THE MILL REEK AND THE DEVONSHIRE COLIC

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According to the Statistical Account of Scotland (Maconochie, 1792) the village of Leadhills in Lanarkshire contains the most famous and ancient lead mines in Scotland. They were included in a grant of lands to the monks of Newbattle Abbey in 1239 and, from a lawsuit soon afterwards, it is clear that the mines were in production about that date. Depending on demand and the price of lead they have been worked periodically ever since. They are at present closed but re-opening is again in progress.

Tennant recorded (Porteous, 1876) in 1772 that :

“ the veins vary in their depth. Some have been found filled with ore two fathoms of the surface ; others sink to the depth of ninety fathoms. The varieties are the common plated ore (galena) called potter's [this may refer to the use of lead in the glazing of earthenware vessels], the small or steel grained ore, and the curious white ores, lamellated and fibrous. The working of this species is much more pernicious to the health of workmen than the common.”

The veins of lead, sometimes bounded by a girdle of quartz, popularly called “ riders ”, occur generally in greywacke or greywacke slate, very hard, highly siliceous rocks. It may be of interest to record here in passing that gold is also found in the neighbourhood. These facts, associated with frequent references to the prevalence locally of chest disease including fibroid phthisis, suggest that the miners suffered from silicosis though the disease was usually attributed to the wet, inclement climate.

Here is an early picture of the smelting works.

“ At the furnace were men enduring the blaze of the red heat. They were piling up the glowing coals upon the bruised and washed ore in the receptacle in the furnace ; and from under the front of the fire we saw the molten lead running down its little channel into its own reservoir, leaving behind the less heavy dross, which was afterwards to be cast out in a heap in the yard.”

In 1792 the mines were worked by the Scotch Mining Company who employed 200 men. These comprised pickmen, smelters, washers and labourers,

besides carpenters and smiths. Pickmen and smelters earned eighteen to twenty pounds a year, while the washers, who were very young, received less. The overseers purchased meal and barley of which it is recorded that “ all the hands employed receive every week a certain quantity for their families, which makes part of their pay ”.

The men worked only five or six hours in the twenty-four and for five days in the week. This no doubt reflects the adverse conditions underground and around the smelter. As a result the men had a great deal of spare time which they employed in reading. For this purpose they fitted up a library out of which everyone who contributed received books. This benefit has been ascribed to Allan Ramsay, the Scots poet, who was born at Leadhills in 1686. Moreover, in this we note the early beginnings of mechanics' libraries and, later, mechanics' institutes during the Industrial Revolution. These developments were, in turn, the inspiration of adult education, a movement which began in Scotland and spread through industrial England (Trevelyan, 1946). One of the great pioneers was Dr. George Birkbeck of the Andersonian University of Glasgow (Oakley, 1946), whose name is still memorialized in the college which he founded in London. As to the quality of the reading and the readers the Rev. J. Moir Porteous, in writing of shepherds, records that : “ Lectures have been delivered on these hills by a shepherd which would have done no discredit to an LL.D. or D.D. ” Lest we appear to protest our virtues it may be added that “ yet a rougher party can rarely be met with than that of some young shepherds when ‘ whuskied ’ at a village fair. Then the drink madness shows the dark beginnings of the darker end ”.

The prevailing distempers or ailments among the local population were rheumatism and the scurvy. The latter was attributed to the use of salted mutton and beef, of which the people were extremely fond, while at the same time being averse to vegetables.

The humidity of the air was blamed for the rheumatism but it may not have been unrelated to employment at the mines or, indeed, to contamination of the air and water by lead.

In the course of a tour through Great Britain the Rev. C. Cruttwell recorded in 1801 that :

"The appearance of Leadhills is disagreeable in the extreme ; rocky, rude and barren, every vegetable is raised with difficulty, and seldom brought to perfection. Spring water is to be obtained of excellent quality, but that which is below the smelting mills is poisonous. The lead ore, before smelting, is broke very small and washed from filth, which frequently contains arsenic. Fowls of any kind do not live many days at Leadhills ; horses, cows, dogs, and cats often find ill effects of this poisonous mineral."

It was estimated that one-tenth of the lead passed away with the smoke. In due course brick and woodwork chambers were erected to precipitate the fumes in flues by a system of water sprays. When these chambers were first cleaned out after working seven months, 58 tons of lead, valued at £1,300 sterling, were recovered.

The effect on livestock and vegetation in the village and surrounding hills is described thus :

"Mossy land, where, as at the edge of rocks, the grass has not a firm hold of the soil, but which springs up quickly and is eagerly sought after by the sheep, is found to be injurious, much soil being swallowed. So also is the smoke of the lead furnaces, which is seen in the morning lying as dew upon the heather or grass."

"Dogs and cats are shortlived. They take the 'lead-brash,' wheel round and die."

These observations, as will appear later, are common to all lead-mining areas. Popularly the ailment is known as *bellan* or the *belland*, which, according to the English Dialect Dictionary means "a kind of colic, in man or animals, caused by swallowing particles of lead ore". The references, however, to fits and weakness may signify the occurrence of nervous disorders.

Old workers still resident in the now semi-deserted village recall that following a successful action in the early 1900s by a local farmer against the mining company, in respect of injury to his lands and cattle, smelting at the Leadhills mine was discontinued. In recent years we have had similar experiences in relation to fluorine fumes from aluminium works and steel foundries and the London "smog". It is incongruous that the well-being of the community must await the malign influence of atmospheric and water pollution on pedigree cattle. The following article which appeared in the *Scots Magazine* in June, 1754, seems worthy of reproduction in full. It is called "An Account of the Disease called Mill-Reek", and it was written by Mr. J. Wilson, surgeon at Durrisdier.

"All the inhabitants at Leadhills are subject to this disease ; but it mostly seizes, and violently affects the men whose daily business it is to melt down the lead. The reek or smoak rising from the melting is believed to be the cause of the disease ; because the melters, who are most subject to it, are most exposed to the smoak, which comes out often full in their faces. The melting houses are called *mills*, because the bellows are worked by water-mills.

In the slighter stage of this disease, an uneasiness and weight is found about the stomach, especially near the cartilago ensiformis ; and sometimes it appears like a colic in the intestines. The spittle of the sick is sweet, and something of a bluish colour, resembling what one observes when he chews lead. The pulse is a little low ; the skin is all over cold ; and a clammy sweat frequently breaks out. The legs become feeble, with a prickling numbness ; and there is a debility and laziness in all the body. The appetite goes away, and they do not digest what food they take. Sometimes a *diarrhoea* makes a cure ; but if it continues too long, it is very hurtful. In this *stadium* the sick are yet able to go about, and to work.

But if these symptoms continue long, and spirituous liquors are drank with an empty stomach, or after working lead, the disease comes to its second stage ; in which to the former complaints are added a fixed pain in the stomach and guts, especially in the lower part of the abdomen, extending itself from the one *os ilium* to the other. The patients become very costive, with the sense of somewhat gnawing their intestines ; and the pulse turns quick, with heat on the skin. Giddiness, with vehement pain, seizes the head ; which is succeeded by an insensibility and delirium, like madness of the worst kind ; insomuch that they tear their own flesh, and bite their hands ; the extremities tremble and are convulsed ; at last they fall low, the pulse intermits at every third or fourth stroke, and they die in a *coma* or apoplexy.

If proper medicines are given in the first stages of this disease, the patient generally recovers ; if it goes on till giddiness begins, the success is doubtful ; and when the cure is delayed to be attempted a little longer, the disease almost constantly proves mortal.

If the work-people at Leadhills would use the following precautions, they might save themselves from this disease, at least would have it very mild.

1. No man ought to go to work fasting ; and he ought to take oily or fat food. A glass of sweet oil pure, or mixed with a little *aqua vitae*, would be a good morning-draught.
2. Physic should be taken spring and harvest, and whenever any effects of the reek are felt.
3. Ardent spirits ought to be drank very sparingly ; and never in time of work at the mill, or immediately after it.

4. No mill-man, when heated by work, ought to go into cold air, but to put on his cloaths immediately, and return to his lodging, to change his working-cloaths for others, and cool gradually.

5. Immediately after coming from work, the aliment should be mostly liquid, as broths.

6. Low and poor diet makes them more liable to be affected, and less able to undergo a cure.

7. When their business can allow, they should go out of the reach of the reek, to breathe an untainted air, and to take victuals free from lead. But I must caution the labourers at Leadhills, not to take long journeys; they are more hurt by travelling one day, than by working two.

The cure of this disease depends principally on cleansing the *primae viae*; and therefore after bleeding such patients, if they are plethoric, I give them a vomit of *emetic wine* or *tartar*; which must be a dose double to what would vomit another person. Half a dram of *vitrum antimonium* is a dose; and during its operation, warm water is to be drank plentifully. If the vomit operates well, and purges briskly too, the patient is in a fair way of recovering; which a second, but a milder dose of *ipecacuana* with some *tartar emetic* mixed, often makes compleat; but if the emetic neither vomits nor purges, the patient is generally worse for it; and a stronger dose should be given soon. If it vomits, but does not purge, a cathartic of the antimonial kind, or of jalap and mercury, in greater than ordinary quantities, ought to be given; and during the time of purging by the emetic or cathartic medicine, the patient ought to drink warm broth plentifully. The vomits and purgatives ought to be repeated at proper intervals, till the uneasiness in the stomach and guts is gone. If these medicines overdo, an opiate may be given at night. But this is to be administered sparingly, lest it bring or increase costiveness, which is the worst thing can befall the patient. At the same time, emollient, anodyne, and laxative clysters, are frequently to be injected, for emptying the guts, if the purgatives do not their duty.

When blood or matter are passed with the *faeces*, the emetics and purgatives are to be abstained from, till, by healing balsamic, but laxative clysters, and mild food, this appearance ceases.

When the belly is much swelled, emollient fomentations, should be often applied to it; but if the madness is begun, little else can be done, than to endeavour to keep the patient quiet, during the little time he has to live.

Sometimes it happens, that after the complaints of stomach and guts are gone, a prickling pain and feebleness remain in the leg, much like to a rheumatism. For which, friction, with a coarse cloth or flesh brush, is necessary. If that fails, *ung. nervinum*, with *ol. terebinth.* mixed, is to be rubbed on every night, before the fire: after which the member is to be wrapped in flannel. If these pains are violent, or the feebleness resembles a

palsy; blisters ought to be applied to the skin under which the large nerves are situated, and the medicines proper in a palsy are to be given.

Some are so wasted before the cure is completed, that they remain afterwards emaciated, weak, and as if they were hectic, with a giddiness in their head: and sometimes they chat to no purpose, or seem hypochondriac. In this condition, the patient should go to the country, to ride a horse-back some miles every day; and at the same time should take bitters, with bark and steel. If the giddiness continues, I have given, with success, *pilul. de myrrh* with a small proportion of *camphor*."

Earthen Wares Glazed with Lead

In May, 1953, under the auspices of the Nutrition Society, a gathering of distinguished scientists met in Edinburgh to mark the bicentenary of the publication of Lind's *Treatise on Scurvy*. His *Essay on the most Effectual Means of Preserving the Health of Seamen in the Royal Navy* is unfortunately less well known. Intervening between these two publications he contributed a short article to the *Scots Magazine* of 1754. It appeared in the May issue, that is one month before Dr. Wilson's article. His purpose was to comment on lead poisoning and, as will appear, the matter was not unrelated to the prevention and treatment of scurvy by the use of fresh fruit juices. He writes

"I received the following information from a gentleman in London:

"That, intending to make the extracts of lemons, he squeezed the juice of a thousand lemons into a large glazed coarse earthen vessel, and allowed it to stand for two days: he then poured off an English gallon of the clear juice into another glazed flat earthen vessel, and put it in a pot of boiling water to evaporate. During the evaporation, a great quantity of sediment appeared among it, which, upon examination, he found to be the salt or sugar of lead, to the quantity of several ounces. He then poured off the remaining part of the juice of the first earthen vessel, which had not been put upon the fire, and was surprised to find the sides and bottom of it also loaded with a large proportion of the same sort of salt."

Lind attributed the effect to solution of the lead glaze of the vessel by the acids in the juice, a fact previously observed in relation to vinegar, cyder, and Rhenish and Moselle wines, and classically as the colic of Poitou. He argued that such earthenware vessels were unsuited to the purpose and advised that

"the most proper vessels for preparing the inspissated juice of lemons, oranges or any other acid fruits, are, first, porcelain, or china ware. The substance of these is of so close a texture, that no saline or other liquor can penetrate them. The glazing, which is made likewise of the substance of the china is so firm and close, that no salt or saline substance can have the least effect upon it."

He also considered as equally suitable the stone ware commonly called Staffordshire.

Thirteen years later on the 29th day of June, 1767, before the College of Physicians in London, Dr. George Baker (later Sir George Baker, Bart.) read *An Essay concerning the Cause of the Endemical Colic of Devonshire*, the earliest account of which had been published in 1703 under the title *Dissertatio de Arthritide Symptomatica* by Dr. William Musgrave. Baker in his review of the subject referred particularly to Dr. Huxham's *Opusculum de Morbo Colico Damnoniorum* published in 1739, in which it is recorded that :

"In the beginning of the Autumn 1724 it (the colic) spread itself over all the county of Devon, among the populace especially, and those who were not very elegant and careful in their diet ; and that, though it may not rage with the same degree of violence, and may affect a vastly less number of people, yet it infests that county more or less every Autumn."

Dr. Huxham was of opinion that the cause of the Devonshire colic was "a very gross, essential acid salt, or tartar, with which the expressed juice of apples, whilst unfermented, abounds". His explanation of the symptoms is of no little interest.

"By long and frequent drinking a liquor of this kind, such a quantity of crude, gross tartar is thrown into the blood, that it thence becomes very acrid ; and not only the blood, but, from that impure source, all the humours thence secreted. So that instead of a very soft, lubricating mucus separated by the glands, discovered by Dr. Havers, we have as it were a sharp, coagulated matter, whence arises a great pain in the joints, and impotence of their motion. Instead of an exceeding soft lymph to moisten the nerves, a corrosive ichor ; and hence epileptical attacks."

Baker dissented from these views and asserted that the colic was precisely the same disease, which is the specific effect of all saturnine preparations. He suspected that the disease was not in pure cyder but in some, either fraudulent or accidental, adulteration.

As an index of the incidence of the condition, Baker cites Dr. Andrew of Exeter who gives the following numbers of patients admitted to the hospital at Exeter for treatment of the disease.

September, 1762, to September, 1763	..	72
September, 1763, to September, 1764	..	75
September, 1764, to Lady Day, 1766	..	86
Lady Day, 1766, to July 6, 1767	..	52
		<hr/> 285

Dr. Andrew adds that "the most violent symptoms of this disorder, such as pain and costiveness, are generally removed, before the sick are brought to the hospital ; and that nothing commonly remains but a paralytic weakness in the arms".

After a series of chemical investigations Baker concluded that the mischief arose in the vats.

"The large circular trough, in which the apples are ground, is generally composed of several pieces of moor-stones, cramped together with iron, some melted lead being poured into the interstices. It frequently happens that these stones, which are thus to be joined, are unequal, and do not correspond with each other ; so that considerable chasms are filled up with lead. In this case the apples, ground by the pressure of the roller, immediately come in contact with no small quantity of this poisonous mineral."

Dr. Thomas Percival, perhaps best remembered for his work on the Manchester Board of Health, in 1773 added to the literature on lead poisoning. He emphasized that the deleterious effects were not confined to man but affected quadrupeds and birds. Furthermore he cited several cases in which he was of opinion that the disease had resulted from external applications of such medicaments as extractum saturni of Goulard and saccharum saturni. He also observed and collected the experience of local practitioners on the occurrence, symptoms and treatment of the *colica pictonum* among Derbyshire lead miners—particularly smelters—and among the manufacturers of white and red lead works in Sheffield. A practitioner of Bakewell in Derbyshire contributed the following account :

"The men first complain of a weight, pain of the stomach and costiveness, which are generally relieved, if they apply early for advice, by a vomit, and pills of soap, rhubarb and aloes : or by any aperient medicines of the liquid kind, with oil added to them. But if these symptoms be neglected, the patients complain of their saliva becoming sweet, of clammy sweats, lassitude, feebleness of the legs, a total loss of appetite, obstinate costiveness, and a fixed pain in the abdomen, with severe retchings. In this stage of the disorder, oily clysters and gentle purgatives are the most effectual remedies ; and are usually repeated at short intervals, till the stools assume a natural appearance. For during the disorder they are hard, dry and scaly like bran. The oleum ricini has of late been used with great success."

Both as a prophylactic and as a remedy in slighter cases of the *colica pictonum* Percival recommended small frequent doses of alum, from which he had observed good effects. The following is of interest :

"In Derbyshire, when miners or smelters of lead find themselves affected with the asthma they usually leave their occupation for a while, and work at the lime kilns, experience having taught them that the fixed air, or *mephitic*, arising from the calcination of lime stone, is an effectual and speedy remedy in this disorder . . . Men employed in burning lime are remarkable for their health and longevity. This observation is the result of more than thirty years' experience ; and perhaps may corroborate the popular opinion, that in consumptions of the lungs it is good to live near places where this process is carried on."

In view of this reference to asthma, which might suggest the occurrence of fibroid phthisis or silicosis, it may be worth while noting that the lead ore in Derbyshire occurs in limestone strata.

Dr. Rotherham of Newcastle-upon-Tyne in a letter to Percival recounted his experience of lead poisoning among lead miners and smelters in Hexham, where he had formerly practised. The workmen knew the disorder as the mill-reek. The effluvia rising from the works caused the bellow in cattle and, as he records, neither dogs, cats nor poultry could thrive in the neighbourhood of the mills.

A letter headed Manchester, October 27th, 1678, from Dr. John Carte to Dr. Grew and extracted by Percival from Dr. Hooke's *Philosophical Experiments* published by Mr. Derham, F.R.S., gives an account of a distemper which was very common among workmen employed in smelting mills, that is the houses where they melt the lead down from the ore, in Derbyshire. The account is a description of the belland as it affected men and other creatures.

In the course of his investigations Percival made a series of experiments. He records that "the very beautiful polish of the Burslem pottery, commonly called the Queen's ware [the most celebrated domestic tableware (earthenware) made by Wedgwood], inclined me to suspect that lead, which is easily vitrified with sand and Kali, enters into the composition of its glazing". After a series of tests he found that lead was an ingredient in the glaze. The amount, however, was small and so he concluded :

"The present experiment, therefore, furnishes no objection to the common use of this beautiful pottery ; but it shews that vessels of it are improper for the preserving of acid fruits and pickles."

Almost simultaneously Dr. Gouldson of Liverpool published a pamphlet on the subject of "earthen-ware Glazed with Lead".

Wedgwood (1773) in his letters to Bentley alludes to these papers. While Queen's ware was exonerated from blame he felt that "when ignorant people read an account of lead and poison and Queen's ware in the same paragraph they might associate the ideas together ... and never after see one of our plates without the idea of being poisoned by it". However, he decided not to engage in controversy with the learned doctors but on a wiser course : "I will try in earnest to make a glaze without lead, and if I succeed will certainly advertise it".

And so from these now remote days down through the centuries medicine has continued indivisible ; the quest for the cause of disease towards its ultimate prevention ; the alleviation of the effects in the patient ; the investigation of the related environmental and social problems and always, as enunciated by Dr. Huxham, "sine experientia, vana omnis theoria, bella sit utcumque". Finally there is the unique contribution, as here illustrated, of the general practitioner, who, close to the people, has unlimited opportunities to advance the frontiers of medical and social science to the well-being of all.

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