

water containing  $\text{CO}_2$  in solution, and thus gives rise to the white crust of "decomposed" flint which forms the outer "cortex" of all chalk flints.

(1) A fact of capital importance, which must affect any theory as to the origin of flint, is that in many localities where a chalk escarpment can be studied it is found that extensive fissures traverse the stratified layers of chalk and flint nodules at a sharp angle, and are filled with a continuous sheet of black, tabular flint. Such fissures may be seen in the cliffs at Rottingdean, near Brighton, often cutting through a thickness of 40 ft. or 50 ft. of the stratified chalk obliquely to the plane of the strata, and from these fissures sheets of flint 3 ft. square and  $\frac{1}{2}$  in. to 1 in. in thickness can be readily removed. The size of these sheets of flint *in situ* is apparently limited merely by the vertical height and inward extension of the fissure. The occurrence of these deep and extensive fissures—mere cracks in so far as their width is concerned—filled with a continuous deposit of black flint, makes it certain that the flint was deposited *after* the fissuring of the chalk, and therefore, almost certainly, after the elevation of the chalk, and probably through the operation of fresh-water of atmospheric origin penetrating the porous mass of chalk after its elevation. It is improbable that the nodules of flint in the chalk have an origin different from that of the "tabular" flint of the fissures. I am not able myself to bring forward any parallel case of the filling of extensive cavities and fissures in a sedimentary rock by a dense chemical deposit. The formation of "septaria" in clay is a parallel on a very small scale. The student of mineral veins and deposits may perhaps be able to throw some light on the matter.

(2) A further fact of importance to any theory of the origin of flint is that the black colour of flint—yellowish- or greenish-brown in thin splinters—is probably due to carbon, though no explanation has been offered of the *uniform* association of this element with flint. The existence in the Upper Chalk of oblong cylindrical nodules of *perfectly colourless* transparent quartz, occasionally showing blue or orange-brown patches or "floating clouds" scattered in the clear colourless silica, is also well known. A fine collection of these has been bequeathed to the Woodwardian Museum, Cambridge, by the Rev. Marmaduke Langdale. They are deposited in cavities once occupied by peculiar sponges (Choanites and Ventriculites). But why they are free from carbon—if carbon is the cause of the black colour of black flint—is not explained.

In the spring of 1916 a combustion analysis of black flint was made in the laboratory of the Royal Institution at my request, under Sir James Dewar's direction. The result pointed to the presence of minute quantities of carbon in the flint. But a very remarkable result was also obtained which it is necessary to re-examine by employing black flint from various localities in such combustions. A definite quantity of *arsenic* was deposited in the combustion tube in the form of the well-known arsenical mirror. Care was taken to check this startling result by exclusion of the possibility of *accidental* impurity in the material used. But I have not been able myself to pursue the matter further, and mention it now under all reserve, in the hope that some expert chemist will inquire into the subject. I am afraid that Sir James Dewar, to whose kindness I owe this initial examination of the chemical constituents of black flint, will not be able to give the necessary time to it.

I may add that another matter inquired into at my suggestion was as to the amount of *removable* water present in normal chalk flint as quarried, and the percentage of its own weight of water, which carefully dried black flint can absorb, and the rate at which

the water is absorbed; further, the variation in these amounts caused by variation of temperature, and the question as to whether a sudden raising or lowering of temperature causes the fracture of *wet* flint *more readily* than of *dry* flint. Experiments were also made as to the form of fracture caused by thermal changes in flint, with the view of determining whether the conchoidal fracture can be produced in flint by thermal change alone, without the previous creation of structural strain by a blow. Although I am not able to report the results of these experiments, I wish to bring the desirability of a thorough chemical and physical examination of black flint to the notice of others who may have facilities for carrying through such an examination which I do not possess. I trust that some such fortunate experimentalist will take up the chemical and physical investigation of flint, without delay, as a serious task. It will take perhaps years to complete, but will yield results of the highest value to geology and to other branches of science.

The occurrence of arsenic in chalk flints may be due to its presence in minute quantities in sponges, the peculiar smell of which in the living state is suggestive of the presence of an organic compound similar to the strongly odorous gas known as diethylarsine.

May 25.

E. RAY LANKESTER.

#### Plated Teeth of Sheep.

THE subject of Mr. Beeby Thompson's letter (*NATURE*, May 31, p. 264) has been noted in various parts of Great Britain. Writing in 1684, Andrew Symson, minister of Kirkinner, records in his "Large Description of Galloway" that "in this parish [Glasserton] there is a hill called the Fell of Barullion, and I have been told, but I give not much faith to it, that the sheep that feed there have commonly yellow teeth, as if they were gilded."

In this matter the worthy minister was unduly sceptical. The Fell of Barhullion is on my property, and jaws of sheep fed thereon have been brought to me with the teeth thickly plated with iron pyrites. The rock of the district is Lower Silurian; in the softer parts (Moffat Shales) large nodules of iron pyrites are found. As there is wet peaty soil on parts of the fell there is no lack of humic acid.

HERBERT MAXWELL.

Monreith, June 2.

#### The Stability of Lead Isotopes from Thorium.

PROF. SODDY'S view (*NATURE*, May 24, p. 244) involves the disappearance from the 20 kilos of thorite (with which he worked) of some 150 grams of unstable lead and its conversion into (probably) thallium. There should be present in the thorite thallium to the amount of about 0.012 gram per gram of thorium.

Such a quantity should be easily measurable. If found to be present, support would be given to Prof. Soddy's suggestion. We are told that the thallium was present in amounts "that sufficed for chemical as well as spectroscopic identification."

There is some difficulty in understanding how two-thirds the ionisation of a ray, additional to the seven  $\alpha$  rays which go to generate the thorium halo, can have left no trace upon the halo. But the range may have been such as to render this possible. It is improbable, however, that a further  $\alpha$ -ray transformation of thallium can have occurred without affecting the ionisation curve to an extent which would be detectable when the halo is compared with the curve as determined from the seven known rays.

J. JOLY.

Trinity College, Dublin, May 29.