# THE FORGOTTEN SPAS AND MINERAL SPRINGS OF SOUTH-EAST SOMERSET

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Provincial spas developed at the end of the 16th Century as places where the wealthy could gather, often in a rural setting, without being constrained by the conventions which normally governed their behaviour. A number of mineral springs in south-east Somerset achieved brief fame in the following centuries for the medicinal properties of their waters. There was such a rush to Alford Spa, near Castle Cary, in the 1670s that there was insufficient water to serve all the patrons; Horwood Spa, near Wincanton, had its own bank in 1809 although the enterprise was bankrupt by 1819. At East Chinnock, near Yeovil, a salt spring, the water from which contained about 6000 mg/l of NaCl, was used for salt making until at least the mid-19th Century. Many of these springs are derived from the Lower Lias where water quality is generally poor and where mineralised waters are liable to be encountered in any well sunk into the clays. The East Chinnock waters are believed to originate from the Inferior Oolite and may contain a component dating from the Pleistocene.

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## INTRODUCTION

During Roman times extensive use was made of mineral and thermal waters for public bathing. In Britain baths were constructed at Bath (Aquae Sulis) and Buxton (Aquae Arnemetiae), where thermal springs were developed and both became the location of Roman settlements. As the Roman Empire declined, buildings were neglected or destroyed and the baths were only used by local people. During the Middle Ages, their use was actively discouraged and the Christian Church denounced the warm bath as sinful (Hembry, 1990).

Additionally, for perhaps thousands of years, certain non-thermal springs and wells had been places of pilgrimage. Many sulphurous springs were believed to have mystic or curative properties and the red iron staining associated with chalybeate springs was associated with blood and death. Such sources were often adopted by the church becoming holy wells perhaps dedicated to a saint or to the Virgin Mary. Holy wells are widespread in south-west England and some hundreds have been described from Cornwall (Quiller-Couch and Quiller-Couch, 1894), Devon (Faull, 2004) and Somerset (Horne, 1923).

At the Reformation holy wells were suppressed, as they were associated with the Catholic past, images were removed and wells sealed. However, it was soon clear that, although shrines could be pulled down, it was less easy to dam the flow of springs. Additionally wealthy individuals, especially Catholics, who were denied the opportunity to take the waters at "home" migrated to the continent to do so. The government became concerned that they were providing an excuse for Catholics to congregate at Spa, in Belgium then under the control of Spain, where a potential column of English dissidents was being formed (Hembry, 1990). So, for reasons of political expediency and because people were reluctant to abandon their use of holy wells for the cure of illness, an accommodation was reached and the policy of prohibition was abandoned. By the rein of Elizabeth I (1558-1603) a new approach allowed the bathing in, and drinking of, waters. So began the development of the provincial "spa" where the wealthy could gather, often in a rural setting, without being constrained by the conventions which normally governed their behaviour.

By Stuart times taking the waters had become an accepted social fashion and spas were patronised by royalty and the court. The practice of going to spas does not seem to have been diminished by the Civil War but it was after the Restoration in 1660 that the number of spas proliferated. After Catherine of Braganza, the wife of Charles II, began visiting Bath or Tunbridge Wells as a cure for her sterility, the vogue for visiting spas became almost universal with every social rank catered for by different establishments.

Overall the south-west of England missed out on the boom in spa-building which followed. Although chalybeate springs with potential for development existed in abundance in Devon and Cornwall no such development took place. The primary reason for this was the isolation of this part of England in the late 17th Century, when wheeled traffic was still rare and journeys were undertaken on horseback. Celia Fiennes, who travelled through Devonshire to Lands End in 1698, found that the lanes narrowed progressively until even single horses sometimes had difficulty in getting through them (Morris, 1947). For similar reasons the two counties missed out on later spa booms and the only mineral water source known to have been developed commercially for medicinal purposes was the Victoria Spa in Plymouth where groundwater with a total dissolved solids concentration of around 17,350 mg/l was pumped from a 360 ft (110 m) borehole (de la Beche, 1839).

The situation in Somerset was rather different because of the occurrence of thermal waters at Bath in the north of the county. Even travel to Bath was difficult in the 17th Century and it was to be some years before the primitive medieval town became a Georgian city. However, the visit of Charles II and his queen in 1663 secured the patronage of the upper classes and facilities gradually improved. Bath waters were noteworthy for improving long-standing gout but unfortunately a side effect of their use was constipation. In consequence other springs within range of the town, which had aperient (purging) properties, were developed to relieve the consequences of drinking Bath waters! One of these was at Alford in south-east

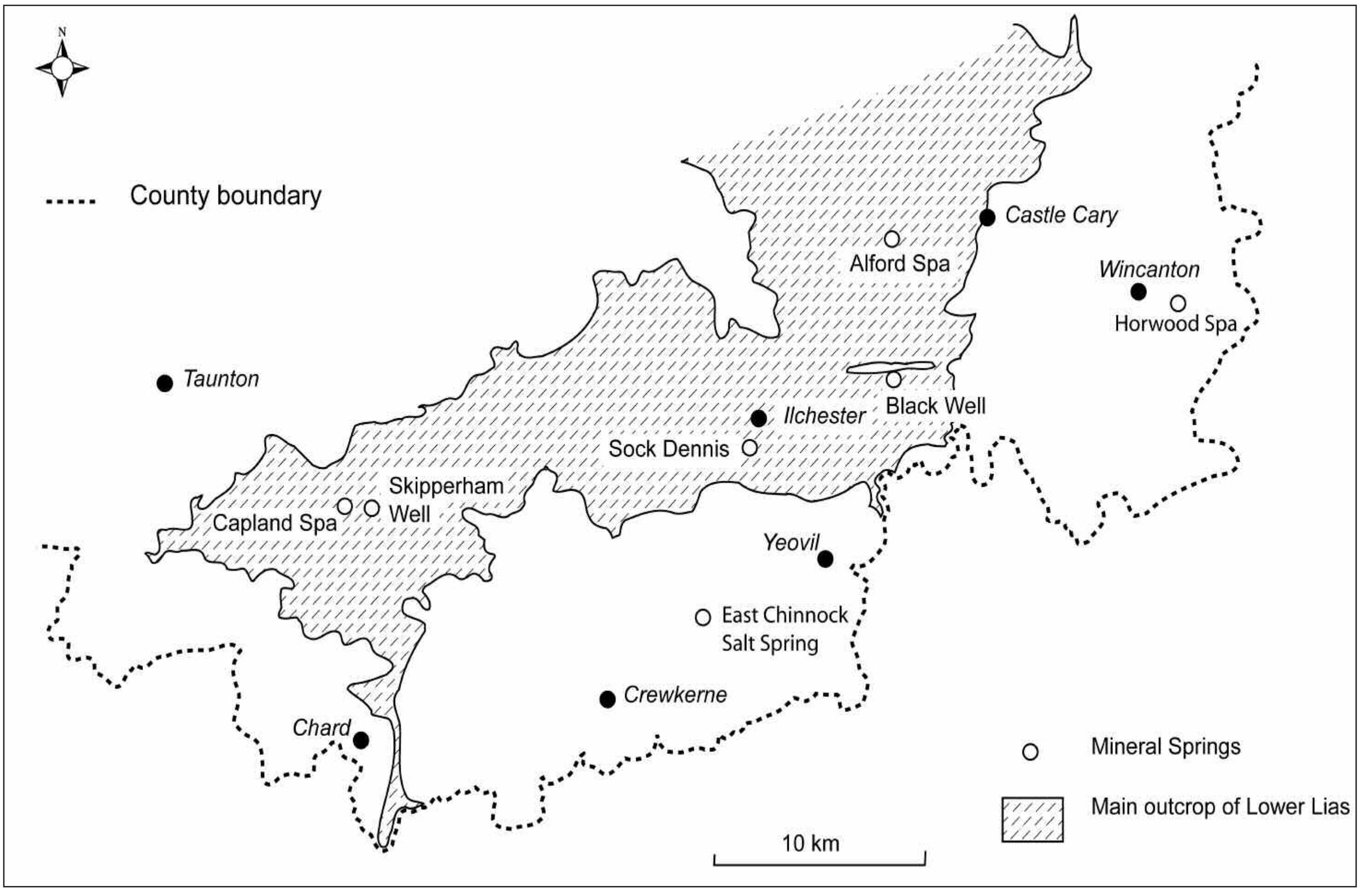


***Figure 1.*** *Map of south-east Somerset, showing mineral springs and the main outcrop of the Lower Lias.*

Somerset. Some other chalybeate mineral springs in the area also achieved brief fame at this time. A further surge in spa building occurred between 1800 and 1815, when war closed the Continent to English visitors, and during this period two additional small spas were promoted in south-east Somerset. A saline water issuing from the Inferior Oolite near Yeovil might also have been developed as a spa. Instead it was used for the production of salt, possibly dating back to medieval times.

The present paper briefly reviews the history and development of seven mineral water sources in south-west Somerset. The geochemical characteristics of these waters depends essentially on the mineralogy of the underlying strata and the water/rock interactions which take place as recharging groundwater moves towards zones or points of discharge. Particular attention is paid to the geological setting of the seven springs and wells. Use is made of historical water quality data to assess the source of the mineral waters and the reasons for their distinctive geochemistry.

## Late 17th Century spas and mineral springs

### *Sock Dennis*

The earliest known reference to mineral waters in south-east Somerset dates from 1666, in a letter from a Yeovil doctor, John Beale, to the Royal Society (Beale, 1666). In his letter he makes reference to a large pool in pastures at Socke about 5 km from Montacute (Figure 1) much frequented by pigeons but avoided by cattle. According to Beale it was "…. not only brackish, but has other loathsome tastes" (Beale, 1666 p.323). He boiled the water and sent a sample of the scum, a vitriolate salt (metal sulphate), which was produced to the publisher of the *Philosophical Transactions*, not a gesture that many current publishers would welcome! He elaborated further on this water in 1670, identifying the location of the pool as Sock-Denis (now Sock Dennis) about 7 km north-west of Yeovil (Beale, 1670). The water was clearly in use as he records that one winter he sent for a quart bottle. The water was thick and blackish and smelt a bit like "…gunpowder newly inflamed" (Beale, 1670 p.1163). There is still a pond at Sock Dennis, 150 m from the farm (Grid reference, ST 518 214), but no subsequent record of its use for medicinal purposes.

Sock is a local word, which describes a marsh or boggy area adjacent to a stream and there are a number of Sock farms on the Lower and Middle Lias outcrops north of Yeovil. Collinson (1791) wrongly equates the pond described by Beale with a similar pond at Sock Farm, Mudford which is 3.5 km due north of Yeovil (ST 558 192) and this error is repeated in the Water Supply Memoir (Richardson, 1928).

### *Alford*

The most famous of the 17th Century south-east Somerset spas was at Alford about 3.2 km west of Castle Cary (ST 608 317; Figure 1). The mineral spring was first discovered by Thomas Earl, a local minister, in 1670 when he observed pigeons flying there in great numbers (Rutty, 1757). The water was saturated with salt, which it deposited like a sediment as it flowed away into the highway (Rutty, 1757). Because of its strong purging effect and its relief of constipation the water was initially much in demand. A trade in the waters had been developed by 1676, probably by Robert Pierce of Bath, and its waters were distributed as far as Bath, Exeter and Plymouth (Hembry, 1990).

The spring was visited by Celia Fiennes in around 1685. Celia travelled extensively and was an authority on English and Welsh spas. Her opinion of Alford was not favourable and she recorded in her journal "Thence to Alford…where was a mineral water which Company resorts to for drinking, formerly it has been more frequented than of late; many now send for them severall miles and have Beer brewed of them, there being no good accomodation for people of fashion, the Country people being a clounish rude people; the waters are mostly from Alom, it's a clear little well and a quick spring, the bottom of the well has a sort of blewish Clay or Marle; it's a quick purger good for all sharpe Humers or Obstruction" (Morris, 1947). Her remarks show why Alford failed to become an established spa, it was too isolated with a lack of lodgings for fashionable people and an unappreciative local population.

The fall in popularity of the spring, recorded by Celia Fiennes, is possibly related to an incident recorded by Robert Pierce and quoted by Rutty (1757) as follows "….it was much resorted to until the promiscuous use of it, without due preparation, care and caution, rendered it injurous to some consumptive persons (who dying almost on the spot) the reputation of it sunk, but unjustly." (Rutty, 1757 p.130). Despite this the waters continued to be used at least until 1776 (Osborne and Weaver, 1996) although by 1791 it had become neglected (Collinson, 1791).

Accounts suggest that when first developed this source was a spring, which flowed away over the highway. The flow appears to have been weak and soon after the spring's discovery there was insufficient water to serve the patrons (Richardson, 1928). The description of Celia Fiennes and other later accounts talk about a well (Collinson, 1791; Horne, 1923) and it may be that a well was dug at the site of the original weak spring to provide storage.

Geochemical data for the water are sparse and there are no modern analyses. Benjamin Allen (1699) reports a colorimetric analysis and other analyses are summarised by Rutty (1757). Of particular interest is the range of concentrations obtained by early analysts. Guidott (reported by Rutty, 1757) measured a total dissolved solids concentration of almost 6 drams per gallon (equivalent to 5000 mg/l) in *c*.1690, whereas Rutty himself obtained only 2 drams from a gallon (1700 mg/l).

By 1791 the "mineral spring" was enclosed in a locked shed at a farmhouse called Alford Well (Collinson, 1791). According to Horne (1923) prior to 1912 the well stood open in the farmyard but was then closed over and a meal-house built above it, however, it was again open when visited some 10 years ago (Osborne and Weaver, 1996). In September 2004, the well was readily located in the garden a short distance from the south-east corner of the house, which dates from around 1900 and is now called Alford Well Farmhouse. The well is lined with stone and covered by a metal grill (Figure 2). The diameter at the surface is around 1 m and according to the owner opens out to about 1.5 m in diameter with a total depth of around 9 m. At the time of the visit, the water level was about 1 m below the surface with a fluctuation over the year of about 0.3 m. The well can be readily pumped dry in about an hour but then takes about 3 days to refill. The water was apparently used for watering cattle during the drought of 1976.

***Figure 2.*** *All that now remains of Alford Well; in the late 17th Century a much visited mineral spring with a powerful purging effect.*

## Queen Camel

A medicinal spring at the small hamlet of Wales, between Queen Camel and West Camel about 10 km north-north-east of Yeovil (ST 590 249; Figure 1), is also referred to by John Beale who thought that the foetid black waters had received their colour and odour from "subterranean steames" (Beale, 1670 p.1163). Known as the Blackwell, perhaps because a silver coin dropped into it rapidly became black, it seems to have been almost as famous as Alford in the late 17th Century. Queen Camel was visited by Celia Fiennes after she left Alford (Morris, 1947) and although she does not mention taking the waters it seems very likely that this was the reason for her visit. Benjamin Allen (1699), records a cold spring with the smell and taste of a foul gun. The water did not have the purging properties of Alford but was thought suitable to be taken both inwardly and outwardly for the treatment of the Kings Evil (a disease with glandular swellings, probably a form of tuberculosis).

Rutty carried out further experiments on the water in 1750, when he measured a total dissolved solids concentration of 915 mg/l, with "sulphur in considerable quantity" (Rutty, 1757 p.448). At this time there was a reservoir for the water, built for bathing and where dogs were cured of the mange (a skin disease caused by parasitic mites) by dipping. The spring is mentioned by Collinson who notes the offensive smell, "much like that of burnt gunpowder mixed with common water" (Collinson, 1791 vol 2 p.75). Horne (1923) reported that water comes up into a substantial stone tank from where it overflows into the River Cam. Water was still apparently "taken away in casks to be used for medicinal purposes, as analysis shows it is similar in composition to Harrogate waters" (Horne, 1923 p.34). When visited by Richardson in May 1925 there was a dip well through a rectangular hole cut in a large flagstone supported on stone blocks. The well was partly filled up with sediment with a strong smell of hydrogen sulphide (Richardson, 1928).

When the well was visited in 2004, it was difficult to recognise the description provided by former writers. It is marked on the 1:25000 Ordnance Survey map and a prominent sign by the side of the minor road from Queen Camel to Wales marks its location. The steps down to it have eroded away and little of the stone tank remains. Water can be seen welling up into the River Cam at the foot of its northern bank and there is a faint smell of hydrogen sulphide and traces of a white precipitate, probably calcium sulphate. However, the spring has been largely reclaimed by nature.

## Skipperham

This well lies 5.3 km north-north-east of Ilminster, 500 m south of Keysey Farm (ST 328 188; Figure 1). Called Skipperham Well on the Ordnance Survey 1:25 000 sheet it has been referred to by a number of names such as St Nipperham's, Skivern's and Skiverton's (WLR, 1917). These are either taken to be corruptions of St Cyprian or to be derived from an anglicised pronunciation of the French "puit s'esquiverant", meaning "ebbing well" (WLR, 1917).

The "well" is in fact a spring and an account of it, complete with a qualitative analysis using various reagents and indicators, is given by Collinson (1791). Evaporation of a pint of water deposited 5 grains of sediment, which is equivalent to a total dissolved solids concentration of about 570 mg/l. The water ebbed and flowed daily, was light grey in colour and slightly chalybeate. Annexed to the spring was a bath and the water was used to treat "scorbutic eruptions" (spots or rash resulting from scurvy) and for bathing the eyes (Collinson, 1791; WLR, 1917). Well into the 20th Century local people assembled at the well during the first three sundays in May to play games and bathe their eyes (WLR, 1917; Horne, 1923). At the beginning of May springs are generally full of water and in many parts of Britain they were visited and/or decorated at this time, perhaps to ensure their continuing flow during the drier summer months.

Although Skipperham has been included with the late 17th Century spas it is likely to be much older. The May celebrations and the association with the eyes suggest an ancient source dating back to early Christian times and beyond.

When visited in 2004 the spring was much as described by WLR (1917). It is confined within a 0.7 m square surround of dressed slabs of Blue Lias limestone. The well, described in 1917 as 3 ft (1 m), in depth is now filled with ballast. A substantial flow of slightly chalybeate water wells up from two areas within the ballast, corresponding to water bubbling up through two fissures as noted by WLR (1917). Water flows away to the west, beneath a disused railway line, into the northward-flowing Venner's Water.

## Geology and hydrogeology

All the four sources described above are derived from the two lower members of the Sinemurian Charmouth Mudstone Formation, previously known as the Lower Lias mudstones. The type sections of these two lower members are exposed in cliffs between Lyme Regis and Charmouth on the Dorset coast. The lower member, the Shales-with-Beef Member, is about 30 m in thickness and comprises thinly interbedded organic-rich and organic-poor mudstones with numerous thin beds (0.02 to 0.2 m thick) of fibrous calcite or "beef". Thin discontinuous limestone beds occur at a few levels (Hesselbo and Jenkyns, 1995; Edwards and Gallois, 2004). The overlying Black Ven Marl Member is about 42 m in thickness and consists of calcareous and non-calcareous mudstones with several laterally persistent tabular limestone beds and horizons of concretionary limestone (Edwards and Gallois, 2004).

Observations by one of us (HCP) show that the farm at Sock Dennis is situated on the upper beds of the Shales-with-Beef Member. At Alford extrapolation from sections found to the north along the River Brue (Hollingworth *et al.*, 1990) and the old Great Western Railway (Woodward, 1905) together with observations at the Dimmer Landfill Site to the south (ST 612 313) suggest that Alford Well is located on the lower beds of the Black Ven Marl Member. The source of the mineral springs at both Queen Camel and Skipperham is less clear cut, as the local sequence is complicated by faulting. However, in both cases it seems likely that the springs issue from the Shales-with-Beef Member.

The Charmouth Mudstone Formation forms flat-lying ground, with the water table often close to the surface, where ponds and boggy areas are common. The source at Sock Dennis is simply a farm pond, which has intersected a shallow water table. The three other sources are, or at one time were, springs. The spring at Queen Camel is some 200 m to the south of the western extension of the Mere Fault. This fault brings to the surface rocks of the Triassic Penarth and Mercia Mudstone groups which form Camel Hill whose highest point, some 50 m above the level of the River Cam, lies 1 km to the north of the Blackwell. Skipperham Well lies close to a possible extension of the NW/SE trending Hatch Fault. Speke's Hill, whose summit is about 18 m above Skipperham Well, lies to the south east. Particularly at Skipperham, the position of the spring could be fault controlled. Alternatively the proximity of faults could be coincidental and at both Queen Camel and Skipperham the springs could be simple manifestations of the groundwater baseflow component to the local rivers, with topographically generated higher heads resulting in visible discrete spring flows.

The origin of the spring at Alford is more difficult to explain as the site is surrounded by flat ground. Woodward (1905) reports that "To the west of Alford Well Farm…gravel lies in irregular pockets on the Lias clay, and it is covered with a comparatively stiff clay 5 or 6 feet thick, which fills inequalities in the gravel" (Woodward, 1905 p.163). He explained these features by slippage of masses of clay over the gravel but could not explain how this occurred. Such features are now thought to be the result of solifluction and it is possible that some of these small gravel pockets gave rise to springs. Yields would have been poor and storage limited and could account for the need to replace the spring with a well soon after it began to be exploited.

Although geochemical data on the groundwaters are limited only Alford appears to have been a true mineral spring. The other three sources all have total dissolved solids concentrations below 1000 mg/l and are variously described as like "gunpowder newly inflamed" (Sock Dennis) and "with the smell and taste of a foul gun" (Queen Camel). These latter sources are all reduced groundwaters containing dissolved iron and can be described as mildly chalybeate. Once exposed to the atmosphere the ferrous iron in solution is oxidised to ferric iron, which precipitates forming an orange-brown slime. Hence these waters do not travel well and are suitable only for local consumption. The lack of local facilities explains why none of them achieved national fame. Although two sources may be associated with faults there is no suggestion that these groundwaters originate from deep-seated sources. Medicinal waters like these occur throughout the Lower Lias outcrop and Richardson (1928) noted that the Lower Lias clays were a notoriously bad source of water with the widespread occurrence of mineral waters, the most famous of which are those of Cheltenham Spa (Richardson, 1930).

| **Geochemical species** | **Mudford Sock** | **Horwood Spa** | **East Chinnock Salt Spring** |
|---|---|---|---|
| Calcium | 366 | 433 | 104 |
| Magnesium | 120 | 758 | 34 |
| Sodium | 444 | 2458 | 2290 |
| | | | |
| Bicarbonate | 464 | 2020 | 292 |
| Sulphate | 1612 | 6934 | 78 |
| Chloride | 245 | 495 | 3536 |
| Nitrate | About 14 | | |
| Organic matter | 256 | | |
| Reference | Buckman (1868) | Richardson (1928) | Richardson (1927) |

***Table 1.*** *Geochemical analyses of southeast Somerset mineral waters, concentrations in mg/l. These are recalculated from old analyses published as hypothetical compounds.*

Alford differs from the other sources in its greater concentration of dissolved solids and the purging nature of the water. Although no quantitative data exist for Alford an analysis of groundwater from a well in the Charmouth Mudstone Formation at Sock Farm, Mudford (Buckman, 1868) has a similar concentration of dissolved solids to Alford (Table 1). The groundwater is severely contaminated, with a concentration of organic matter approaching 260 mg/l, nevertheless it provides some general idea of the likely composition of Alford water. The analysis is similar to some of the Cheltenham Spa wells (for example, see Richardson, 1930 p.214) and with its high concentrations of sulphate, bicarbonate, calcium, magnesium and sodium would have a diuretic effect (increased passage of urine) and an aperient effect (relief of constipation) ranging from laxative to purgative depending on dosage.

The compositions of all these Lower Lias waters can be explained on the basis of simple water/rock interactions, involving the dissolution of common minerals such as gypsum and calcite, together with residence time. Through cation exchange an increase in residence time will increase the concentration of species such as magnesium and sodium at the expense of calcium (Mather, 1997).

## Early 19th Century spas

### *Horwood Spa*

Collinson (1791) records the presence of a mineral spring on Horwood Common about 1.6 km west south-west of Wincanton (ST 728 279; Figure 1). This was one of at least thirteen such springs, which were developed into spas between 1800 and 1809 as war closed the Continent to English water pilgrims (Hembry, 1990). On the basis of a publicity pamphlet, which contains recommendations dating from 1805 and which had run to ten editions by 1807 (Anon, *c.*1807; Hembry, 1990), the transformation from mineral spring to spa probably took place around 1804 to 1805. Prospects must have seemed good as, unlike Alford, Wincanton had a good economic base for a spa. It was on the Bath to Weymouth road, with a direct coach service to London and several inns. In addition, it was financed by the Messiter family, led by Richard Messiter the most eminent barrister in Somerset at this time (Hembry, 1990).

A two-storey limestone villa was built over the spring with a sunken bath serviced by a pump from a cistern beneath a large central public room. At the side of the house a chapel, dormitories and stabling were available for patients (Anon, 1926; Sweetman, 1903). The water was bottled and transported to London where it was distributed from four separate warehouses (Anon, *c.* 1807). In 1806 French prisoners of war were held at Wincanton and were amongst the spa's patrons. In 1808, in order to service the clients, a banking house was established in a field a short distance away, which issued its own £5 notes (Sweetman, 1903). Despite these auspicious beginnings, prosperity did not last long. The bank stopped payments in 1810 and Messiter was declared bankrupt in 1819. By 1836 it was reported that the spa had fallen into disuse (Phelps, 1836).

Horwood Well House, later known as Physic Well Farm and now Physicwell House, is still a delightful place (Figure 3). The house looks much as it must have done in 1810 and the large ecclesiastical window in one of the outbuildings identifies the chapel, which catered for the needs of the soul some 200 years ago. Beneath the central public room, now used as a dining room, a large brick roofed cistern can be accessed via a 50 cm square wooden cover. The water level is about 80 cm below the level of the floor with a water depth of some 4.5 m. A standpipe about 5 cm in diameter once led to the pump by which water was transferred to a large sunken stone bath, which is still preserved beneath the floor of a small extension, perhaps at one time a lean-to at the back of the house. As late as 1924 this pump was still in position, and in working order (Richardson, 1926). Two additional stone-lined storage cisterns are also set into the ground above the house from where water could have been fed by gravity to the bath.

***Figure 3.*** *Physicwell House, near Wincanton, constructed around 1805 as Horwood Spa.*

According to Richardson (1926, 1928) the mineral water is derived from the "lower portion of the Oxfordian", which would now be mapped as the Middle Jurassic Kellaways Formation. This attribution was followed by Edmunds *et al.*, (1969) in their review of British mineral and thermal waters. Modern mapping (British Geological Survey, 1996) shows that, what is now Physicwell House, lies about 300 m to the south of the NE/SW trending Mere Fault on the Stewertby and Weymouth members of the Oxford Clay Formation (Figure 4). Lithologically these consist of calcareous, variably silty, shelly

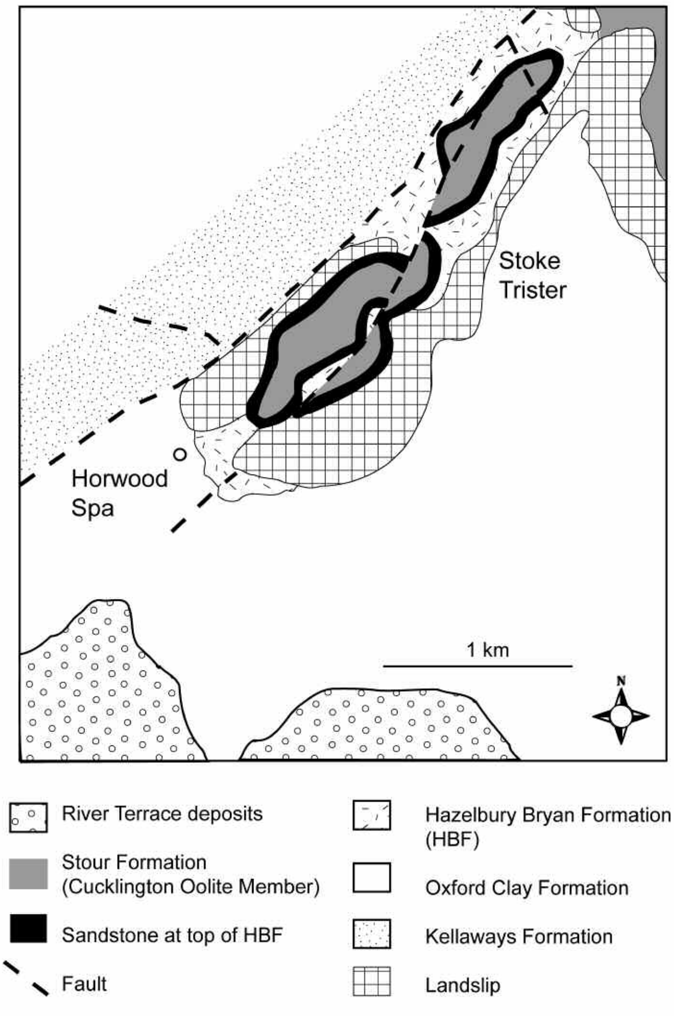


***Figure 4.*** *Geological map of the area around Horwood Spa (from British Geological Survey, 1996).*

mudstones with some very fine-grained sandstones (Bristow *et al.*, 1999). Locally, small quantities of groundwater have been obtained from shallow wells in the weathered zone but for water supply purposes the mudstones are regarded as a major aquiclude.

Immediately to the northeast of Physicwell House lies Coneygore Hill (Stoke Tristor) where an outlier of Upper Jurassic Corallian Group rocks overlies the Oxford Clay Formation and is mapped as encroaching to within a few metres of the house (Figure 4). Immediately overlying the Oxford Clay Formation is the Hazelbury Bryan Formation, which consists of clay and sandy clay. A series of sand units are present, one of which extends all the way round Coneygore Hill where it occurs at the very top of the formation. On the lower slopes of the hill, much of the outcrop of the Hazelbury Bryan Formation is obscured by landslips (Figure 4). The overlying Stour Formation consists of a series of alternating mudstones and limestones and one of these limestones, the Cucklington Oolite Member, caps the hill. These Corallian rocks are permeable and Bristow *et al.* (1999) record that the base of the Hazelbury Bryan Formation is commonly marked by weak springs.

On the basis of the modern mapping it is suggested that the source of the mineralised water is more likely to be the Corallian Group rocks rather than the mudstones of the Oxford Clay Formation. It is difficult to define the exact edge of the landslipped material and field observations suggest that this could be closer to Physicwell House than shown on the published map. The summit of Coneygore Hill is some 60 m above the site of the spa well providing the hydraulic head, which supported the original spring. This arose close to the junction of the Oxford Clay and landslipped Corallian rocks.

With a total dissolved solids concentration of some 13,140 mg/l, Horwood Spa water has a much higher salinity than the mineral waters from the Lower Lias considered previously. This is reflected in the directions for taking the water provided by the management who recommended "….half a pint, night and morning, about an hour before going to rest, and about an hour after breakfast:….so as to keep the body gently soluble, but not act as an aperient" (Anon, c. 1807). The hydrochemistry is dominated by magnesium, sodium and sulphate. Gypsum is common in the Hazelbury Bryan Formation (E C Freshney, personal communication) and is likely to be the source of the sulphate.

## *Capland Spa*

This spa lies in the small hamlet of Capland about 8.3 km north-west of Ilminster on the old turnpike road to Taunton (ST 302 190; Figure 1). Now bypassed by the A358 Trunk Road, the house can be identified by the name "Capland Spa" carved on the stone arch above the front door. According to Phelps (1836) the mineral water was "discovered" in 1820 when a well was dug at the site, however, Hembry (1990) puts the date somewhat earlier as 1815. The spa was apparently well frequented and water, which was said to be as effective as that from Cheltenham, was sent around the country (Phelps, 1836). At one time the water was evaporated and "salts" made in a "salt house" at the site (Richardson, 1928).

The spa seems to have fallen into disuse when its owner died in 1856. However, Ussher (1906) reports that, as late as 1874, H. B. Woodward was told that people still visited the well. The name above the front door is all that remains of the Georgian spa; the well was filled in before 1928 (Richardson, 1928) and the salt house has been demolished.

The well penetrated 3 m of a strong yellow clay followed by 7.6 m of blue marl. Adjacent road works on the A358 suggest that the well was sunk into the lowest member of the Charmouth Mudstone Formation, the Shales-with-Beef Member. As such its geology is similar to the late 17th Century spas discussed earlier and it is in fact only some 2.7 km due west of Skipperham Well. Water was encountered in the well at about 9 m below ground level and did not rise any higher (Phelps, 1836).

On evaporation the water yielded some 8 lbs of crystals from a hogshead, which is equivalent to a total dissolved solids concentration of around 14,800 mg/l. This is far higher than any of the other Lias Group sources and the water is about three times more saline than the highest concentration obtained for the Alford water. The high concentration explains why it was worth evaporating water at this site. According to Phelps (1836) the water corroded iron very fast and contained sodium, calcium and iron together with chloride, sulphate and carbonate. The crystals formed on evaporation were said to be similar to Glaubers salt (hydrated sodium sulphate, used chiefly as a laxative) and the water was described as a chalybeate aperient (Phelps, 1836). It would certainly have had a marked purging effect on the spa's patrons!

## **East Chinnock salt spring**

The salt spring at East Chinnock lies 400 m north of the old turnpike road linking Yeovil and Crewkerne, now the A30, about 10 km south-west of Yeovil (ST 482 130 Figure 1). The first record of the salt spring appears in a letter from a Sherborne doctor, Nathanial Highmore, to John Beale of Yeovil (Highmore, 1669). By evaporation, Highmore obtained 80 grains from a wine quart, equivalent to a total dissolved solids concentration of around 4500 mg/l. Beale later records that in a "very droughty summer I found it strong brine" (Beale, 1670 p.1162).

Collinson (1791) described the spring as forming a pool with reeds and aquatic plants. The spring "never fails in dry, nor overflows in wet seasons" (Collinson, 1791, vol. 2, p.327). From the pool narrow drains had been cut to a house where salt was made, presumably by evaporation. The proportion of salt in the water was about one fortieth part (Collinson, 1791). Phelps (1836) repeated Collinson's account, adding the results of some colorimetric tests which confirmed the presence of sodium chloride. Woodward (1894) refers to the salt house as "where common salt was formerly obtained in quantity" (Woodward, 1894, p.513), implying that it was disused by this time. By 1918 the spring was recorded as having gone completely out of use (Horne, 1923).

Richardson (1927, 1928) visited the spring in May 1925 when it was still running although it was not easy to obtain samples because of the marshy ground. An analysis of the water (Table 1) indicated a total dissolved solids concentration of 6236 mg/l of which 5832 mg/l was common salt.

The current Ordnance Survey 1:25000 map of the area (Sheet 129, Yeovil and Sherborne) dated 2004 still marks "Salt Hole" and "Spring" in a field about 200 m northeast of Barrows Hill Farm but there was no flow in 2004 and no evidence that such flows had occurred in the recent past. Sedges grow in the north-east corner of the field but anecdotal evidence suggests that the spring may not have flowed since the 1970s at the latest. To the west of the spring, behind a bungalow close to Barrows Hill Farm, is a flooded pit from which clays of the Middle Jurassic Fullers Earth Formation were worked in the past for making bricks and agricultural pipes. The lower part of the clay was so impregnated with salt that the pipes made of it would not burn and had to be discarded (Richardson, 1927). According to the owner water continually wells up from 6 springs at the base discharging water into an adjacent brook to the north. Water quality is apparently good.

According to Richardson (1927) in this area the geographic distribution of the Fullers Earth Formation, the underlying Inferior Oolite Group limestones and the Bridport Sands Member of the Upper Lias Formation is not easy to determine. However, from the current geological map it appears that the spring issues from the Inferior Oolite, which is likely to be in hydraulic continuity with the underlying Bridport Sands (Shand *et al.*, 2004).

The area around the salt spring is a block, bounded to the north by the east/west trending Coker Fault and by a parallel fault some 1.4 km to the south (Figure 5). A cross section of the block indicates that to the north the Inferior Oolite/Bridport

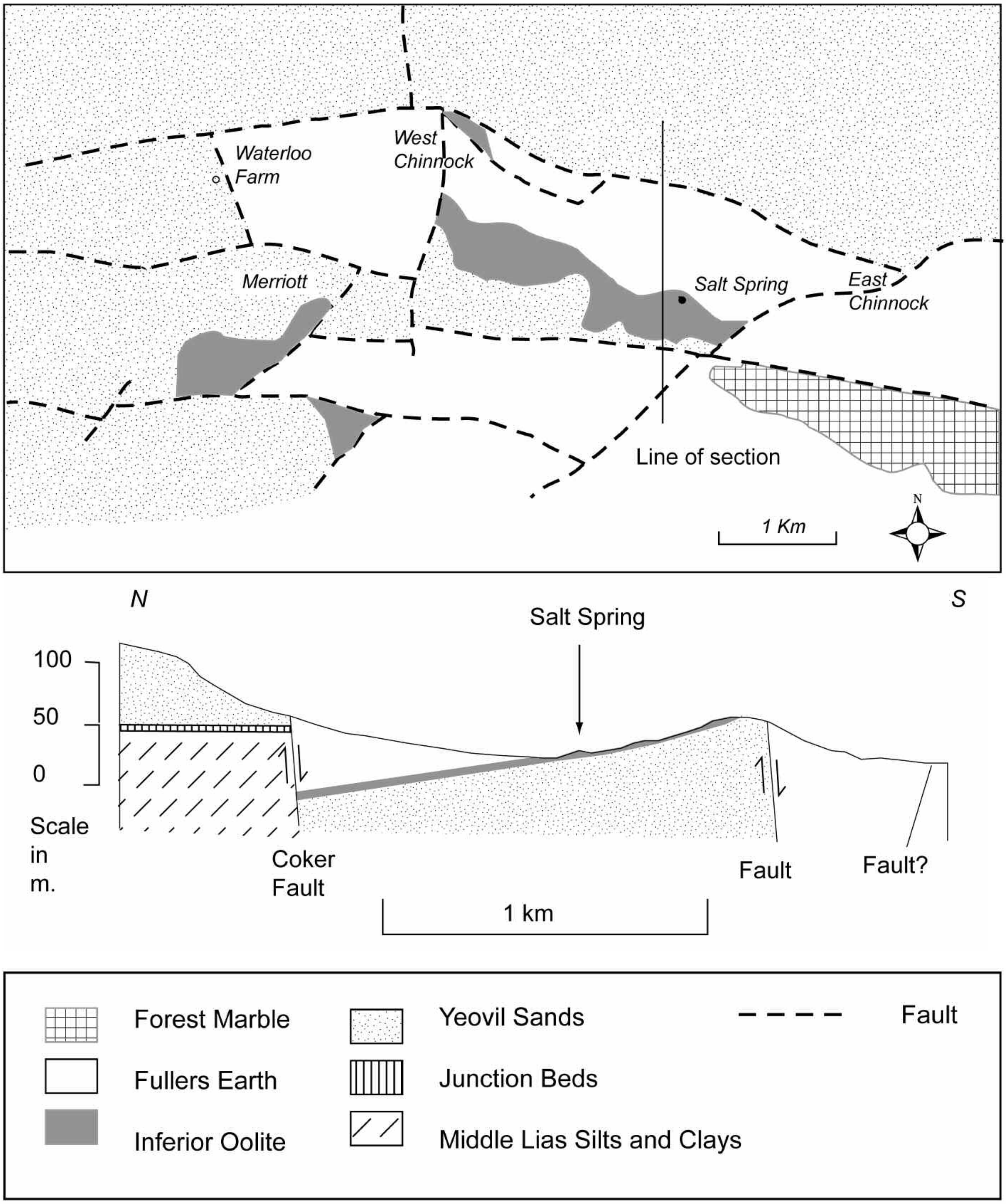


***Figure 5.*** *Sketch map and cross section of the geology of the area around the salt spring at East Chinnock.*

Sands are faulted against Lower Lias clays and to the south against the Fullers Earth clays (Figure 5). Thus within the block poorly permeable clays isolate the Inferior Oolite/Bridport Sands aquifer to both the north and south. Within the block to the east the aquifer is confined beneath the Fullers Earth Formation (Figure 5) such that groundwater recharge can take place only in the west. It is suggested that the original spring represented the natural discharge point for groundwater flowing eastwards within this block from this recharge area to the west.

Figure 6 shows an artesian borehole drilled within the block in 1967 at Waterloo Farm, Merriott (ST 441 139), some 5.2 km west of the salt spring. Development of the aquifer within the block, by this and other boreholes, means that the head at the spring has gradually reduced over the years until the spring has ceased to flow.

The composition of the spring water is very different from that of other mineral springs considered in this paper. Taking the composition of a Mercia Mudstone Group brine from Droitwich (Edmunds *et al.*, 1969) and diluting it 50 times gives a composition comparable to that at East Chinnock (Table 2), although the bicarbonate concentration is much higher in water from the salt spring. It is possible that saline groundwater has migrated from saliferous beds in the Mercia Mudstone Group at a depth of around –750 m OD, via one of the east/west trending faults that dissect the area. However, such an explanation is difficult to reconcile with the relatively recent drying up of the spring and does not entirely fit the geochemical data.

The hydrochemistry can also be explained in terms of a mixing model involving recharging water and much older groundwater held in storage. For example, in the Inferior Oolite of South Lincolnshire, the Lincolnshire Limestone is confined beneath clays to the east of its outcrop. Groundwaters are present, which have undergone considerable water/rock interaction and mixing, resulting in compositions very similar to that at East Chinnock (Table 2). Such groundwaters, containing a component of water of at least Pleistocene age, are not uncommon in the British Isles (Darling *et al.*, 1997). At East Chinnock such palaeowaters could have been trapped within the fault-bounded block and flushed out only slowly by modern recharge. Development to the west cut off this modern recharge, reducing heads and eventually drying up the spring.

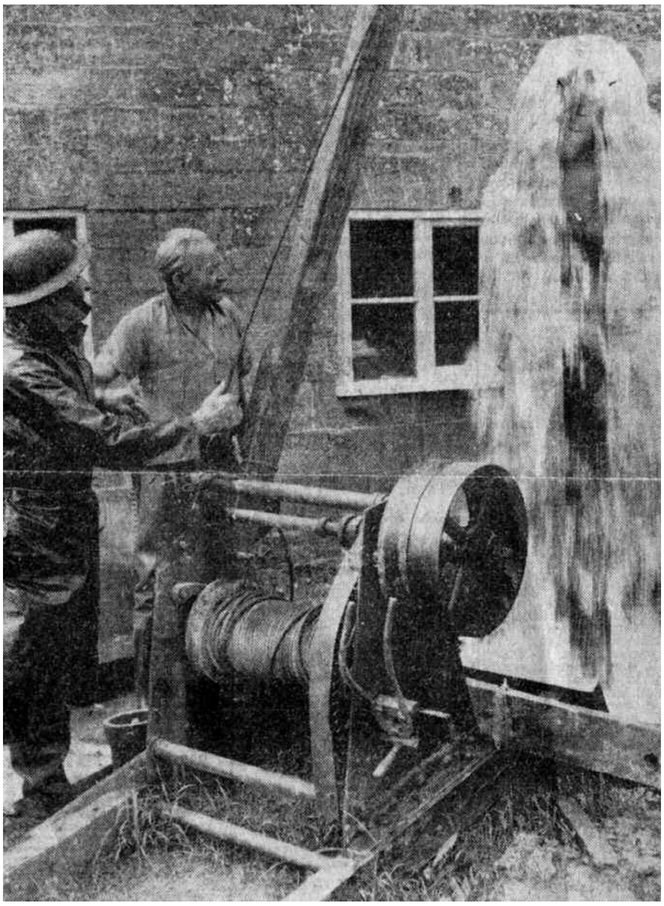

***Figure 6.*** *Newspaper cutting from 1967 showing an overflowing borehole at Waterloo Farm, Merriott.*

## CONCLUSIONS

From the end of the 17th Century a number of small mineral springs in south-east Somerset were developed for medicinal use. Many of these springs arise from the two lower members of the Charmouth Mudstone Formation. Although some are close to major faults, it seems likely that this is coincidental as their compositions can all be explained by straightforward interactions between groundwater and the poorly permeable clays.

Sock Dennis, Queen Camel and Skipperham are all chalybeate springs. Once exposed to the atmosphere they precipitate ferric iron and are therefore suitable only for local consumption. Alford has a greater concentration of dissolved solids and its purging properties made it a suitable antidote for the constipation which was an unwelcome side effect of drinking Bath waters. However, its isolation and lack of facilities meant that it never became an established spa.

The prospects for Horwood Spa must have seemed favourable as transport links were good, accommodation was available and a plentiful supply of mineral water was on tap. However, competition from the larger urban spas, the opening up of the continent and the newly emerged seaside resorts meant that it rapidly fell into disuse. The mineral water was derived from Corallian Group rocks at their contact with the mudstones of the Oxford Clay Formation.

Water quality at Capland Spa was probably similar to that at Alford as the mineral water was again derived from the Charmouth Mudstone Formation. Like Horwood, the spa rapidly faded, serving only local people who believed the mineral water could cure simple ailments.

The East Chinnock Salt Spring was never a spa but a valuable source of salt in this part of Somerset. Salt production finished before the late 19th Century and the spring ceased to flow around the middle of the 20th Century. The water is derived from the Inferior Oolite and is likely to contain a component of water of Pleistocene age isolated in a faulted block. Groundwater development in the western part of the block has reduced the hydraulic head resulting in the drying up of the spring.

| **Geochemical Species Salt** | **East Chinnock Spring** | **Droitwich Brine / 50** | **Lincolnshire Limestone saline water** |
|---|---|---|---|
| Calcium | 104 | 27 | 42 |
| Magnesium | 34 | 2.6 | 34 |
| Sodium | 2290 | 2414 | 2050 |
| Bicarbonate | 292 | 0.5 | 395 |
| Sulphate | 78 | 90 | 122 |
| Chloride | 3536 | 3711 | 3190 |
| Reference | Richardson (1927) | Edmunds *et al.* (1969) | Edmunds *et al.* (1989) |

***Table 2.*** *Comparison of East Chinnock Salt Spring with other published analyses, concentrations in mg/l.*

Mineral springs, such as those described, are dispersed over much of Britain and in the late 17th Century numbered over 400 (Osborne and Weaver, 1996). Their re-examination may yield information of interest to modern-day hydrogeologists as they seek to establish a natural baseline quality for British aquifers to meet the requirements of the European Union's Water Framework Directive (Ward *et al.*, 2004)

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