, formed by the Water which trickles down Drop by Drop; and whose outer Surface, fixing themselves by their small Bases, forms, by degrees, a sort of blunted Pyramids, which, like so many Rays from the Axis, which is nothing but the hollow Pipe, become solid at last. This Axis seems composed of Plates, almost cylindrical, laid one over another; but, if broken, the Whole divides into Fragments of a Parallelopiped Figure. The blunted Pyramids, that are about the Axis, divide themselves at first into other blunted Pyramids; but, afterwards, almost all these Fragments divide of themselves into other Fragments of a Parallelopiped Figure.

The Stone of the Mountain of *Barege*, upon which the *Asbestos* grows, breaks also constantly into Fragments of the same Figure.

I have likewise preserved a Bit of Rock half transparent, the Fragments of which are like the others.

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Having seen several Productions of Nature, in which one discovers, that the Figure I have been speaking of so remarkably prevails, I was nevertheless surpris'd, when I found the same Figure in the Sediment of the Water of the *Fontaine de Salist*.

I had let a considerable Quantity of the Water of the mineral Spring evaporate; there remained a shining Dust, in which I could distinguish nothing. I then looked at it through a Microscope; and, among several Crystals of a less regular Figure, I found many which were quite regular and well-shaped, with Six Faces, and oblique Angles. Several Persons, who have, at different times, been Eye-witnesses of this Sight, have been well satisfied with it.

The Waters of this Spring contain no Iron, as it is commonly believed. When you put the Tincture of Galls in it, it grows neither black nor red: This Mixture only turns it a little, and makes it look whitish, after having stood some Hours.

When these Waters are evaporated by a mild and equal Heat, the small Crystals are found swimming on the Surface; where they join, and form a Film upon the Water; some of which sticks also to the Sides and the Bottoms of the Vessel. Those Crystals which are formed first, are insipid; but those which are produced towards the End of the Evaporation, are, indeed, of the same Shape, but of a tart and saltish Taste. There remains yet a little of this Matter, which cannot be reduced to very regular Crystals: It is of a very sharp and pungent Savour, but has nothing of the prevailing Character of Acid or Alkali; at least, it makes no sensible Impression upon blue Paper.

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The Waters of the Spring *du Pied* have the same Quality as those of the *Salut*: They produce the same Effect when mixed with Galls; yield Crystals exactly of the same Figure, but in yet greater Quantity.

I have not made the same Experiments with the other Springs at *Bagneres*; but, it is probable, they do not differ from the former, except as to More or Less.

To conclude these Observations; I have also found, at *Bagneres*, a particular aquatic Plant, which I had seen, for the first time, in the great Bason of the boiling Spring at *Dax*: It bears neither Fruit nor Flower, as far as appears; its Substance is intirely composed of small Bladders full of Air; the Surface of it is like Net-work or Canvas; it grows only in the hottest mineral Springs; it may be found at the Spring, called, *de la Reine*, at the *Bath des Pauvres*, and at the *New Spring*; but most plentifully at that Place where Part of the *Spring de la Reine* issues out of a Rock near the *Capuchins*. Nobody, as far as I know, has ever spoken of this Plant, before I gave an Account of it Two Years ago, at the public Resumption of our Academical Meetings. The Vegetation, and particular Qualities of it, may, perhaps, deserve to be more narrowiy examined; and I believe it may be properly called, *Fucus thermalis vesicularis*, *Superficie reticulari*.

However different the preceding Subject of my Discourse may be from what I am next going to speak of; I beg Leave to set down One Observation more, which I have made on the *Pie du Midy*, and of which the Result may prove curious.

It is well known, that the greatest Degree of Heat in common Water is that which it acquires by boiling; that is to say, if Water is put upon the Fire, it grows by degrees hotter and hotter, till it quite boils; but, after that, though there be never so much Fire added, and it stand never so long upon it, it will never grow hotter than it was on the first Instant, when it began to boil. Hence the Degree of Heat of boiling Water is looked upon as fixed and invariable.

Fahrenheit, that ingenious Master in Mechanics, so well known by his Mercurial Thermometers, is the first who has remarked the contrary. He observed, that the Heat of boiling Water was greater when the Air was heavy (that is to say, when the Mercury stood higher in the Barometer); and, on the contrary, the Heat was less when the Air was lighter.

Mr. *Le Monnier* the younger, who has obliged us with a Translation of Mr. *Cote's* Lectures in Natural Philosophy, with excellent Notes upon the said Work, has put *Fahrenheit's* Discovery past all Doubt, and has very much improved it.

On the 6th of *October* 1739, being provided with a Barometer, and a Mercurial Thermometer of M. *Delisle*, he climbed up to the highest Top of the *Canigou*, a Mountain in *Roussillon*, which passes for the highest among the *Pyrenees*: There he found his Barometer to stand at 20 Inches $2\frac{1}{2}$ Lines; whilst at *Perpignan* it stood at 28 Inches 2 Lines. The Difference between the Heat of the Water which he boiled there, and that which he boiled at *Perpignan*, was 15 Degrees of his Thermometer.

The same Thermometer being surrounded with Snow, the Mercury fell down to the same Degree as pounded Ice had made it do at *Paris*.

Hence he concludes, that the Heaviness of the Air has a sensible Influence on boiling Water; but that it in no way alters the Term of Congelation.

All these Particulars may be seen, *p.* 408. of *Cote's* Experimental Lectures; and in the Memoirs of the Academy of Sciences of *Paris*, *Anno* 1740.

This is the same Experiment which I have repeated on the Top of the *Pic du Midy*; thinking that so singular a Fact ought to be observed more than once.

I carried Two Barometers, the Tubes of which the Reverend Father *Francis* had been so good as to fill for me with great Care. I had likewise with me Two Mercurial Thermometers, upon which I set the Degrees at *Bagneres*: I took the fixed Terms of the Graduation; that is to say, that of Congelation, and that of boiling Water, afterwards putting nought to the Term of Congelation. I marked 180° Difference between this Term and that of boiling Water.

Being come to the highest Top of the *Pic du Midy* on the 9th of last *July*, the Mercury rose in one of my Barometers to 20 Inches 2 Lines; and in the other, to 20 Inches 1½ Line. I surrounded my Thermometer with Snow, and the Mercury fell exactly to the same Degree as the Snow had made it fall to at *Bagneres*. Afterwards I plunged it into boiling Water; whereupon the Mercury rose to 165° of my Graduation: So that the Difference between the Heat of boiling Water on *Pic du Midy*, and that at *Bagneres*, consisted of 15°.

At my Return to *Bordeaux*, I observed, that I had marked the Term of boiling Water at *Bagneres* less high by $3\frac{1}{2}$, than at the Term of boiling Water at *Bordeaux*, taken at the time when the Barometer was at 28 Inches 2 or 3 Lines: Therefore having anew graduated my Thermometer the 165th, the Degree of the former Graduation fell now upon the 162^d; so that the complete Difference between the Term of boiling Water on the Top of the *Pic du Midy*, and that of the same at *Bordeaux*, the Barometer being at 20 Inches 3 Lines, amounts to 18 Degrees on the Thermometer of *Fahrenheit*.

Now the Conformity between the Observation made by M. *Le Monnier*, and this Repetition of the same Observation, can hardly be greater; seeing the Heights of the Barometers are almost the same; and the 15 Degrees of Difference, found by M. *Le Monnier* on *De Lisle's* Thermometer, amount precisely to 18 Degrees on the Thermometer of *Fahrenheit*, which I made use of.