

ON TWO ANCIENT SAMPLES OF BUTTER.

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The specimen of Irish bog-butter which we have submitted to analysis cannot be traced with any certainty to a particular locality. There is no doubt, however, that it is a perfectly authentic specimen, some centuries old; indeed, we should probably be right in concluding its age to be not less than 1,000 years.

Whether the specimens of ancient butter found in the bogs of Ireland, and occasionally in those of the Faeroe Isles, and of Scotland, were originally inhumed for the sake of security, or for their preservation and ripening, we have no means of ascertaining. They are inclosed in rough wooden vessels, square, oblong, or cylindrical, sometimes consisting of a hollowed tree trunk. A fine example of the last-named form is preserved in the museum of the Royal Irish Academy, at Dublin, and is figured and described on pages 212 and 268 of their museum catalogue. For the history and archæology of bog-butter, reference may be made to Dr. Wilde's paper in the proceedings of the Royal Irish Academy, vol. vi., p. 369, where will be found a list of the authorities who have discussed the subject.

Bog-butter has been chemically examined by Prof. E. Davy in 1826 (*Proc. Roy. Dublin Soc.*); by Williamson (*Ann. Ch. Pharm.*, 1845, liv., 125); and by Brazier (*Chem. Gaz.*, 1852, 375). Brazier concluded that it mainly consisted of an acid, having the same composition as palmitic acid, and melting at 53° C.

We will describe the physical and chemical characteristics of the sample we have examined. It weighs nearly five pounds. In shape it is an irregular oval, about twelve inches by eight inches, and six inches thick. The surface is deeply indented in many places, and some of these indentations present such an appearance as would be produced by the pressure of the stave of a cask. The general appearance of the sample leads to the opinion that it has been enclosed in a rough cask or tub of an oval form, and as that decayed, an irregular pressure has been brought on to the substance. There are several clearly cut cylindrical holes through the sample: these holes are much like those which would be produced by a cork-borer or a cheese taster. The surface of the sample bears a resemblance to a very old and dirty cheese. The interior is of an almost sandy colour, and although somewhat like cheese in texture, it is more friable and pulverulent. It has a slightly greasy feel to the fingers, and a slight but distinct odour of cheese, not butter.

A small portion from the inside of the mass was examined microscopically. A few fragments of foreign matter did polarize, but the bulk of fat did not, and no trace of crystalline structure could be detected. A good deal of foreign matter, partly curd, was seen.

The sample fused very slowly, even at 212° (100° C.), and the curd and foreign matter separated with considerable difficulty. The fat which adhered to the curd was removed by washing with ether, but was not used in the subsequent analysis of the fat. The original sample contained:—

Moisture	..	..	..	..	..	..	1.40	per cent.
Curd, fibre, and other matters insoluble in ether	..	..	..	..	..	..	3.98	„
Ash*	..	..	..	..	..	..	.32	„
Fatty Matters	..	..	..	..	..	..	94.30	„
							100.00	

\*Containing Chlorine .033 = Chloride of Sodium .054.

The curd was microscopically examined. It contained a considerable proportion of vegetable matter, and some large fragments of wood, the structure of which was too much destroyed to enable the species to be identified. The largest of these fragments was nearly a quarter of an inch long. The curd also contained some fungoid growths

and mycelium. A considerable proportion was, however, clearly of animal origin; many fragments of muscular tissue were found, and some hairs. These were quite sufficient to prove the fact, that the fat itself was of animal origin, although it was mixed with some proportion of vegetable matter, which was probably derived from the bog.

This curd and other matters insoluble in ether gave the following results:—

Nitrogen by soda lime process	..	..	..	..	3·64 per cent.
= Casein	..	..	..	..	23·05 „
Ash	..	..	..	..	8·70 „
Containing Chlorine	..	..	..	..	·82 „
= Chloride of Sodium	..	..	..	..	1·35 „
Fibre (crude Cellulose)	..	..	..	..	27·60 „

The fatty matter, after separation from the curd, was very dark coloured. It contracted greatly when cooling, and was almost or quite as hard and resonant, when struck, as a good sperm candle.

Its melting point was 121° F. (49·5° C.).

Its specific gravity, taken at 155° and compared with water at the temperature of 100° F. (38° C.), was 875·4.

Assuming that the ratio of expansion is fairly accordant with that found in the fats previously examined by one of us\*, this would correspond to an actual density of ·902 at 100° F. (38° C.).

The fat was saponified with alcoholic soda in the usual way, the soap decomposed with acid, and the washings containing the soluble fatty acids distilled.

The whole of the processes were carried out by flask washing, to avoid loss.

The following results were obtained:—

Volatile fatty acids, calculated as butyric	..	..	..	..	·06 per cent.
Soluble fatty acids, not volatile	..	..	..	..	·42 „
Insoluble fixed fatty acids	..	..	..	..	99·48 „
Glycerin	..	..	..	..	Minute traces.

The insoluble fatty acids were converted into lead salts, and the oleate of lead separated by ether. The results were:—

Oleic acid	..	..	..	..	9·0 per cent.
Stearic and palmitic acids	..	..	..	..	91·0 „

The distillate certainly had a faint, though of course very slight, smell of butyric acid; enough however to prove its presence.

The traces of glycerin were far too small to admit of any approach to estimation.

It is interesting to observe how complete has been the decomposition of the original glycerides of the butter, both the resulting glycerin and the soluble fatty acids set free, having been almost entirely removed by the action of water only at a low temperature. Time has been an important factor in the change.

The other sample of butter is much older. It was taken some time ago from an Egyptian tomb, which probably dates from about 400 or 600 years before Christ. The sample is therefore nearly 2,500 years old. It was contained in a small alabaster vase, and had apparently been poured in while in a melted state.

The vase was brought by Lord Prudhoe from the Delta. It bears an inscription

\* THE ANALYST, vol. iv., p. 133.

in hieroglyphics, indicating that it was once the property of *Hasheps*, a queen of the 18th dynasty. It is quite possible that the butter was once perfumed, serving the purpose of an ointment; but if so, every trace of such perfume has vanished.

In appearance, colour, smell, and taste, it corresponds closely with a sample of slightly rancid butter.

The quantity at our disposal—some six grains—was so small, that it was only possible to apply a few tests.

Under the microscope the sample polarized distinctly.

It was entirely soluble in ether.

It melted readily, and showed no infusible residue.

It was practically free from moisture and from ash.

The fusing point was 127·5° F. (53° C.).

A small quantity was saponified, and the soap was decomposed in a small flask.

The soluble fatty acids were found to be 8·0 per cent. by direct weighing.

The washings containing these soluble acids, had, when warmed, a distinct odour of butyric acid. Any attempt at the estimation of the proportion, on such a small quantity, would of course have been useless.

The insoluble fatty acids weighed about 86 per cent.

The figures, as far as it has been possible to obtain them, indicate that this sample has not undergone any notable decomposition during 25 centuries. This stability must, in all probability, be attributed to the fact of the butter having been melted and sealed, so as to secure it against atmospheric influences. In this respect it presents a marked contrast to the bog-butter previously referred to.

Mr. Hehner said he had a lingering doubt in his mind as to how it could possibly be proved that it was ever butter. It might have been some other animal substance; it looked like chalk now, but it might have been cheese, which under certain circumstances is transformed into fat.

Dr. Bartlett thought they had never had a specimen of ancient cheese presented to their notice, but in fragments of ancient cheese they found something very different to that then before them. The oldest cheese he was acquainted with was some that was contained in a screwed up flask, recovered from the *Royal George*. It had dried up into a perfectly solid mass, containing only a small amount of fat. He thought the large amount of fatty acids would lead them to suppose that that was not originally cheese.

The appearance of adipocere, such as is found in coffins, is not at all dissimilar to that. Adipocere is said to be produced by the action of running water on animal flesh.

Mr. Blyth said that putting on one side the chemical evidence, they certainly had marks very similar to what a stave would make, and besides that the presence of hair. He thought the evidence pointed to it being butter rather than anything else. With regard to the holes he suggested that they might have been made by some boring insect or beetle.

Mr. Angell said the only thing which struck him with regard to the examination was the amount of the curd, which was rather indicative to his mind of fatty degeneration.

Mr. Wigner, in reply, said that as to the older sample, the alabaster vase was

recently opened in the presence of two or three gentlemen. Mr. Church took this sample and it has not left our charge since. Its age, therefore, was undoubtedly what it was represented to be.

With regard to the sample of bog-butter, it had been suggested that it was cheese, but those who had studied the subject were aware that cheese had been repeatedly found in these Irish bogs, and that it was not found in cases or tubs as the butter is, but invariably showed signs of having been wrapped in a kind of canvas or cloth, the characteristics and form of cheese being to a great extent preserved; neither would it be reasonable to expect such perfect conversion of cheese into fatty acids. The possibility of its being adipocere was negatived by the analysis. Adipocere contained much lime and phosphoric acid, and the sample was almost absolutely free from these constituents. Dripping, or some other animal fat, might have undergone a similar decomposition to that of the present sample, but there was nothing to indicate that the theory of dripping was more probable than that of butter. On the contrary, the results of the microscopical examination, and the percentage of true casein found, pointed distinctly to butter.

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