

Geology of the Bath area: Applied geology: hydrogeology

From Earthwise

[Jump to navigation](#) [Jump to search](#)

**This topic provides a summary of the geology of the Bath area - covered by the British Geological Survey
1:50k geological map sheet 265.**

Authors: A J M Barron, T H Sheppard, R W Gallois, P R M Hobbs and N J P Smith (BGS).

Geological factors have a significant influence on the activities of man and as such are major considerations for land-use planning and development. Consideration of earth science issues early in the planning process can help ensure that site and development are compatible, that local resources are not damaged or contaminated, and that any appropriate mitigation measures are taken prior to development. Potential geological hazards may present a public health risk or require costly remediation. Engineering ground conditions and designated sites of geological conservation strongly influence the location and design of any new development.

Hydrogeology

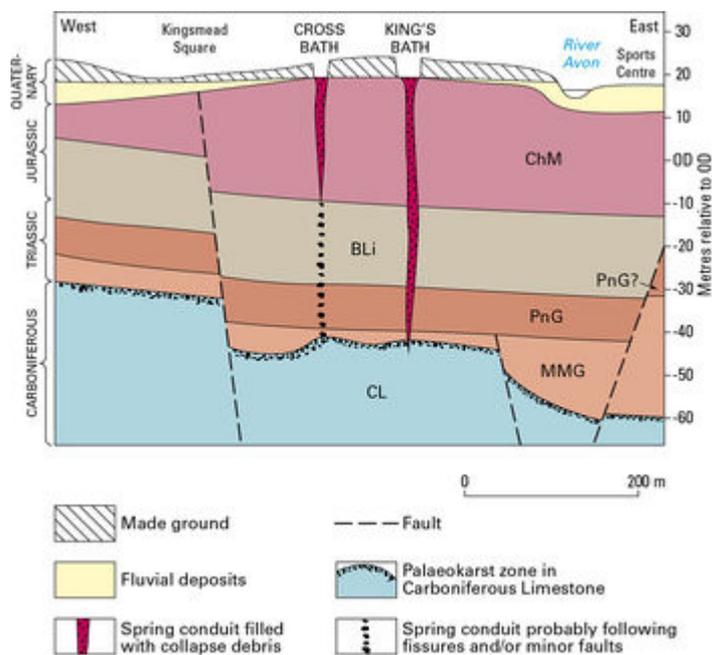
Several major aquifers lie within the district. These are rocks which have a high permeability and/or a known or probable presence of significant fracturing. The Carboniferous Limestone is a major aquifer with water flowing largely in fractures and voids, whilst the conglomerate and breccia of the Mercia Mudstone Group Marginal Facies form the only significant aquifer of Triassic age. Younger aquifers include the sand and sandstone of the Bridport Sand Formation, the limestone beds of the Inferior Oolite Group and Forest Marble Formation, the sandstone of the Lower Greensand Group, and most importantly the ooidal limestones of the Chalfield Oolite Formation. These rocks may be highly productive, and able to support large abstractions for public water supply.

Minor aquifers are rocks which do not have a high primary permeability but may host water in a series of variably-connected fractures. These include the Cornbrash Formation, the Kellaways Sand Member, limestone units in the Fuller's Earth Formation, the Blue Lias Formation and the sandstone units of the South Wales Lower and Middle Coal Measures, Pennant Sandstone and Grovesend formations. Whilst these aquifers are unlikely to yield enough water to sustain public water supplies, they are important for local private abstraction and in supplying groundwater to rivers and streams. The mudstone formations of the district, including the Oxford Clay Formation, Kellaways Clay Member, Fuller's Earth Formation, Charmouth Mudstone Formation, Penarth Group and Mercia Mudstone Group are regarded as non-aquifers. Whilst water flow through such rocks is small, some of these rocks can yield sufficient water for domestic use.

Superficial deposits within the district do not form good aquifers. Where they overlie a non-aquifer bedrock they may yield small quantities of water, but they tend to drain rapidly and are unlikely to support continuous demand. In comparison, superficial deposits above bedrock aquifers are commonly dry. Alluvium and river terraces adjacent to streams and rivers may support limited abstraction, although this will be at the expense of surface flow.

Major public supply groundwater abstractions from the Jurassic aquifers are found in the Malmesbury area, and surface water abstraction from the River Avon takes place in the region of Bath. These provide water to a large part of the district including the city itself. Abstraction has

raised concern about river levels in late summer, and as a consequence groundwater is used to support streams and rivers during low-flow periods. Details of groundwater and surface water abstraction and licences can be found in the Environment Agency CAMS (Catchment Abstraction Management Strategy) documentation for the Bristol Avon.



Cross-section showing the geological setting of the Bath hot springs. For key to bedrock units, see Geological Description. P785919.

Hot springs

The famous hot springs of Bath are one of only five groups of thermal springs in the UK, and the only that qualify as 'hot', emerging at a temperature of about 45°C with a combined flow of about 15 litres per second (Stanton, fig. 8.3 in Kellaway, 1991)^[1]. The King's, Cross Bath (**P785919**) and Hetling springs, all of which are found within a small distance of each other in the centre of the city, would in their natural state have risen to the surface through the Charmouth Mudstone bedrock and the terrace gravels of the River Avon. They were discovered by the native Britons, perhaps as long ago as 863 BC, when it is reputed that their healing powers cured a Celtic prince of leprosy. A shrine, dedicated to the local water goddess Sulis, was in existence at Bath at the time of the Roman conquest of AD 43; from this the Roman town derived the name Aquae Sulis. The Romans identified Sulis with their goddess Minerva, responsible among other things for medicine, and they first began to develop the bath-house complex soon after the conquest of Britain, possibly during the reign of the Emperor Claudius (AD 41-54). The baths fell into disrepair following the collapse of the Roman Empire, but were rebuilt in association with renewed interest in bathing waters during the 18th and 19th centuries (cover photograph). In 1810, the springs diverted and failed, and it was none other than William Smith who restored the water to its original course. Today, the springs and bath houses form a major British tourist attraction.

Like all the other British thermal springs, including Hotwells in the adjacent Bristol district, the waters at Bath are sourced in the Carboniferous Limestone Supergroup, which lies beneath the city at depths as shallow as 50 m below ground level (**P785919**). It is widely accepted that rainwater falling on the Carboniferous Limestone outcrop in the Mendip Hills, south of the district, descends to great depths in the Radstock Basin where it becomes geothermally heated, before rising beneath Bath and breaking through the aquiclude formed by the Mesozoic rocks. The nature of the conduit to the surface is more controversial: Andrews et al. (1982) favoured a fracture zone over a Variscan

thrust fault, and Kellaway (1996)^[2] suggested that the hot water escapes to the surface via fractures located over a deep-seated crustal lineament (the Avon–Solent Fracture Zone). However, seismic reflection surveys (McCann et al., 2002)^[3] failed to find evidence of the fracture zone beneath the city. Several boreholes have penetrated the Carboniferous Limestone in the area of the springs, of which two were sited adjacent to the hot springs (Kellaway, 1991)^[1]. In all cases, the upper part of the Carboniferous Limestone was found to be heavily karstified and affected by dissolution and the formation of large voids. This surface formed an exposed part of the post-Carboniferous (Permo-Triassic) land surface, which was subsequently overlain by mudstone-dominated Mesozoic strata (see Geological description). A number of faults (including possibly the eastward extension of the Pennyquick Fault) and fractures were propagated through the cover by post-Early Jurassic structural reactivation (**P785919**), and were exploited by the downcutting River Avon during the Pleistocene (Gallois, 2007)^[4]. Eventually this erosion brought the Carboniferous Limestone sufficiently close to the surface for the thermally-heated waters within it to escape. Once escape-pathways had become established the rate of flow would have increased, flushing fine-grained material from the voids in the karst and further increasing discharge, until a series of stable hot springs became established. Although not discounting the presence of fractures and minor faults, Gallois (2007)^[4] suggested that the conduits are conical debris-filled pipes, which at least at the King’s Spring, formed by collapse over the karstic cavities in a shallow-buried knoll of Carboniferous Limestone (**P785919**). The debris includes blocks of Triassic and Jurassic rock, river gravel and even fragments of Roman building materials (Gallois, 2006)^[5].

References

1. ↑ ^{1.0} ^{1.1} Kellaway, G A (editor). 1991. Hot springs of Bath — investigations of the thermal waters of the Avon valley. (Bath: Bath City Council.)
2. ↑ Kellaway, G A. 1996. Discovery of the Avon–Solent Fracture Zone and its relationship to Bath hot springs. *Environmental Geology*, Vol. 28, 34–39.
3. ↑ McCann, C, McMann, A C, McCann, D and Kellaway, G A. 2002. Geophysical investigation of the thermal springs of Bath, England. 15–40 in Sustainable Groundwater Development. Hiscock, K M, Rivett, O, and Davison, R M (editors). *Special Publication of the Geological Society of London*, No. 193.
4. ↑ ^{4.0} ^{4.1} Gallois, R W. 2007. The formation of the hot springs at Bath Spa, UK. *Geological Magazine*, Vol. 144, 741–747.
5. ↑ Gallois, R W. 2006. The geology of the hot springs at Bath Spa, Somerset. *Geoscience in south-west England*, Vol. 11, 168–173.

Geology of the Bath area — contents

[Introduction](#)

[Survey history](#)

[Geological description](#)

[Pre-Carboniferous rocks](#)

[Carboniferous](#)

[Triassic](#)

[Jurassic](#)

[Cretaceous](#)

[Quaternary](#)

[Artificially modified ground](#)

[Geological structure and regional geophysics](#)

Applied geology

Hydrogeology

[Mineral resources](#)

[Building stone](#)

[Geological hazards](#)

[Geological conservation](#)

[Information sources](#)

[References](#)

Retrieved from

'http://earthwise.bgs.ac.uk/index.php?title=Geology_of_the_Bath_area:_Applied_geology:_hydrogeology&oldid=23769'

Category:

- [Bath - the geology of the area](#)

Navigation menu

Personal tools

- Not logged in
- [Talk](#)
- [Contributions](#)
- [Log in](#)
- [Request account](#)

Namespaces

- [Page](#)
- [Discussion](#)

Variants

Views

- [Read](#)
- [View source](#)
- [View history](#)
- [PDF Export](#)

More

Search

Navigation

- [Main page](#)
- [Recent changes](#)
- [Random page](#)
- [Help about MediaWiki](#)

Tools

- [What links here](#)
- [Related changes](#)
- [Special pages](#)
- [Permanent link](#)
- [Page information](#)
- [Cite this page](#)
- [Browse properties](#)

• This page was last modified on 2 December 2015, at 13:26.

- [Privacy policy](#)
- [About Earthwise](#)
- [Disclaimers](#)

•



