The Black Country

Global Geopark Project

Annex 2 Separate copy of Section B 'Geological Heritage'

The Association of Black Country Authorities

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A5 Application contact person

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B. Geological Heritage

B1 General geological description of the proposed Geopark

The Black Country is situated in the centre of England adjacent to the city of Birmingham in the West Midlands (Figure. 1 page 2) .The current proposed geopark headquarters is Dudley Museum and Art Gallery which has the office of the geopark coordinator and hosts spectacular geological collections of local fossils. The geological galleries were opened by Charles Lapworth (founder of the Ordovician System) in 1912 and the museum carries out annual programmes of geological activities, exhibitions and events (see accompanying supporting information disc for additional detail). The museum now hosts a Black Country Geopark Project information point where the latest information about activities in the geopark area and information to support a visit to the geopark can be found.

Figure. 7 A view across Stone Street Square Dudley to the Geopark Headquarters at Dudley Museum and Art Gallery

For its size, the Black Country has some of the most diverse geology anywhere in the world. A claim supported by the founder of the Silurian Period of earth history, Sir Roderick Murchison, who stated in January 1842 in his inaugural address to the Dudley and Midland Geological Society that *'Nowhere in England are more Geological features brought together in a small compass that in the environs of Dudley or in which their characters have been more successfully developed by the labours of practical men'.* Those practical men were the miners, engineers and entrepreneurs of the Black Country. With very few exceptions all of the geological exposures are the remnants of mining and engineering endeavours of the Industrial Revolution and contain some of the most important geological evidence in the world for certain aspects of earth science. The geology exposed and the wider geodiversity and industrial heritage features across the Black Country link together to provide an enthralling geological narrative that is testimony to changing environments through some 430 million years of geological time. Some aspects of the geology are not visible or accessible at the surface. Evidence of this deeper geology is represented in the historic geological collections of the Black Country, and in every well-appointed natural history collection in the world. This material was collected during the days of mining or from borehole cores taken to explore the deeper geology. In addition a host of field evidence is present in the geosites of the geopark.

Ancient deep crustal structures beneath the Black Country

Some aspects of that deeper geology only express themselves at the surface as a series of structural trends established in periods of deformation that predate the oldest rocks seen exposed in the area. Deep beneath the exposed rocks of the Black Country, the ancient crust contains structural trends and lineaments with folds and faults showing NNE-SSW directions that are of late Precambrian age (Charnian, Malvernian and Uriconian trends of some 700 – 600 million years in age). These are the geological foundations of the Black Country and comprise the central part of a relatively stable crustal unit that has been referred to as the Midlands Microcraton. This was a crustal block that has resisted the intense deformation events of the following 500 million years of earth history that affected and more intensely deformed rocks at its margins some distance away from the Black Country. This prolonged stability and gentle deformation has been a key controlling factor in the later geological units deposited in the area. Later phases of earth movements have tended to re-activate older structures and 'tighten' the folds created by earlier phases, or change the sense of movement along faults.

Structural evidence for the tectonic history of the exposed strata of the Black Country

A number of important unconformities (both with and without angular discordance) are present in the sedimentary successions of the area. Dominant structural trends of fold axes and faulting also provide evidence for periods of significant

earth movements and are reflected in the outcrop patterns of the exposed geology. Taken together these indicate that at least 5 phases of tectonic activity have affected the Black Country. The most significant of these are clearly related to major global orogenic activity. These include the Caledonian Orogeny (compressional tectonic structures producing anticlines and synclines in the older Palaeozoic strata), the Variscan Orogeny (compressional tectonic structures such as reverse (thrust) faulting), Late Carboniferous rifting (including a short duration event where the extensional tectonics gave rise to the decompression of the upper mantle, generation of basaltic magmas and their intrusion into the crustal rocks above) and ongoing post-Triassic structures. A later phase of tensional tectonics then initiates the boundary faults of the exposed Black Country Coalfield. The latest phases of earth movements, the Alpine Orogeny also gently affected the area but a lack of post-Triassic deposits and cross-cutting structures prevents a full understanding of these later events.

Stratigraphy of the Black Country

Resting on top of the Midlands Microcraton is a (dominantly) sedimentary sequence of Palaeozoic, Mesozoic and Quaternary strata. Deposition of the Palaeozoic Silurian and Upper Carboniferous sedimentary rocks has created successions that are condensed in contrast to same age sequences in adjacent areas. This means that palaeontological and lithological evidence is 'concentrated' within thinner sequences of strata. The marine shelf and near sea-level terrestrial palaeoenvironments in which they were deposited led to conditions that were suitable for the exceptional preservation of fossils. Two internationally important lagerstätten occur in Black Country Strata: the life assemblages of Silurian marine fossils at Wrens Nest National Nature Reserve Dudley and the Upper Carboniferous fossil insect faunas of the Pennine Coal Measures Group of the Coseley Lagerstätte, near Wolverhampton.

Figure 8. 315 million year old fossil spider-mite and the NMR Cat-scan done of it showing the incredibly well preserved detail of its soft tissues *(images courtesy of Russell Garwood (University of Manchester) and Wolverhampton City Council)*

No bedrock strata younger than the Middle Triassic are present in the Black Country. Pleistocene 'sculpting' of the landscape by two phases of ice advance during the last 500,000 years and the deposition of their glacial and glacio-fluvial superficial deposits was the penultimate geological event. Recent Holocene processes related to the activities of rivers, slope movements and human activities added the final modifications to the landscape of the Black Country that we see today.

The Silurian Period in the Black Country

The Silurian rocks of the Black Country present evidence of changing conditions on a sub-tropical shallow marine shelf environment on the eastern edge of the closing Iapetus Ocean such that it was sited on the continental edge of a destructive plate margin (the western edge of the palaeocontinent of Avalonia). At this time the Black Country lay some 20 – 30^{o} south of the equator and global evidence indicates that eustatic changes of sea level were occurring and influencing deposition here. In this shallow marine environment, dominantly carbonate-rich mudstones accumulated throughout the Coalbrookdale Formation times, and during the Wenlock and Ludlow epochs. Occasional short-lived episodes of low-stand sea levels created shallower waters contemporaneous with a limited supply of terrigenous sediment. Beds of limestone - the Barr Limestone of the Coalbrookdale Formation, the Lower Quarried and Upper Quarried Limestones of the Much Wenlock Limestone Formation and the Aymestry Limestone of the Whitcliffe Formation - were deposited during such episodes over significant parts of the shelf.

The closing ocean tectonic setting gave rise to island arc volcanism throughout the Wenlock and Ludlow epochs, which are represented by thin bentonite clay horizons throughout these sequences. Zircon crystals within these bentonites have been important in age determinations during recent International Geoscience Correlation Programme work (IGCP project 591). The radiometric date for the Wenlock-Ludlow series boundary was established at Wrens Nest National Nature Reserve in Dudley in 2011. The geochemical signatures of these bentonites have been used in regional and international geological correlation studies and in plotting the chemical evolution of the magmas supplying the arcs. The shelf setting was not uniform with deeper waters out to the west fringed further east by the large reefs of the Wenlock Edge area. During Wenlock times, the Black Country shelf seas were sheltered from open ocean conditions to the west by the reef structures on the shelf slope at Wenlock Edge. This gave the area a tranquil back-reef lagoonal environmental setting in which invertebrate life proliferated, such that the Wenlock age strata in the Dudley area contain among the most abundant, best preserved and diverse palaeontology in the British Isles.

Figure 9. 428 million year old ripple bedded fossiliferous

limestones on the western side of Wren's Nest National Nature Reserve.

Table 1 Correlation and Nomenclature of the Stratigraphy of the Black Country

2014 Nomenclature (after BGS)	Thickness Range	Series (after ICS)	Age/Epoch (after ICS)	Previous Nomenclature
TRIASSIC				
SHERWOOD SANDSTONE GROUP		Middle Triassic Lower to Middle Triassic	Ladinian	Sherwood Sandstone Group
Helsby Sandstone Formation	150m		Olenkian to Anisian	Bromsgrove Sandstone Formation
Wilmslow Sandstone Formation				
Wildmoor Sandstone Member	61-240m	Lower Triassic	Olenekian	Wildmoor Sandstone Formation
Chester Formation	50-120m	Lower Triassic	Induan to Olenekian	Kidderminster Conglomerate Formation
Hopwas Breccia Formation		Permian to Lower Triassic	Undefined	Hopwas Breccia
PERMIAN				
Bridgnorth Sandstone Formation	60m	Cisuralian	Undefined	Bridgnorth Sandstone Formation
Clent Formation	137-243m	Cisuralian	Undefined	Clent Breccia Formation
CARBONIFEROUS				
WARWICKSHRE GROUP				
Salop Formation		Pennsylvanian	Westphalian D	
Enville Member	61-198m	Pennsylvanian	Westphalian D	Enville Formation
Alveley Member	140-274m	Pennsylvanian	Westphalian D	Keele Formation
Halesowen Formation	76-152m	Pennsylvanian	Westphalian D	Halesowen Formation
Carboniferous basic intrusive igneous rocks	0-.80m	Pennsylvanian	Westphalian C	
Carboniferous extrusive igneous rocks	8-12m	Pennsylvanian	Westphalian C	
The Etruria Formation	61-207m	Pennsylvanian	Westphalian C	Old Hill Marl Formation
Pennine Middle Coal Measures and Pennine Lower Coal Measures Formation	94-152m	Pennsylvanian	Westphalian A & B	Middle (Productive) Coal Measures
SILURIAN				
Raglan Mudstone Formation	80m	Přídolí	undefined	Ledbury Formation
Temeside Shales Formation	10m	Přídolí	undefined	Temeside Formation
Downton Castle Sandstone Formation	20m	Přídolí	undefined	Downton Castle Sandstone
Ludlow Bone Bed Member	0.38m	Přídolí	Přídolí/Ludfordian	Ludlow Bone Bed
Whitcliffe Formation	9-15m	Ludlow	Ludfordian	Upper Ludlow Shales
Aymestry Limestone Formation	8m	Ludlow	Gorstian	Aymestry Limestone
Elton Formation	152m	Ludlow	Gorstian	Lower Ludlow Shales
Much Wenlock Limestone Formation	52- 65m	Wenlock	Homerian	Wenlock Limestone
Upper Quarried Limestone Member	8.6- 10.4m	Wenlock	Homerian	Upper Quarried Limestone
Nodular Limestone Member	31.1-37.8m	Wenlock	Homerian	Nodular Beds
Lower Quarried Limestone Member	12.2-16.2m	Wenlock	Homerian	Lower Quarried Limestone
Coalbrookdale Formation	152 -213m	Wenlock	Homerian/Sheinwoodian	Wenlock Shale
Barr Limestone member	9m	Wenlock	Sheinwoodian	Woolhope (Barr) Limestone
Buildwas Formation	22m	Landovery	Sheinwoodian	Wenlock Shale
Rubery Formation	117m	Landovery	Telychian	Rubery sandstone and shale

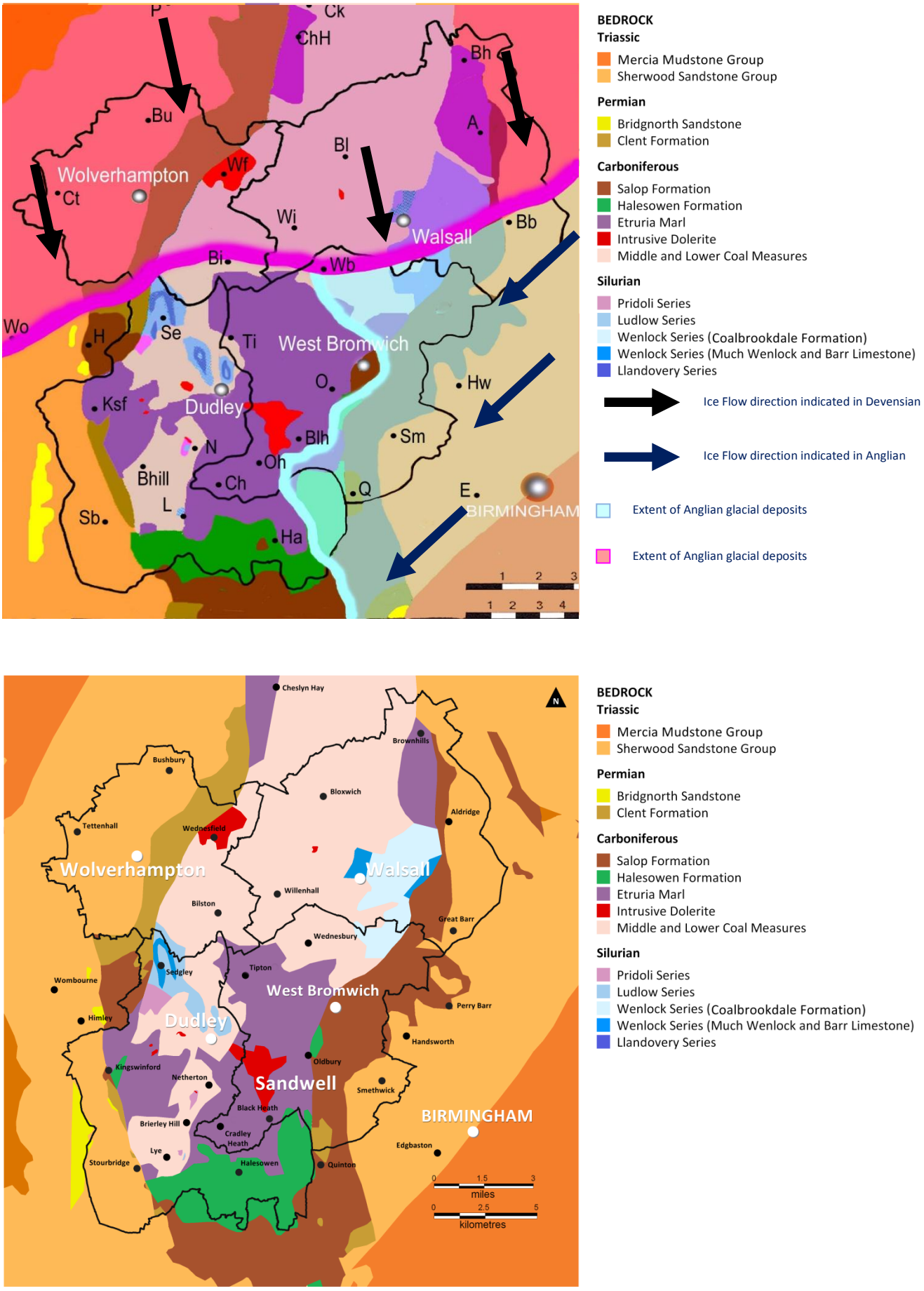


Figure 10. *Simplified geological map of the Black Country and its immediately surrounding areas*

Currently over 600 species of marine invertebrate macrofossils, representing some 29 major taxonomic groups, are described. In the southern part of the Black Country, the Castle Hill and Wren's Nest area is the type locality for 186 fossil species (more than any other British site). Of these, 63 species have not been found anywhere else in the world. In recognition of this exceptional palaeontology, the Much Wenlock Limestone Formation of the Dudley area is a fossil lagerstätten, containing rare and internationally important life assemblages (in the form of beds of articulated crinoids) preserved in exquisite detail beneath deposits of terrigenous mud and volcanic clay. Rare annelid worms and early plant remains have also been found, containing soft tissue imprints. The diversity and quality of the fossil evidence found here constitutes approximately 65% of the evidence used by Murchison in The Silurian System to define the Wenlock Series. Dudley's fossils are among the most perfectly preserved Silurian fossils in the world**.** This is reflected in the fact that they have always been highly valued and are found in many museum collections and displays across the globe.

Much work remains to be done on these strata and active research continues. Many new taxa, particularly of microfossils, have yet to be described. Current research is focussing on scolecodont and conodont faunas in collaborative research with the Universities of Oxford and Birmingham in the UK and the University of Erlangen in Germany.

Figure 11. Calymene Blumenbachii – Iconic Black Country trilobite and mascot of the limestone workers of Dudley and a beautifully preserved articulated specimen of Gissocrinus.

Towards the end of the Ludlow Series times, the continents of Avalonia and Laurentia finally collided (the Caledonian Orogeny) with the closing and loss of the Iapetus Ocean. The gentle subsidence of the shelf ceased and a slow period of uplift and marine basin infill began. By the end of Přídolí times the landscape of the Black Country was emerging above sea level. River systems had established, draining to the southwest depositing sediment in a marginal marine embayment that later formed low-lying alluvial plains of the Old Red Sandstone (Devonian) continent. This is seen in the Downton Castle Sandstone Formation (known in the Black Country as the Gornal Grit) which provided distinctive building stone, grind stones and abrasives for Black Country Industries. The Ludlow Bone Bed marks the base of this formation and contains early vertebrate and terrestrial arthropod fossils. Three sites within the Black Country in the uppermost Ludlow and lowest Přídolí age rocks are nationally/ internationally important for these early vertebrate remains.

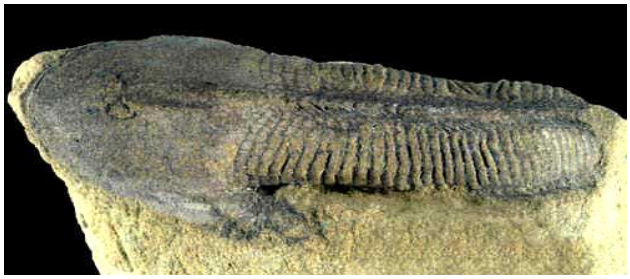


***Figure 12. Hemicyclaspis murchisonii* – complete Agnathan bony fish remains discovered in Harpers Quarry Lower Gornal near the town of Sedgley in 1946.**

No strata of upper Přídolí, Devonian or Lower Carboniferous age have been identified within the proposed Black Country Geopark area.

The Carboniferous Period in the Black Country

During the Lower Carboniferous, elevated landforms created by the Caledonian continental collision were present across the Black Country and were being eroded as they gently drifted north with prevailing global tectonics. By Upper Carboniferous times the Black Country area was a flat, landscape covered in forests with many rivers, mudflats and lakes. The area lay on, or slightly to the north of, the equator in tropical climates. The Pennine Lower and Middle Coal Measures strata accumulated as this area gentle subsided. These are dominantly grey rhythmically repeating units of mudstone, siltstone and sandstone which feature an abundance of the economic minerals coal, clay-ironstones and refractory fireclays. These cycles formed within a richly vegetated landscape of very subdued topography that lay very near to sea level. This was a waterlogged swamp forest similar to present day equatorial rain forests, occupied by primitive tree-fern and other gymnosperm plants that supported a substantial terrestrial ecosystem. Periodic gentle subsidence led to influxes of the sea that deposited thin beds rich in marine fossils. These form important marker horizons within the sequence that have aided correlation within the district and across the country. These, together with re-emergence due to sea level fall or tectonics, created repeating cycles of sediments.

The variability of the rocks and their rapid lateral changes in the thickness is striking and reflects a period of crustal instability. One significant feature is that their overall thickness of the sequence increases very dramatically northwards. At the southern margin of the Black Country, the thickness is less than 90m, 10km to the north the same sequence is around 220m thick. Further north into the Cannock area these strata attain thicknesses greater than 400m. This indicates the presence of a more stable area of crust beneath the Black Country and results in a significantly condensed sequence here. An important consequence of this crustal stability to the story of the Black Country is that it allowed the slow uninterrupted accumulation of decaying forest matter in a gently subsiding swamp that created the 'South Staffordshire or Black Country 'Thick Coal', a seam of coal up to 12m thick, and an energy resource that was the fundamental reason for the establishment of the Black Country as a powerhouse of the Industrial Revolution.

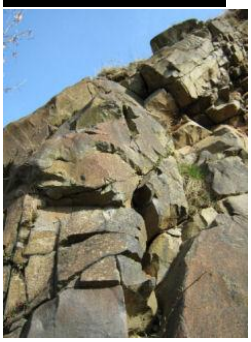
Figure 13. Section of approximately half of the full thickness of the Thick Coal in a temporary opencast coal mine exposure site at Dibdale Road in Dudley in 1989.

Occasionally this swamp environment had conditions that produced exception preservation of terrestrial fossils. Near to the town of Coseley in Wolverhampton occurs one of the Black Country's lagerstätten in Carboniferous, Pennine Middle Coal Measures Sequences. This preserves plant and insect faunas in spectacular detail. Particularly significant are its trigonotarbid spider- mites, other insects and arthropod faunas which provide a very useful comparator to the Mazon Creek deposits of the USA. In 2004 these fossils were subject to collaborative international research involving collections and sites in these two locations.

Figure 14. Soft bodied preservation in the Coseley lagerstätten, - a fossil millipede in a clay ironstone nodule

Immediately succeeding the Pennine Middle Coal Measures strata of the Black Country are rocks belonging to the Warwickshire Group. The lowest of these is the Etruria Formation a sequence of red and purple mudstones with occasional channel sandstones – 'Espley Sandstones',

conglomerates and palaeosols. This indicates near- arid conditions developed for a time with alluvial channels depositing gravels on the low plains of the emergent landscape.



Towards the end of the Etruria Formation times, the area underwent a minor period of extensional tectonics which depressurised the upper mantle and lead to the generation of basaltic magmas which intruded into the overlying strata. A number of igneous intrusions occur in the Black Country which relate to this event.

Figure 15. Example of weathered microgabbro/dolerite intrusion in the rock faces Rough Hill Quarry in Sandwell

There is evidence for only one instance of extrusive igneous activity within the Carboniferous here. This occurs within Etruria Formation strata at Kingswinford in the Barrow Hill and Tansey Green Clay Pit, where10m of grey-green volcanic ash and ejecta occurs. Here, there are also hydrothermal stockworks of alteration and steam eruption injected veins hat have been dated to 307Ma. These deposits are important not only as they are the only example in the Midlands but more significantly because they preserve in anatomical detail early conifers in life position. This site has also become known as the 'Dudley Volcano' and the local community's tenants and residents association has adopted the volcano as its logo. In recognition of its scientific importance the site was designated a Site of Special Scientific Interest (SSSI) in 2013 by Natural England.

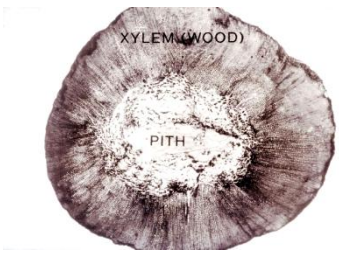


Figure 16. Thin section of one of the anatomically preserved conifers from the ash beds of Tansey Green Clay Pit (Image courtesy of Dr Colin Waters, BGS)

The overlying Halesowen Formation is dominantly thick, cross-bedded, sandstones with occasional partings of grey mudstones and contains rare, thin impersistent coal seams. This suggests that during these times, a return to wetter conditions occurred in this area. The Salop Formation, which in turn overlies the Halesowen Formation, shows similar characteristics to the Etruria Formation, indicating a return to semi-arid, better drained conditions.

The Permian Period in the Black Country

At the close of the Carboniferous Period many of the landmasses on Earth had collided and joined together to form the supercontinent of Pangea. The Black Country, then situated about 20 degrees north of the equator and totally landlocked,

suffered a scorching arid climate and became a harsh dry landscape. Permian Strata of the Black Country deposited at this time are strongly unconformable and rest on strata of different ages in different parts of the area. The Clent Formation is a coarse angular breccia with clasts of dominantly purple volcanic rocks believed to be Precambrian (Uriconian) age from Shropshire. There are also quartzites and other clasts present which are thought to be of local Lower Palaeozoic age. The presence of this breccia in parts of the Black Country testifies that local or regional tectonics had produced a significant local relief (thought to be basin-and-range topography. These breccias were deposited as screes in the immediate proximity of rock faces or transported short distances as alluvial fans or debris flows by rapid rainfall and flooding events in the desert. The overlying Bridgnorth Sandstone Formation is an aeolian sandstone and contains stacked fossil sand dunes with strong cross-bedding and frosted, well rounded silica sand grains which were deposited by westerly blowing winds.

Figure 17. Exposure of redbeds in the heart of the Stourbridge syncline at Wordsley

The Triassic Period in the Black Country

The transition between Permian and Triassic sequences here is one that sees a period of uplift and rapid erosion depositing a basal breccias, the Hopwas Breccia Formtion, followed by the spread of fluvial conditions in a semi-arid basin-and- range landscape. The basal Breccia indicates rapid deposition of coarse clastic material by debris flow or alluvial fan processes close to the source rocks. Immediately overlying this sequence, the Chester Formation is a medium to coarse grained sandstone with substantial beds of conglomerate containing mature rounded pebbles of quartz and quartzite (with some volcanic materials and fossiliferous Palaeozoic rocks). These pass upwards into the Wildmoor Sandstone Member and the Helsby Sandstone Formation which are composed of finer grained sandstones that together comprise the Sherwood Sandstone Group. This series of strata represents the deposits of a major river system that originated in northern France eroding the Variscan mountains. During the Chester Formation times it was a fast flowing, braided river, but higher in the sequence the river became more mature and was meandering.

Figure 18. Exposure of the Chester Formation at Pinfold Lane Quarry, Walsall with detail of the pebbles in the horizon

There are no bedrock strata younger than the Sherwood Sandstone Group present in the Black Country.

The Quaternary in the Black Country

The final part of the Black Country geological history is represented by the superficial deposits occurring mainly in the northern and eastern parts of the Black Country (but are almost completely absent in the south and south western area). These deposits comprise tills ('boulder clays'), glaciofluvial outwash, river deposits, peri-glacial solifluction and mass-movement deposits. There are also deeply-incised and completely infilled northwest-southeast trending buried sub-glacial channels in the north area of the Black Country. The till in the north is more consistent and represents oblation deposits of the Devensian glaciations. Erratics indicate that ice sheets moved down from Scotland, north Wales and the Lake District and advanced southwards to the Black Country. The southern limit of the ice sheet at the glacial maxima some 17000 years ago appears to have been a little to the north of Dudley. However, evidence from adjacent areas suggests that the ice limit may have extended, at least on the western side of the district, a few kilometres to the south of the Black Country. The earlier ice sheets of the Anglian glaciations, which peaked about 440,000 years ago, had pressurised sub-glacial rivers which scoured deep channels into the Black Country. The best known of these is the Moxley Channel that runs northwest to southeast from the Darlaston area in Wolverhampton to the Moxley area of Walsall. This structure is a few kilometres in length, half a kilometre wide and more than 35m deep. When the ice sheets retreated, these channels were quickly infilled by glaciofluvial deposits of sand and gravel. Peat horizons also occur within the channel fills from abandoned ox-bow lakes. Patches of sand and gravel were left behind as irregular mounds (kames) during the final stages of deglaciation at the end of the Devensian. The best known of these is Norton Covert (Geosite No 25), on the southern margin of the Black Country. Finally the modern drainage pattern developed. The River Stour incised itself deeply into the soft Carboniferous rocks in the southern Black Country as the area rebounded isostatically after the offloading of the ice sheets. This clearly happened in stages. In the Stourbridge area a river terrace is present some 10m above the current level of the river beyond the edges of the Black Country up to four river terraces are present in the River Severn, ranging in height above the modern alluvium from 2 to 30 m. The terrace deposits of the Stourbridge and Amblecote area have yielded a small number of mammalian bones. The most recent superficial deposits of Flandrian age are the modern alluvium (mainly clays and silts) of the river valleys, and slope deposits (head and colluvium) formed by mainly by solifluction and soil creep. Anthropcene deposits represented by deep and variable made ground are prevalent across much of the Black Country.

B2 Listing and description of geological sites within the proposed geopark

Geosites of the Black Country Geopark

The story of the Black Country is a long and complex one and its landscape contains many 'hidden gems' of British geology that unveil that story. In total there are 99 designated geological sites in the Black Country ranging from internationally important stratigraphy sites with fossil lagerstätten such as Wren's Nest National Nature Reserve, to sites of much more local importance which are the best example of a feature or sequence that occurs locally (SINC's – Sites of Importance for Nature Conservation). All designated geological sites are given protection either under specific national conservation law or for non-statutory sites, within the planning and development control system. Some of the local and regionally important geological sites offer little that would provide a rich experience to a general, non-specialist visitor. Therefore the list of geosites for the Geopark, considers the needs of geotourism and includes only those geological sites that have the very best and most important/representative geological heritage and that provide good access for visiting parties. The chosen list of includes non-geological related heritage (biodiversity, archaeological and cultural heritage) as well as geoart features that are important to explain the full story of the landscape and that enrich the local geological story. Occasionally a geosite in this list includes a cluster of features under one collective name due to geographical proximity and logical association when considering the geotourism potential and practicalities of the likely visitor need (for example Castle Hill or Wolverhampton City centre clusters)In each case Black Country Geosites are selected by the partnership on their unique merits on a site-by-site basis which considers their Earth science importance, their suitability for intellectual and physical access, their potential to contribute to geoeducational projects, and cultural/community inclusion etc. These geosites provide a comprehensive set of destinations through which the visitor can explore the Black Country story through any heritage experiences they may desire, whether this be a deep specialist exploration of the geological science of the area or a simple introduction to geology and its importance to the area as a first step on a much more general geological journey with the family. They provide the best and most important sites for active research in each of the specialist fields and take forward our understanding of the landscape.

An extensive audit of the geodiversity and related heritage has been undertaken during the past 2 years. Table 2 below summarises part of the detailed data gathered for geosites that has informed, and ultimately resulted in, their selection as the key Black Country geosites and features that together give a real sense of the place. These geosites provide good physical and inspirational intellectual access to their heritage. They expose all geological formations that are present in the ground here and give an insight into its unique cultural development. Additional tables in succeeding sections present the other attributes of these geosites that are relevant to the focus of those sections.

Figure 19. The industrial development of the Black Country landscape, the layout of its hills and valleys, the courses of its rivers and the construction of its inland waterways to open up the coalfield along which factories and mines opened up, and even the culture of its peoples is all a consequence of , or strongly influenced by the underlying geology. This intimate relationship is very well seen in landscapes such as this view taken along the Amblecote canal between Brierley Hill and Wordsley in the southern part of the Black Country.

No.	Geosite Name	Des.	Barr Limestone member	Coalbrookdale Formation	Lower Quarried Limestone Member	Nodular Limestone Member	Upper Quarried Limestone Member	Elton Formation	Aymestry Limestone Formation	Whitcliffe Formation	Ludlow Bone Bed Member	Downton Castle Sandstone Formation	Temeside Shales Formation	Raglan Mudstone Formation	Pennine Lower Coal Measures Formation	Pennine Middle Coal Measures Formation	The Etruria Formation	Carboniferous extrusive igneous rocks	Carboniferous basic intrusive igneous	Halesowen Formation	Alveley Member	Enville Member	Clent Formation	Bridgnorth Sandstone Formation	Hopwas Breccia Formation	Chester Formation	Wildmoor Sandstone Formation	Helsby Sandstone Formation	Glaciofluvial	Till	Erratics
	Stratigraphy		STRATIGRAPHY					SILURIAN							CARBONIFEROUS								PERMIAN			TRIASSIC			QUATERNARY		
1	Dudley Museum & Dudley Town Geotrail	AM																													
2	Wrens Nest National Nature Reseve	NNR																													
3	Barr Beacon & Pinfold Lane Quarry SINC	SINC																													
4	Saltwells Local Nature Reserve	LNR, SSSI																													
5	Barrow Hill & Tansey Green Clay Pit	LNR, SSSI																													
6	Moorcroft Wood Local Nature Reserve	LNR																													
7	Cotwall End Valley Local Nature Reserve	LNR, SSSI																													
8	Sedgley Beacon Hill and Quarries	SINC																													
9	Bantock House Museum	AM																													
10	Singing Cavern and Dudley Canal Tunnels	SAM, SINC																													
11	Brownhills Mining Heritage Monuments	HL																													
12	Bumble Hole & Warrens Hall LNR	SAM, LNR																													
13	Galton Valley	SAM, LNR																													
14	Sandwell Valley Country Park	HL																													
15	West Park Wolverhampton	SAM, HL																													
16	Walsall Arboretum	SAM, HL																													
17	Castle Hill & Zoo	SAM, HL																													
18	Black Country Living Museum	AM																													
19	Red House Glass Cone & the Crystal Mile	LB, HL																													
20	Walsall Geotrail, Museums & Art Gallery	AM, HL																													
21	Wolverhampton Geotrail, museums and gal	AM, HL																													
22	Wednesbury Geotrail, Muesums and Galler	AM, HL																													
23	Blue Rock Quarry	SINC																													
24	Shire Oak Quarry Local Nature Reserve	LNR, SINC																													
25	Norton Covert	SINC																													
26	Leasowes Park, Halesowen	SAM, HL																													
27	Northycote Farm, Wolverhampton	SINC, HL																													
28	Hay Head Quarry	SSSI																													
29	Daw End Railway Cutting & Linley wood	SSSI																													
30	Ketley Quarry	SSSI																													
31	Bromsgrove Road Cutting	SSSI																													
32	Wychbury Hill	SINC																													
33	Park Lime Pits Local Nature Reserve	LNR, SINC																													
34	Wightwick Wedge & Smestow Valley	SINC,HL																													
35	Barnford Hill Park	SINC																													
36	Buckpool and The Leys Local Nature Reserve	SINC																													
37	Compton to Tettenhall Ridge	SINC, HL																													
38	Coseley Canal Cutting & Tunnel	SINC																													
39	The Rowley Hills	HL																													
40	Coombswood Valley	SINC, HL																													
41	The Gorge Sedgley	SINC																													
42	Hayes Cutting Lye	SINC																													
43	Stafford Road Cutting SINC	SINC																													
44	Holloway Street Quarry SINC	SINC																													
45	Stourbridge Old Town Gasworks	SINC																													

Table 2 Geosites of the Proposed Black Country Global Geopark and their Stratigraphy

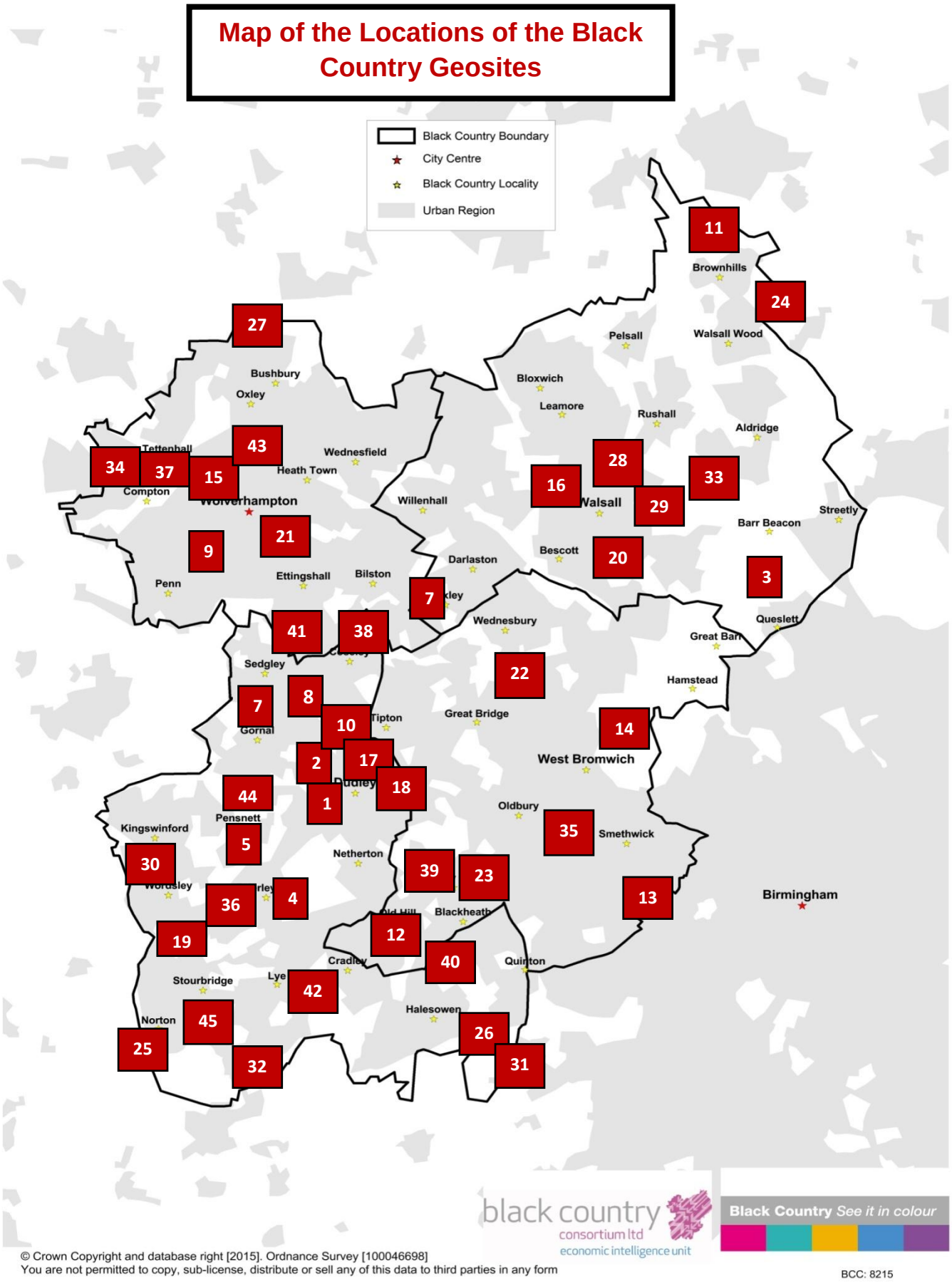


Figure 20. **Locations of the Black Country Geopark Geosites**

B3 Details of the geological interest of these sites

			SPECIFIC GEOLOGICAL ATTRIBUTES							RELATED HERITAGE								
	Geology & Related Heritage	Designations	Structural Geology Importance	Palaeontological Importance	Significant Geological Collection	Important Stratigraphic reference site	History of Geology Connections	Geomorphological Importance	Spieleological Importance	Landscape Viewpoint	Building Stones interest	Geoart Features	Mining & Quarrying Heritage	Industrial Heritage	Canal Heritage	pre-industrial Archaeology	Biodiversity Importance	visitor centre/museum/gallery
No.	**Geosite Name**	**Des.**																
1	Dudley Museum & Dudley Town Geotrail	AM																
2	Wrens Nest National Nature Reseve	NNR																
3	Barr Beacon & Pinfold Lane Quarry SINC	SINC																
4	Saltwells Local Nature Reserve	LNR, SSSI																
5	Barrow Hill & Tansey Green Clay Pit	LNR, SSSI																
6	Moorcroft Wood Local Nature Reserve	LNR																
7	Cotwall End Valley Local Nature Reserve	LNR, SSSI																
8	Sedgley Beacon Hill and Quarries	SINC																
9	Bantock House Museum	AM																
10	Singing Cavern and Dudley Canal Tunnels	SAM, SINC																
11	Brownhills Mining Heritage Monuments	HL																
12	Bumble Hole & Warrens Hall LNR	SAM, LNR																
13	Galton Valley	SAM, LNR																
14	Sandwell Valley Country Park	HL																
15	West Park Wolverhampton	SAM, HL																
16	Walsall Arboretum	SAM, HL																
17	Castle Hill & Zoo	SAM, HL																
18	Black Country Living Museum	AM																
19	Red House Glass Cone & the Crystal Mile	LB, HL																
20	Walsall Geotrail, Museums & Art Gallery	AM, HL																
21	Wolverhampton Geotrail, museums and galleries	AM, HL																
22	Wednesbury Geotrail, Muesums and Galleries	AM, HL																
23	Blue Rock Quarry	SINC																
24	Shire Oak Quarry Local Nature Reserve	LNR, SINC																
25	Norton Covert	SINC																
26	Leasowes Park, Halesowen	SAM, HL																
27	Northycote Farm, Wolverhampton	SINC, HL																
28	Hay Head Quarry	SSSI																
29	Daw End Railway Cutting & Linley wood	SSSI																
30	Ketley Quarry	SSSI																
31	Bromsgrove Road Cutting	SSSI																
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33	Park Lime Pits Local Nature Reserve	LNR, SINC																
34	Wightwick Wedge & Smestow Valley	SINC,HL																
35	Barnford Hill Park	SINC																
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37	Compton to Tettenhall Ridge	SINC, HL																
38	Coseley Canal Cutting & Tunnel	SINC																
39	The Rowley Hills	HL																
40	Coombswood Valley	SINC, HL																
41	The Gorge Sedgley	SINC																
42	Hayes Cutting Lye	SINC																
43	Stafford Road Cutting SINC	SINC																
44	Holloway Street Quarry SINC	SINC																
45	Stourbridge Old Town Gasworks	SINC																

Table 3 Geosites of the Proposed Black Country Global Geopark and their geological designations and related heritage

Geosite 1 Dudley Museum and Art Gallery and Dudley Town Centre Geotrail

This is the current **Geopark Headquarters** and the starting point to pick up information and advice about a visit to the Black Country Global Geopark. The museum has 3 geological galleries displaying the finest fossils found in the local rocks and introduces some 30,000 people each year to the wonders of earth sciences. The museum hosts a Black Country Geopark Project discovery room , temporary geological exhibitions and events, runs geological education sessions, offers a rock and fossil identification service and offers advice on geological heritage related to engineering and planning matters. The Keeper of Geology coordinates a volunteer geoteam who help with the geological work of the museum. This is the hub of geopark activity. The town centre is rich in geological themed artworks and historic buildings and structures that provide a rich geotrail to be explored in the area around the geopark headquarters. For further information visit; http://www.dudley.gov.uk/see-and-do/museums/dudley-museum-art-gallery/

Geosite 2 Wren's Nest National Nature Reserve (SSSI, National Nature Reserve, internationally important)

This is a Site of Special Scientific Interest, an internationally important locality for exceptional palaeontology and is the site at which the radiometric date of the Wenlock –Ludlow series boundary was established (427.77 MY +/- 0.5MY). It is also a nationally important site (Scheduled Monument) for limestone mining history. The geology is Silurian, and includes strata of the Elton Formation, Much Wenlock Limestone Formation, and Coalbrookdale Formation. This is a key geotourism and geoeducational site for the geopark. It has one of the new Black Country Geopark Project interpretation signs (July 2015) walking trails, a warden service, and a community friends group, along with a website, teaching packs, a guide book, leaflet, and on-site interpretation. A Section 106 planning agreement is in place to fund a new warden's base and teaching classroom at the site when the second phase of an immediately adjacent housing development is carried out. For more information http://www.dudley.gov.uk/resident/environment/countryside/nature-reserves/wrens-nest-nnrwrens-nest-nnr/

Geosite 3 Barr Beacon and Pinfold Lane Quarry (SINC - regionally important)

This is a large, abandoned sand and gravel quarry that previously worked strata of Triassic Chester Formation and the Hopwas Breccia in large quantities to supply building materials for construction across Birmingham and the Black Country. This site is the only accessible site where the junction of the Hopwas Breccia and Chester Formation may be seen and has a wide range of sedimentary structures within these fluvial deposits. The site is maintained by the ranger service and is the subject of community based geoconservation work. The site has one of the new Black Country Geopark Project interpretation signs (July 2015), formal footpaths (including a stretch of the 'Beacon Way', a geological guidebook and leaflet that cover both this site and Barr Beacon Hill. This is a key geoscience and educational site of the geopark. For more information http://cms.walsall.gov.uk/barr_beacon_local_nature_reserve.htm

Geosite 4 Saltwells Local Nature Reserve SSSI's nationally important)

In 1981 Saltwells was the first Local Nature Reserve declared in the West Midlands County. It covers over 100 hectares, and is one of the largest urban nature reserves in the country. In the 18th century Lady Dudley deliberately planted trees here to hide the scars of coal mining. This has matured to become Saltwells Wood. Mining ceased in the 1940's, leaving impressive exposures of importance to the understanding of the geology of the Midlands of England and the Black Country in particular. The geology of this site is nationally and regionally important including both SSSIs and SINCs designated sites (described below), and includes rare and important mining and industrial heritage features. Its boundaries include a large clay pit, bell-pit mining features, deeper old mines and spoil heaps, an abandoned mineral tramway, as well as biodiverse streams, woodland and adjacent canal heritage. The exposed geology ranges between Carboniferous Pennine Lower Coal Measures Formation, and Silurian Přídolí and Ludfordian strata with a very unusual unconformity with no angular discordance between these units on the flanks of the faulted and intruded Netherton Anticline. Together these features form an important assemblage of rare exposures essential to the understanding and interpretation of the complex geological structure and geological history of the Black Country. It has one of the new Black Country Geopark Project interpretation signs (July 2015). This is a major geosciences, geotourism and geoeducational asset of the geopark. The site has a warden service, a friends group, on site interpretation, and a geology leaflet is currently being drafted. An additional geological guidebook and a new warden's facility are planned for this site.

Geosite 4a Brewins Canal Section (SSSI, nationally important)

Adjoining Saltwells Local Nature Reserve, this nationally important geo site shows the geological relationships between Late Silurian, Ludfordian, and Přídolí Epoch strata. The section includes a nearby abandoned tramway cutting that features the Ludlow Bone Bed. Both sections have yielded important conodont faunas. The unconformable junction with the overlying basement conglomerate beds of the Black Country Coalfield (Pennine Lower Coal Measures Strata) is present in the canalside section, which also includes a basaltic intrusion associated with the Netherton anticline on which this site sits. This geosite links the canal heritage directly into the geological science here.

Geosite 4b Doultons Clay Pit (SSSI, nationally important)

This is a nationally important geosciences site that provides a unique exposure of the development of Carboniferous Pennine Lower Coal Measures coal deposits on older Silurian landscapes of the English Midlands. This is the best exposure of the cyclic sedimentation within Coal Measures in the Midlands coalfields, and is regarded as a standard for this facies. The site also exposes the junction between the Pennine Lower and Middle Coal Measures. The strata here also yielded brine, and a former brine bath house existed here in the late nineteenth century. More information is available at; http://www.dudley.gov.uk/resident/environment/countryside/nature-reserves/saltwells-local-nature-reserve-/

Geosite 5 Barrow Hill and Tansey Green Clay Pit (SSSI, nationally important)

A Local Nature Reserve, this is a nationally and internationally important geosite for the Late Carboniferous Etruria Formation, and its associated igneous (intrusive and extrusive) rocks with exceptionally preserved palaeontology It is a particularly important site for demonstrating the timing and nature of Midlands basaltic igneous activity during the Late Carboniferous Period. The ash beds in the Tansey Green Claypit contain anatomically preserved primitive conifer fossils in life position. This site has one of the new Black Country Geopark Project interpretation signs (July 2015) and is important for geotourism and geoeduation. A geological leaflet is available, and an online Earth Science education pack produced by GeoConservation UK can be downloaded from the web. It has a warden service and walking trails, though on-site interpretation is limited. This site is also an important community wellbeing/health promotion site used by 'Action Heart' based at the adjacent hospital for the rehabilitation of heart surgery patients. For more information go to http://www.dudley.gov.uk/resident/environment/countryside/nature-reserves/buckpool-fens-pools-and-barrow-hill-nature-reserves/barrow-hill-local-nature-reserve/ and http://www.sssi.naturalengland.org.uk/special/sssi/images/uploaded_files/2000767.pdf

Geosite 6 Moorcroft Wood Local Nature Reserve (SINC - regionally important)

At the start of the Industrial Revolution this was a busy centre of industry with coal mines, canals and early blast furnaces. However, as the coal was worked out it was abandoned, in particular the site of the former Moorcroft Old Colliery. Moorcroft Wood, which now occupies the old colliery site, is a local nature reserve covering 27 acres and is an abandoned industrial landscape. Here coal mining subsidence has created a 'sag' or water-filled depression in the landscape into which large boulders of iron and steel making wastes have been strewn. This is one of only two sites remaining in the Black Country where such materials can now be seen and as such it is of particular importance in relation to the iron and steel industries of the Black Country. The woodland was planted by the Midland Reafforesting Association in the early 20th century as part of their pioneering urban forestry work. Their aim was to

restore the old spoil heaps and quarry workings so as to provide an amenity area for a hospital which formally stood on the site. The site is also bounded by two canals which offer unique access to the site and connections to other geosites on the canal network. T his site has one of the new Black Country Geopark Project interpretation signs (July 2015) and has a number of walks and is important for wildlife. It also has a nature centre operated by the wildlife trust for Birmingham and The Black Country which offers a limited programme of activities. The Wildlife Trust's Moorcroft Environment website offers more information; http://cms.walsall.gov.uk/index/nature_reserves.htm

Geosite 7 Cotwall End Valley Local Nature Reserve, including Turner's Hill (SSSI, nationally important)

This is a wide natural valley feature, aligned along two fault zones associated with branches of the Western Boundary Fault of the Black Country Coalfield. To the east of the site stands a high ridge (Turners Hill SSSI) composed of strata of Upper Silurian, Přídolí Series, and Ludfordian Epoch strata. This is comprised of the Downton Castle Sandstone Formation and Ludlow Bone Bed, Upper Ludlow Shales, Whitcliffe Formation, Aymestry Limestone Formation, and Elton Formation with abundant shelly fossils. The valley base's down-faulted ground consists of Carboniferous Etruria Formation, with traces of old mines and marl pits. To the west of the stream the ground is further downthrown by the faults and its elevation rises again due to the near surface presence of the more competent Salop Formation strata. These features together form a key geosite that demonstrates the effects of major tectonics along the western boundary fault of the exposed coalfield. This site is important in terms of science, geoeducation and geotourism. This site has one of the new Black Country Geopark Project interpretation signs (July 2015). It has a community friends group, a warden service, walking trails, and on-site interpretive material. A geology trail, leaflet, and trail guide are planned for this geosite. More Information can be found at; http://www.dudley.gov.uk/resident/environment/countryside/nature-reserves/cotwall-end-local-nature-reserve/

Geosite 8 Sedgley Beacon Hill and Quarries (SINC - regionally important)

Sedgley Beacon Hill and quarries is an important geosite for its exposures of fossiliferous Upper Silurian Aymestry Limestone Strata. It is also a high point of the landscape and offers commanding views across the southern Black Country and the west to the hills of Shropshire and Wales. This geosite constitutes the best exposure of the Whitcliffe Formation and Aymestry Limestone Formation in the Black Country. The site's footpaths connect to a long distance footpath across the southern Black Country area, 'The Limestone Way'. In terms of its associated heritage assets, the Beacon site is one of the chain of English hills that were part of a warning system for invasion during Elizabethan times. It also contains a notable landmark structure 'The Sedgley Beacon Tower', a Victorian 'folly' constructed under the orders of Lord Wrottersley and said to be his tower for observing the night sky. This is a key geotourism and viewpoint site that helps to place the Black Country Landscape into perspective. This site has one of the new Black Country Geopark Project interpretation signs (July 2015). It has a friends group and is managed by the local authority. Currently there is limited on-site interpretation and a geological leaflet is planned.

Geosite 10 Dudley Canal and Tunnel Trust Singing Cavern and Dudley Canal Tunnels (SINC - regionally important)

This geosite is the most important geotourism site of the geopark to experience a spectacular insight into the geological and limestone mining history of the Black Country. A 45 minute canal narrow-boat excursion takes you into a 1790's canal tunnel and a network of underground canal tunnels and limestone mines. The geological and industrial heritage of the area is brought to life in a series of underground audio visual presentations. This geosite contains spectacular underground exposures of a range of Silurian geology from the Coalbrookdale Formation through to the Elton Formation and also includes major structural geology features of the Castle Hill anticline as well as active speleothems. This is part of the limestone mining Scheduled Monument designation for Dudley. This geosite is very closely associated with adjacent geosites at Wrens Nest, Castle Hill and Dudley Town Centre, and connects to a number of other geosites along the canal network. It is managed by Dudley Canal and Tunnel Trust who run a new canal heritage visitor centre at the site called 'The Portal' that hosts geopark interpretation and who offer a range of canal trips and events all-year round. They also provide educational sessions including geology and local history. Further information can be found at; http://dudleycanaltrust.org.uk/

Geosite 15 West Park Wolverhampton (SINC - regionally important)

This geosite is a formal park covering 17 hectares in area (including its lake) and provides a beautifully landscaped green space within a ten minute walk of Wolverhampton city centre. The park is considered to be one of the best, unspoilt examples of a Victorian park left in England and is Wolverhampton's premier open space. This geosite is particularly important for its range of well-displayed and easy access glacial erratics that are thoughtfully placed around it's many footpaths and recreational areas. A number of these erratics have interpretation associated with them explaining their points of origin. The flat landscape here reflects the till plain on which it sits above a very low relief Permo-Triass bedrock shelf adjacent to the western edge of the coalfield. The site enjoys the full range of facilities of the city centre just a few minutes walk away and has on site sporting facilities, cafe and toilets. It is a prime geotourism and recreational site of the geopark, and is in close proximity to the geotrail within the city centre and the collections at the Art Gallery. New Black Country Geopark signs are intended for this site.
More information is available at; http://www.wolverhampton.gov.uk/article/1875/West-Park

Geosite 16 Walsall Arboretum (SINC - regionally important)

This geosite was formerly the site of limestone mines that were active between 1770 and about 1835 when groundwater inflows made the mining uneconomic and the lakes formed as the groundwater levels equalised. These mines were extracting the Silurian, Much Wenlock Limestone Formation strata that outcrop within the arboretum site. By 1874 the area was turned into an arboretum and lake site. In 1951 the first night –time illuminations were done as part of the 'Festival of Britain' and these became a feature until a few years ago. The site contains a glacial boulder with interpretation adjacent to the main lake. Facilities at the site have been dramatically improved in 2014/5 through a major redevelopment project and now include, a visitor centre/cafe, bandstand and boating with a network of footpaths including a nature trail and long distance path that links this site the geosite 28 Hay Head . It is an important geotourism and recreational site of the geopark, and is in close proximity to the geotrail, museum and art gallery in the town centre. Black Country Geopark signage is intended for this site. More information is available at;
http://cms.walsall.gov.uk/index/leisure_sports_community/arboretum/past_news_about_the_project/arboretum_through_time.htm

Geosite 17 Castle Hill (Includes lagerstatten internationally important, and (SINC - regionally important)

Castle Hill is the most important geotourism node in the Black Country Geopark Project. It is a faulted anticline of Silurian Elton Formation, Much Wenlock Limestone Formation (MWLF) and Coalbrookdale Formation strata which represent a folded uplifted and eroded palaeo- landscape that is overstepped by Carboniferous Pennine Lower and Middle Coal Measures with a major unconformity at its contact. The hill is the site of a number of individual type locations for Silurian Fossil species and is significant in ongoing international research projects for microfossils. This is also the site of the world's first true stratigraphical geological map published in 1665, Both the Silurian and the Carboniferous sequences here were of major economic importance and consequently heavily mined and quarried during the industrial revolution. The limestone mining features are recognised as nationally important as a part of the Scheduled Ancient Monument for its limestone mining features and Classic Limestone Quarried Landscapes with adjacent geosite 2 –Wren's Nest National Nature Reserve. The hill therefore offers multiple comparative sections of fossiliferous MWLF strata. Castle Mill Basin at the northern end of the site hosts an exceptionally fine fossil reef mass. It is an exceptional cluster of geological, industrial, and cultural heritage features including Living History Museums, accessible mines and canal tunnels. There is a visitor infrastructure with additional visitor facilities planned for 2014-2016. This is a key geosciences research, geotourism and geoeducational site of the Black Country with managed facilities, educational and interpretive resources. Black Country Geopark signage is intended for this site. More information is available at;
http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=2&ved=0CCcQFjABahUKEwjBs937o-DHAhWGp9sKHen3BL4&url=http%3A%2F%2Fwww.dudley.gov.uk%2FEasySiteWeb%2FGatewayLink.aspx%3FalId%3D275781&usg=AFQjCNEJzOZZxp7YdQ5pI5kcpBje7n14pw and http://www.dudleyzoo.org.uk/around-dzg/dudley-castle

Castle Hill is both a major geological geosite but is also a very important historic landscape feature. It includes important cultural history associations, both as the home of the barons and lords of Dudley but also n more recent times as a mined landscape innovatively restored as zoological gardens. These include special architectural features in the form of the 'Tecton' Structures which are twelve listed buildings, seven Grade II and five Grade II*, erected in 1937 of architect Lubetkin. This 40-acre (16 ha) zoo is located within the grounds of the medieval Dudley Castle. The Zoological Gardens opened to the public on 18 May 1937. Most of the zoo buildings are art deco in style. The site has a wide range of visitor and hospitality facilities and there are plans to expand and enhance these. In January 2013, regeneration work began on this site with the help of ERDF funding. This linked the many heritage features of Castle Hill along its eastern flank and provided new entrances to the zoo , Black Country Living Museum and the Dudley Canal & Tunnel Trust. It also provided enhanced parking capacity and a visitor hub associated with the new pathway network. Geological interpretation is part of the regeneration works for the hill and Geopark signage is planned for the site . Further information is available at; http://www.dudleyzoo.org.uk/ and http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&ved=0CCUQFjAAahUKEwji9Kylvu3HAhVJ6RQKHVe9CRE&url=http%3A%2F%2Fwww.dudley.gov.uk%2FEasySiteWeb%2FGatewayLink.aspx%3FalId%3D220116&usg=AFQjCNGwCxcrYfMwQdMi0QbwP-4giXZ56Q

Geosite 18 Black Country Living Museum (related non- geological geosites are described in section C4 below)

Geosite 19 Red House Glass Cone and the Crystal Mile (related non- geological geosites are described in section C4 below)

The following geosites constitute a collective of town centre geotrails that provide an insight into the development of the major townships of the Black Country and their urban fabric as the industrial revolution took hold , population increased and industrial wealth spread and was re-invested in buildings and infrastructure of the area. Differences in the local industries and cultures are expressed In the nature of the local museums associated with these town centres and the artworks in the streets and galleries in each one.

Geosite 20 Walsall Geotrail, Museums and Galleries

This geosite is a classic town centre rich in building stones and imported decorative rock-types that provide a varied geotrail. Walsall's town centre sits immediately adjacent to geosite 16(Walsall Arboretum) and the town includes a Local History Centre, Walsall Leather Museum and Walsall New Art Gallery. These enrich the stories of Walsall and provide very well-presented cultural heritage attractions within the town. The town centre is full of amenities and easily accessed by bus car and train. A geotrail leaflet is being prepared for this geosite. Further information is available at;
http://cms.walsall.gov.uk/index/libraries_museums_and_arts/museums/localhistorycentre/walsall_history/walsall_in_history.htm

Geosite 21 Wolverhampton Geotrail, Museums and Galleries

This geosite is a larger city centre rich urban landscape with important buildings many architectural stones and imported decorative rock-types that provide a rich building stones geotrail. Wolverhampton's city centre sits immediately adjacent to geosite 15 (West Park) and the town includes a Local Archives Centre, and art gallery which hosts the second-largest geological collection of the Black Country but none of this is currently on display but can be viewed by appointment. Wolverhampton is also the evening entertainment capital of the Black Country with many restaurants and bars with live music, amenities and theatre venues. It is easily accessed by bus car and train. A geotrail leaflet is being prepared for this geosite. Further information is available at; http://www.historywebsite.co.uk/

Geosite 22 Wednesbury Geotrail Museums and Galleries

This geosite is a small town centre with important historic buildings and industrial associations. Architectural stones and imported decorative rock-types here also provide a building stones geotrail. The town's Museum and Art Gallery hosts a fine geological collection of about 7000 objects but none of this is currently on display but may be viewed by appointment only. Wednesbury has an active local history society that organizes a programme of talks and organizes local heritage exhibitions. A geotrail leaflet is being prepared for this geosite. Further information is available at;
http://www.historywebsite.co.uk/articles/Wednesbury/Contents.htm

Geosite 23 Blue Rock Quarry (SINC - regionally important)

This geosite provides the best and most easily accessible exposures of the largest dolerite intrusion in the Black Country (The Rowley Lopolith). This site comprises a 20m long relic quarry face in the restored - Samson/Blue Rock quarries. The exposed rocks are entirely weathered dolerite/microgabbro of Late Carboniferous Westphalian C age. The site has been the recent focus of community geoconservation activities that saw a sculptural seating area put in place

with an interpretive cairn installed in early June 2014. The rock faces exhibit excellent examples of columnar jointing, nodular exfoliation, and weak mineralisation. Good, safe access makes this a very useful geoducational and geotourism site where it links to the wider landscape of the Rowley Hills. Sitting on the northern slopes of the Rowley Hlls, the site offers a viewpoint across the developed plain of the coalfield to the north. This site is within working memory of local residents and has local quarrying heritage significance. The site has a friends group, is managed by the wildlife trust for Birmingham and the Black Country and volunteers from the Black Country Gelogical Society. It has good footpaths and adjacent meadow areas that are important for their biodiversity and make this an important, accessible site for the geopark. More information is available at; http://www.bbcwildlife.org.uk/rowley-hills

Geosite 24 Shire Oak Quarry Local Nature Reserve (SINC - regionally important)

This is a large former sand and gravel site with extensive exposures of Triassic Chester Formation overlain by Quaternary glaciofluvial sands and gravels. It is an important site when taken in context with Geosite 3 Barr Beacon, which together demonstrate the variability of the formation and its fluvial deposits across the Triassic Basin in which it was deposited. The site has a car park and formal footpaths as well as seating and play areas. There is limited on-site geological interpretation but currently no printed or online geological information is available for this site, but these are planned for the near future. This is an important geoscience and geoeducational site for the geopark, and has potential for geotourism as part of the future Black Country geological motor tour.
More information is available at; http://cms.walsall.gov.uk/index/shire_oak_park_nature_reserve.htm

Geosite 25 Norton Covert (SINC - regionally important)

This geosite is an abandoned sand and gravel pit, now naturally revegetated, and is important to the story of the Black Country as it is the only site that provides exposures of Quaternary, Devensian stratified outwash sands and gravels in the southwestern area of the proposed geopark. The site has a friends group, formal paths, a geological interpretive leaflet, and on-site interpretation. This is an important geosite within the geopark for geosciences, geotourism, and geoeducation, and will feature on the planned motor tour of the geology of the southern Black Country. Black Country Geopark signage is intended for this site.
More information is available at; http://bcgs.info/pub/wp-content/uploads/2014/10/norton_covertleaflet.pdf

Geosite 28 Hay Head Quarry (SINC - regionally important)

This geosite lies within the Cuckoos' Nook and Dingle Local Nature Reserve occupying 7 hectares of the borough. It is important both as the only site at which the effects of the eastern boundary fault of the Black Country coalfield can be seen in the landscape, and also as the type location of the lower Wenlock series (Barr Limestone Member of the Coalbrookdale Formation (Sheinwoodian stage)) and also is that of the 'Barr Trilobite', Bumastus barriensis. Exposues lying within the long linear strip of the old quarries are of shaley units with bentonites. Straigraphically they are within the Lowest part of the Much Wenlock Limestone Formation and contain fossils and microfossils that contrast strongly with the upper parts of the Wenlock Series exposed elsewhere (Geosites 2 , 10 and 17) These beds are abruptly terminated to the east where they are down-faulted by the Eastern Boundary Fault and are juxtaposed with Coal Measures strata., The faulting also results in contrasting soils on either side that introduce two completely contrasting types of woodland. Parts of the site are ancient semi-natural woodland with an associated rich flora including many plants which are rare or uncommon in the conurbation This is an important geoscience site in on-going research on microfossils and carbon isotope correlation. Walking trails, education material, and an interpretive leaflet are available for this key geopark, geotourism, and geoeducation site. Black Country Geopark signage is intended for this site
More information is available at; http://cms.walsall.gov.uk/index/nature_reserves.htm and http://cms.walsall.gov.uk/index/environment/conservation_and_regeneration/nature_conservation/sites_of_important_nature_conservation/hay_head_wood.htm

Geosite 29 Daw End Railway Cutting & Linley wood (Site of Special Scientific Interest, nationally important)

This is a nationally important site for geoscientific interest, featuring a reef formation from the marine Silurian. Its geology is Much Wenlock Limestone Formation and Coalbrookdale Formation, forming a steep embankment alongside an active railway. There is no public access. Interpretive information exists for the site and it is important in the history of geology in the Black Country. At the eastern end of the section there is an important unconformity with the Pennine Lower Coal Measures Strata and a geological fault. It is in close proximity to the other Much Wenlock Limestone Formation and Coalbrookdale Formation features of Walsall, and provides a number of good comparative sections to understand the regional variation in these units. There are no on-site facilities at this geosite and none are planned due to the nature of its ownership and access. The Linley Wood part of this geosite has important mining heritage, and is currently subject to private interest as a potential cave diving centre, parts of the accessible mines are flooded, and as such there may be future tourism potential here, but for the time being this geosite remains the sole preserve of scientific specialist enquiry. More Information is available at: http://blackcountryhistory.org/collections/search/?q=Walsall%20&%20District%20Co-operative%20Society&fq%5Bdc.subject%5D%5B%5D=Lime%20Works

Geosite 30 Ketley Quarry (Site of Special Scientific Interest, nationally important)

Ketley Quarry is a nationally important geosciences site that provides the best exposures of the junction between the Carboniferous Etruria and Halesowen Formations in the English Midlands. This is an active quarry site, and recent agreements with the owners will conserve and make accessible key sections in the site for future educational and tourism groups. This site is being considered for its future use as an educational resource for engineering and environmental geology and extractive industries with the University of Birmingham. This is an outstanding section with an unconformity between the two formations. Access is by appointment at the moment, but on restoration of the workings it will be publically available. Black Country Geopark signage and educational resources are planned for this site. More information is available at;
http://jncc.defra.gov.uk/page-2945

Geosite 31 Bromsgrove Road Cutting (Site of Special Scientific Interest, nationally important)

This is a geoscience site providing the best available exposure of the lower part of the Carboniferous Halesowen Formation sequence. In particular, a fine section through the basal sandstone member is present which provides important evidence for the environmental interpretation of Britain during the

Westphalian Epoch. This site is primarily a scientific and higher education resource and access is restricted due to its location and logistics of access. No on-site interpretation is currently in place but Black Country Geopark signage is planned for this site . More information is available through Natural England websites also http://jncc.defra.gov.uk/page-2945 and https://books.google.co.uk/books?id=ew9JCAAAQBAJ&pg=PT283&lpg=PT283&dq=bromsgrove+road+cutting+geological+site&source=bl&ots=0Fcwbcrem2&sig=4jFyGvbPvIXSXkTwrJVIy7Ba5bM&hl=en&sa=X&ved=0CE0Q6AEwCGoVChMIrqyBjJjjxwIVgl0aCh2fHQZD#v=onepage&q=bromsgrove%20road%20cutting%20geological%20site&f=false

Geosite 32 Wychbury Hill (SINC - regionally important)

This geosite has exposures of Permian Clent Formation in the banks of the farm track leading to the summit of this steep, rounded hill. Such exposures are very rare in the Black Country and important to understanding how this unit varies laterally and vertically from its type locality of the Clent hills to the south of the Black Country. This is also a site which illustrates the connection of geology and landform to early human settlement in the Black Country as the summit of the hill hosts earthworks of an iron-age fortified structure (Wychbury Camp) of national significance as a Scheduled Ancient Monument. The site is a viewpoint and footpath connecting landscapes adjacent t the Black Country and has potential for geotourism as part of a long distance through the geopark and as a location on a planned motor tour of geological sites in the Black Country. As a rural and walking route geosite there are no visitor facilities on or planned for this site. More information is available at;
http://www.hawnebasin.org.uk/walks/Roy%20Burgess/d599e9_cf0e2eb9ca6e4f9290e3bc8a5aca720e.pdf

Geosite 33 Park Lime Pits Local Nature Reserve (SINC - regionally important)

This geosite was a former limestone quarry working the Wenlock Limestone Formation strata that outcrop here. Long abandoned quarries known locally as ' the pits' now contain beautiful clear pools surrounded by mature beech woodland and species rich calcareous grassland and meadows. This makes it a prime geobotanical asset of the Black Country due to its lime rich soils giving rise to over 300 species of plants species being recorded. There is speculation that the limestones from these quarries was used by the romans during their occupation of Britain in the first to fourth centuries for paving athe main roman road in the area –Watling Street' a little to the north of the site, however large scale extraction occurred much later and is associated with the Industrial Revolution. During that main period of activity, limestone was transported from the pits by pony-pulled rail trucks and local canals to the iron foundries of the Black Country. When quarrying ceased some 150 years ago the Victorians landscaped the old workings and the quarries became flooded to form the pools that occupy the site today. More information;
http://cms.walsall.gov.uk/index/environment/conservation_and_regeneration/nature_conservation/sites_of_important_nature_conservation/park_lime_pits.htm

Geosite 34 Wightwick Wedge and Smestow Valley (SINC - regionally important)

This geosite sits within the wide Smestow Valley, which is a major geomorphological feature of the Black Country on its western margin. It has been an important access route through the local sandstone ridge and hills. This glacial meltwater enhanced valley now holds the Smestow Brook and was the obvious route to place an industrial railway line and the Staffordshire & Worcestershire canal. The exposed geology in the valley includes , a series of narrow, twisting, ribbon-like sand and gravel areas that are are cut into the upper part of the exposed bedrock, the Triassic Wildmoor Sandstone Member. These are enigmatic channel features infilled with sediments relating to the Quaternary Devensian glaciations of the area. Such features are unique in the Black Country and make this an important geoscience site. The quarries here also include a variety of sedimentary structures, and showing both dip and strike sections of the bedrock making this a potentially important geoeducational site. At Wightwick Lane there is an important junction between the Wildmoor Sandstone Member and the overlying. Further glacial geoheritage is present at Wightwick Manor above Wightwick Bank where a particularly good display of Quaternary Devensian glacial erratic boulders is on display within a managed garden setting of the Ntaional Trust property. This is an important geotourism site for the geopark that offers a range of visitor facilities and has potential to be an important geoeducational site of the geopark.The site has informal paths, but as yet no on-site or printed geological interpretation is available. Its presence adjacent to the Staffs and Worcester canal give this geosite potential as a geotourism site for inclusion within the planned canal geotour for the Black Country.
More information; http://www.wolverhampton.gov.uk/article/3355/Smestow-Valley-Local-Nature-Reserve

Geosite 35 Barnford Hill Park (SINC - regionally important)

This geosite is the best and most easily accessible exposure of the Upper Carboniferous, Salop Formation , Enville Member withn the geopark. The exposure has been termed 'the Pudding Rock' by locals and is a large rounded mound of conglomerate remaining after quarrying activities had ceased, and workings were restored to form this public parkland. The exposure stands in the centre of what is now a well-managed recreational park with a range of sporting facilities and children's play areas. This history of the park notes that it was given "for the use of the public for ever" in 1915 by Mr W A Albright of Messrs Albright and Wilson, a major Black Country Chemicals manufacturer and innovator. The exposure shows the characteristic very coarse grained nature and distinctive included clasts that are characteristic of this geological unit.and its elevated position provides good views across the Black Country landscape to the nort and west. The site is a geotourism and geoeducational asset that is very well managed , has a pavilion and good accessible footpaths and there is an interpretive sign for the geology of the Pudding Rock itself. There is a community friends group associated with this site but as yet no on-site or printed geological interpretation is available. Black Country Geopark signage is planned for this site. *Image Credit - Creative Commons*

Geosite 36 Buckpool and the Leys Local Nature Reserve (SINC - regionally important)

Ths geosite links two large nature reserve areas of the southern Black Country and is important for demonstrating the effects of movements on the Western Boundary Fault of the coalfield. It is also significant in terms of historical geology being associated with the work of J. Beete Jukes, an early director of the British Geological Survey in determining the nature of the South Staffordshire Coalfield and its geology. It has good exposures of a number of upper Carboniferous and Permo-Triass strata and has strong associations with the canals and in particular the internationally important glass making industry of the 'Crystal Mile' and can be inked with geosite 19 The Red House Glass Cone. The Buckpool

and Fens Pools Local Nature Reserve is also an important wildlife haven It includes old railways and canals with their rich industrial heritage, and pools, ponds, streams, grassland and scrub that combine to make this area unique in Dudley. Collieries were operating at the Dell, on the Leys and the Wallows and around Grove and Middle Pools. There were claypits where Middle Pool and the Farmer's Pond are today, and a large brickworks on The Leys. The Pensnett Railway ran between Middle and Fens Pools, bringing coal from the Earl of Dudley's Baggeridge pits to the Round Oak Iron and Steel Works, whose blast furnaces lit up the night sky for miles around. More information is available at;
http://www.dudley.gov.uk/resident/environment/countryside/nature-reserves/buckpool-and-fens-pools-nature-reserve/

Geosite 37 Compton to Tettenhall Ridge (SINC - regionally important)

This geosite traces the geology of a long escarpment on the southwestern edge of Wolverhampton and how it imparts local distinctiveness to the landscapes and building materials of the Compton and Tettenhall area. This landscape is associated with the western boundary of the Black Country Coalfield and strongly influenced by the glacial and post glacial events. 'The Rock' at Tettenhall is a high road cutting on the sides of the A41, through the sandstone ridge at Tettenhall (the original London-Holyhead Road). The cutting exposes Triassic Wildmoor Sandstone Member and Helsby Sandstone Formations, and exposes the junction between the two units. A roadside quarry in private land shows very good chemical reduction spots in the layers, related to groundwater flow and chemical conditions within the strata. This is an important geoscience site and has potential for geoeducation and geotourism, particularly when combined with other geosites in the immediate area and their features (Geosites 15 and 34in particular). There is an historic church site on the Triassic ridge of Tettenhall, with bedrock of Triassic Wildmoor Sandstone Member. Small cave-like excavations in the sandstones at the rear of the church have been used by local residents for storage, and give good exposures of the rock types and textures of the bedrock here. The churchyard and church provide a range of petrologically diverse gravestones and have scattered Quaternary Devensian glacial erratics. There is a geological leaflet available that explains the geology of this area of the Black Country. This site has easy access and is a useful geotourism and geoeducational resource for the geopark. More information is available at; http://www.tettenhall.co.uk/history/

Geosite 38 Coseley Canal Cutting (SINC - regionally important)

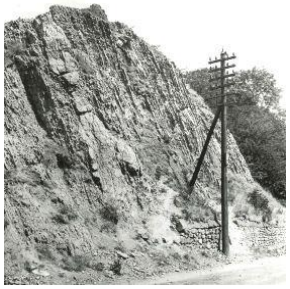
This geosite site exposes a rare section of the softer sedimentary succession of the Carboniferous Pennine Middle Coal Measures Strata. It is the best exposure of these rocks on the Dudley-Sedgley anticlinal ridge, and plant fossils can be found here. It is located within a high sided rock cutting where the adjacent canal is cut into the landscape such that at its base, the canal enters a short canal tunnel. The sequence exposed is of pale coloured sandstones, mudstones, and ironstones.. Its position on the well-used inland waterway of the canal makes it an easily visited and viewable site for geotourism and geoeducation, although close examination of the rock faces is discouraged due to the nature of the exposures here. No on-site interpretation is present as yet, but there are plans for this and interpretive literature in the future. Black Country Geopark signage and its inclusion in a canalside geology leaflet for the geopark are planned for this site. Further information is available at;
http://www.sedgleylocalhistory.org.uk/cos/costun.html

Geosite 39 The Rowley Hills (SINC - regionally important)

This geosite covers the highest landforms of the Black country that are produced by the resistant nature of a large, Upper Carboniferous, faulted lopolithic intrusion of olivine dolerite beneath the landscape here. These hills offer commanding views in all directions and have a long history of aggregate quarrying. Exposures around the hill provide evidence of the nature of emplacement and effects on country rocks of the intrusion. The largest quarry on the hill is the Hailsone Quarry which is a very large and deep aggregate quarry that finally ceased its quarrying activity in 2010. Partly infilled, there are long-standing restoration plans for infill that will be requiring re-appraisal of the planning permission before such levels of infill are met. Consultation is now occurring for alternative restoration options including partial hard development of the quarry floor with rockfaces retained for educational and recreational purposes. It lies within the area proposed for the establishment of a Rowley Hills Country park. It is steeped in the quarrying history and its rockfaces contain very rare twisted and curving cooling joints which are thought to mirror the contact surfaces of the intrusion with the surrounding country rock. Small faults with breccias and vein infill are also present in the quarry faces. The upper terraces of the quarry contain good examples of columnar jointing and a full weathered profile with 'onion skin' exfoliation. Currently in private ownership no public access is possible but representation has been made on future plans for the quarry and this site has considerable potential for geoeducation and geotourism. The area has an active community friends group, there is an geology leaflet available for the hills and many footpaths and local amenities are present on and around the site. Black Country Geopark signage is planned for hills. Further information is available at;
http://bcgs.info/pub/?page_id=577

Geosite 40 Coombswood Valley (SINC - regionally important)

This geosite occupies an elongate tributary valley of the river Stour in the southern Black Country. It is geologically important as it provides the best long section of Carboniferous, Etruria Formation in the Black Country, which contain plant fossil material. This is also referred to in Latin manuscripts of the Halesowen Abbey where underground coal mining was occurring as early as 1281 – providing a known date for the start of underground coal mining activity in the Black Country. Exposures here are associated with the only thrust/reverse faulting known (The Russels Hall Fault) which is important to understanding the tectonic history of the geopark. There is a leaflet that introduces the history of the valley and a footpath network in the valey associated with its canals but currently no on-site interpretation is present at the site . This is part of the geotourism site network for the geopark and ill be one of the linked geosites on the canalside geology leaflet for the geopark with good geoeducational potential. Black Country Geopark signage is planned for the valley. Further information is available at; http://www.hawnebasin.org.uk/walks/COOMBESWOOD%20LEAFLET.pdf



Geosite 41 The Gorge, Sedgley (SINC - regionally important)

This geosite sits on the border between the borough's of Dudley and Wolverhampton and is important as a comparative section of Silurian, Much Wenlock Limestone Formation, Nodular Member strata which is best exposed on the south side of the adjacent road cutting and in quarries on either side of the road. These strata are highly fossiliferous and offer an important palaeontological comparison with the exposures in the Silurian inliers further to the east (Wrens Nest NNR and Castle Hill). The northern part of the site is in the ownership of Wolverhampton, and includes a now derelict

building which used to be an environmental interpretation centre a decade or so ago. Access is by appointment only to that area of the site. Currently there is no on-site interpretation and this site will be included in the geological leaflet. It is an important geosite within the geopark, mainly for geoscience however this site has both geoeducational and geotourism potential and discussions are currently occurring with Wolverhampton City Council about the future of this site. Further information is available at; http://www.tourismleafletsonline.com/pdfs/Discover-Dudley-20150427191253.pdf

Geosite 42 Hayes Cutting , Lye **(SINC - regionally important)**

This geosite is important for its palaeontology, structural geology, and the nature of the unconformity between the Upper Silurian and Carboniferous strata at the southern tip of the Netherton Anticline. The site is a long roadside cutting behind a metal railing fence and features a dipping sequence of strata including Silurian Ludlow Bone Bed, Upper Ludlow Shales Group Whitcliffe Formation, Aymestry Limestone Formation and Carboniferous Pennine Lower Coal Measures. This site is particularly important to geosciences in demonstrating the variability and diachronism of the basal beds of the Black Country Coalfield as it spread across older palaeozoin landforms and links directly to comparable sections at Geosites 4 and 7. This site has considerable scientific importance and was used in a collaborative research project some 10 years previously with the Belfast Museum and the Ulster University, and is currently of interest for research by the University of Birmingham. Access to the site is by agreement with the landowners and is within the remit of scientific enquiry. This site has potential to be a valuable site for geotourism and geoeducation, and is also being considered for the planned motor trail of the geology of the southern Black Country. Further information is available at; http://jncc.defra.gov.uk/page-2941 and http://jncc.defra.gov.uk/page-2945

Geosite 43 Stafford Road Cutting (SINC - regionally important)

This is the only exposure of glacial till that is available currently in the Black Country, making it an important geosciences site for the area.. The main part of the outcrop is a laterally extensive outcrop of Triassic Helsby Sandstone Formation, which has a profile of the palaeolandscape of the last ice age preserved as an irregular, eroded upper surface with a capping of Quaternary Devensian Glacial till. Interbedded sandstones, pebbly sandstones and mudstone pellet breccias, in this section indicate the nature of a new phase in the Triassic period very different from the preceding Wildmoor Sandstone Member. This site is a long road cutting adjacent to the A34and has very easy access of a wide footpath. It has potential as a geoeducational and geotourism site as part of a Black Country geotour, however this is a very busy city road and large groups are discouraged from the road edge here. There is currently no on-site or available specific geological literature but further site interpretation is planned for this site.

Geosite 44 Holloway Street Quarry (SINC - regionally important)

This is an important geosite for the geopark, linking geology, quarrying heritage and the build environment of a conservation area The site comprises extensive, shallow sandstone quarries that provide the best and most extensive exposures of Silurian Downton Castle Sandstone Formation strata (the 'Gornal Grit') in the Black Country. These quarries and the surrounding urban area (particularly Vale Street conservation area) offer an important, tangible direct link between the quarried stone, its uses in constructing the urban fabric, and providing 'distinctiveness' to the built character. A few hundred metres to the north of the site is Ruiton Mill, constructed from the sandstone and itself a Scheduled Monument.. There are no specific visitor facilities at this site but there are walking trails across the site. There is currently no interpretive material available and no on-site interpretation. Geopark signage is planned for the site**.** Further information is available at;

http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=3&ved=0CC4QFjACahUKEwi3rd3EvOTHAhXlKtsKHbfZBEw&url=http%3A%2F%2Fwww.dudley.gov.uk%2FEasysiteWeb%2Fgetresource.axd%3FAssetID%3D5788%26type%3Dfull%26servicetype%3DAttachment&usg=AFQjCNFN8YWRqVNMm3QDO7SuIggMuwxSDA

Geosite 45 Stourbridge Old Town Gasworks Site (SINC - regionally important)

This geosite is important as the only publically accessible exposure of interglacial deposits in the Black Country which are seen resting on exposed solid strata belong to the Triassic Wildmoor Sandstone Member. The bedrock contains excellent exposures of cross bedded sandstones. The interglacial deposits are present as a river terrace gravels (the First Terrace of the River Stour) which is of the Quaternary Ipswichian interglacial. Extensive rockfaces run around the edges of this site, and are a remnant of a much earlier period of sand and gravel quarrying that created a platform on which the old coal-gas works was established. In recent years this was cleared and a new housing development has been placed here. As part of the planning considerations for this site, the development was designed to place the access road adjacent to the rockfaces so that easy future access is guaranteed. As the name suggests, this site is associated with a former gasworks industry and the soft rocks of the Triassic here hide a subterranean network of tunnels behind them that were air-raid shelters for workers at the gasworks during the last war. This area will also feature in future plans to interpret the geology of the 'Crystal Mile' reflecting the glass making area of the southern part of Black Country Geopark. Currently there are no interpretive resources available for this site. This is an important for geoeducation, geosciences and as a geotourism resource. Geopark signage is planned for the site. Further information is available at; http://www.amblecotehistorysociety.org.uk/Contents/Subjects/Airraid%20Shelters/Industry/Gasworks/Gasworks.htm

B4 Listing and description of other sites of natural, cultural and intangible heritage interest and how they are related to the geological sites and how they are integrated within the proposed Geopark

The geology of the Black Country is only known and exposed in today's landscape because of man's exploration of the land and its resources. The story of their discovery, variety and abundance of economic minerals, their extraction and use in the heavy industries is a fundamental attribute of the geopark. This imparts a unique character to this special landscape. The industrial landscape is quite different to most other geologically special areas within the geoparks network. Key industrial heritage sites and derelict sites (sometimes naturally reclaimed by nature) are essential to explaining the Black Country's unique urban/geological landscape. Carefully selected biodiversity, industrial archaeology and cultural sites are included in the geosites listing of the geopark for this reason. They constitute a vital aspect of the area's story and offer some of the most inspirational and compelling heritage experiences of the Black Country Geopark Project. Of the non-geological heritage sites

listed, the canal heritage is particularly special. The canals are an extensive network of inland waterways that thread through the urban landscape connecting many geosites together. They provide access ways for walking, boating and cycling between geosites and contain superlative industrial heritage which is a direct consequence of the geological story and its exploitation. Many engineering structures were constructed of 'blue brick' made from the extensive Etruria Formation clay pits of the area which now provide a special character to the look and 'texture' of the place. The canal story is so completely interwoven with the geological heritage and its exploration that they are inseparable. The non-geological geosites described below represent the best and most accessible industrial and cultural amenities that compliment and complete the geological story of this special place.

Geosites in which the Industrial, Cultural and Artistic Heritage of the Black Country is the dominant feature

The locations of geosites listed below are shown on Figure 20 on page 17 of this report, and their site features are listed in table 2 on page 16 and Tables 5 & 6 on pages 36 & 37 respectively. There are many sites and features of an industrial, cultural or artistic nature that include or reflect a geological or mining theme. However, we have restricted the list on the basis of 'best intellectual and physical accessibility', and their connections to other geopark assets and also their unique contributions to the story of the heritage and landscape of the Black Country and its deeply rooted communities.

Geosite 9 Bantock House Museum

Bantock House is an important heritage site (grade 2 listed building) to the southwest of Wolverhampton that was formerly the family home of the Bantock family and is set in 48 acres of parkland. Its main theme is Edwardian life of a wealthy industrial Black Country family showing the aspirations of those who generated their wealth from the mines and factories of the area. The museum is one of the tourism nodes for the western part of the geopark stocked with geopark literature alongside that of other local attractions. The house has a temporary exhibition space and hosts local history lectures (in the autumn of 2015 the Black Country Geopark was one of the lectures and will be used both to promote and engage local communities with the geopark). The exhibition area has also been host to the first dedicated Black Country Geopark exhibition 'The Riches beneath us : The Black Country's Amazing Rocks' featuring displays of local fossils including the genuine 'Coseley Spider' Eophrynus prestvicii fossil on loan from the Lapworth Museum of Geology at Birmingham University where it is permanently resides http://www.bantockhouse.co.uk/Exhibition/54/the-riches-beneath-us-the-black-countrys-amazing-rocks . The parkland also once hosted a glacial erratic and its housing is still present in the park. With views over the Dutch Garden, the popular courtyard café serves homemade food, drinks and ice creams, while the museum shop has a range of cards and, gifts. Geopark signage is planned for the site. Further information is available at;

http://www.bantockhouse.co.uk/

Geosite 11 Brownhills & Walsall Wood Mining Heritage Monuments

Entitled **The Brownhills Colossus,** this is one of many pieces of Black Country mining themed public art. This is a particularly impressive monument that celebrates and commemorates the rich deep underground coal mining of the Brownhills community. Standing 12m high in the centre of the main traffic island at the entry to the town, this stainless steel fabricated figure is of one of the largest figurative sculptures in the United Kingdom. Truly iconic, this sculpture was designed by artist and sculptor John McKenna drawing upon extensive consultation with the local community of Brownhills. More information;

http://www.a4a.co.uk/brownhillsminer.html

As part of the re-generation scheme of Walsall Wood, a number of metal sculptures were commissioned by Walsall Metropolitan Borough Council. These were designed and built by Black Country artist Luke Perry and his team at Industrial Heritage Stronghold Ltd. Walsall Wood community like its near neighbour Brownhills were established as coal mining centres. The main monument, standing 20m high has been designed as the pit head to Walsall Wood Colliery. It shows the typical pithead construction at the colliery used to lower and raise the mine cages in the main pit shaft that was here. It is the largest monument of this type in the world. Linked with the adjacent mining sculpture at Brownhills, this forms part of a substantial mining geoart trail across the Black Country that celebrates this most important aspect of the geoheritage of the geopark. For more information visit; http://www.industrialheritagestronghold.com/?page_id=454

Geosite 12 Bumble Hole and Warrens Hall LNR (SINC- Regionally important)

This geosite is a classic coal mining landscape of the Black Country and a very important industrial canal junction that even today provides a vital link along the inland waterways to areas beyond the Black Country for tourism and commerce. It is situated on the southern face of the Rowley Hills and straddles the border between the boroughs of Dudley and Sandwell. It offers superb views across the south of the geopark and beyond to the Clent, Abberley and Malvern hills of Worcestershire. The tall chimney of Cobb's Engine House is testament to the site's industrial past, along with the Netherton Canal Tunnel. The area was once covered with industry including factories, boat yards, coal mines, blast furnaces, iron works, timber yards, brick kilns. Cobb's Engine House (properly known as Windmill End Pumping Station) is a Scheduled Ancient Monument and a Grade II listed building built around 1831. It housed a stationary steam pump used to pump water firstly from Windmill End Colliery and later mines in the area. Utilizing a shaft 525 feet deep, 1,600,000 litres of water were pumped from the mines into the canal daily. It ceased work in 1928 and the Newcomen type engine was moved to the Henry Ford Museum in Dearborn, Michigan in 1930. The adjacent Netherton Canal Tunnel was the last canal tunnel to be built in Britain during the great canal building age from 1750 -1860. The ceremonial 'first sod' of the earthwork was turned by Lord Ward the Earl of Dudley on 31 December 1855 and the canal opened on 20 August 1858. The site has car parks, many footpaths, a leaflet, interpretive signage , a friends group and a visitor centre at Bumble Hole, and hosts the Black Country Canal Festival each September. New Black Country Geopark Signs are planned for this site. More information is available at http://www.dudley.gov.uk/resident/environment/countryside/nature-reserves/bumble-hole-and-warrens-hall-local-nature-res/ and http://www.bcbf.com/page4/the-bumble-hole.html ; http://www.sandwell.gov.uk/info/200248/parks_and_green_spaces/754/warrens_hall http://www.aditnow.co.uk/mines/Cobbs-Engine-House-Shaft/ http://en.wikipedia.org/wiki/Netherton_Tunnel_Branch_Canal

Geosite 13 Galton Valley (SINC- Regionally important)

This is a large, man-made valley cut into thick Quaternary, Anglian age glaciofluvial sands and glacial channel fills to create a major canal and railway transportation corridor during the Industrialisation of the region. It is the best site to appreciate the scale of man's manipulation of the landscape during the height of the Industrial Revolution. The valley hosts some of the most important industrial heritage sites of Britain. These included

Galton Bridge was built by the famous British engineer Thomas Telford in 1829. It spans the Birmingham Canal Navigations New Main Line and it carries a road called Roebuck Lane. When it was constructed, its single span

of 151 feet (46 metres) was the highest in the world More information is available at;
http://en.wikipedia.org/wiki/Galton_Bridge
Chance's Glass Works is cluster of listed building and adjacent canal bridges on the Birmingham Canal Navigation Main Line. They were the innovative manufacturies that produced most scientific grade glass and most of the glass for the world's light houses, as well as the glass in London's iconic Crystal Palace during the industrial Revolution. All of these industrial heritage features fall within the Smethwick Summit - Galton Valley Conservation area.
Steward Aqueduct, an impressive structure**,** the Grade II listed aqueduct, was built by Thomas Telford in 1829 when he bypassed James Brindley's earlier Birmingham Canal (at the Wolverhampton Level) with his New Main Line (at the Birmingham Level). Both canals contributed to the Industrial Revolution in the Midlands by conveying coal and raw materials to Birmingham, and finished products to the country and ports. More information;
http://www.search.revolutionaryplayers.org.uk/engine/resource/exhibition/standard/?resource=2034

The Engine Arm Aqueduct near Smethwick, West Midlands, England, was built in 1825 by Thomas Telford to carry a water feeder, the Engine Arm, from Edgbaston Reservoir over the BCN New Main Line canal to the adjacent and parallel Old Main Line. It is a Scheduled Ancient Monument. It is a 52-foot (16 m) span structure consisting of a cast-iron trough supported by a single arch with five ribs, each consisting of four sections with bolted joints. The trough is supported on three of the ribs, with the adjacent towpaths being supported by cast-iron arcades of Gothic-styled arches and columns. All cast-iron features were

manufactured at the Horseley Ironworks in nearby Tipton. The waterway in the aqueduct is 8 feet (2.4 m) wide with the towpaths either side being 4-foot-4-inch (1.32 m) in width each. The eastern towpath is paved in brick with raised strips for horses. More information is available at;
http://en.wikipedia.org/wiki/Engine_Arm_Aqueduct
A major geotourism and geoeducational asset of the geopark, Galton Valley has a visitor centre in the old Victorian canal pumping engine house (a Scheduled Monument), some on-site interpretation. It has extensive footpaths along the two canals and two rail stations within the cutting providing ease of access. There is online information and plans for a geotrail linking the industrial heritage to the geological story, and intentions to link with a building stone trail of the adjacent Smethwick town centre. New Black Country Geopark signs are intended for this site

Geosite 14 Sandwell Valley Country Park

This geosite is a large country park in the broad valley of the River Tame just 10 minutes walk from West Bromwich town centre. Its 270 hectares include many heritage features including;
RSPB Sandwell Valley LNR based around part of Forge Mill Lake within Sandwell Valley Country Park which is one the Geopark's tourism nodes with the geopark booklet stocked at the new RSPB visitor centre. A project is underway to produce displays about the geology of the valley, the Sandwell Valley Collieries and mining disaster, and the evolution of birds. Further information is available from the RSPB website at
http://www.rspb.org.uk/reserves/guide/s/sandwellvalley/ also in the valley are; - **Sandwell Park Farm ,** a fully restored working Victorian farm. Local History galleries with displays, Grazing meadows, a traditional farmyard, walled kitchen gardens, Grade II listed buildings, a small museum and award-winning tea rooms and rooms for hire and shop, **Forge Mill Farm,** a recreated working farm that offers visitors the chance to see a variety of rare breed farm animals. The farm shop sells fresh meat, vegetables, plants, gifts and serves drinks and light snacks. There is a children's play area, a farm trail, good access to Forge Mill Lake and ample car parking For further information visit;
http://www.sandwell.gov.uk/info/200248/parks_and_green_spaces/741/sandwell_park_farm
http://www.sandwell.gov.uk/info/200248/parks_and_green_spaces/742/forge_mill_farm
Forge Mill Lake Local Nature Reserve, centred around a large lake beside the River Tame it has a host of pathways, a cycleway and a bridleway lead from the lake to other areas of grassland and woodland. Hedgerows and areas of scrub also link these habitats to provide a rich and varied place for wildlife. More information;

http://www.sandwell.gov.uk/info/200248/parks_and_green_spaces/746/forge_mill_lake **Priory Woods Local Nature Reserve** The nature reserve comprises over 21 hectares of mature woodland, pools and grassland and contains the ruins of **Sandwell Priory. This** was a small medieval Benedictine monastery house, Founded in the 12th century, it had a fairly turbulent history and was dissolved in 1525 – more than a decade before the main Dissolution of the Monasteries under Henry VIII. More information;
http://www.british-history.ac.uk/report.aspx?compid=37842 and
http://www.sandwell.gov.uk/info/200248/parks_and_green_spaces/750/priory_woods

Sot's Hole LNR This shallow sided valley of a small brook contains a former mill pool amongst a range of other habitats including dry and wet ancient semi-natural woodland and marshy grassland. Sot's Hole is one of the most important woodlands in the Sandwell Valley. more information ;

http://www.sandwell.gov.uk/info/200248/parks_and_green_spaces/753/sots_hole **Hampstead Mining Disaster monument** This substantial piece of mining inspired public art commemorates both the importance of the valley in extending the life of the Black Country Coalfield as the first pioneering deep coal mine on the eastern fringe of the exposed coalfield that was sunk In 1876. The South Staffordshire Thick Coal was finally accessed in April 1880 at a depth of around 600m. The mine finally closed on March 26th 1965 bringing the end of a mining industry i this part of the Black Country and

subsequently all traces of the mine were removed when the area was redeveloped for housing. This site is an immensely important reminder within this urban landscape of the industry that founded the communities here and many of whom lost their lives in the mining tragedy of March 1908 , The Hamstead Miners Memorial Trust have created a display of Hamstead Colliery memorabilia in the Tanhouse centre, where they are raising funds for to maintain the memorial and keep alive the memory of the Hamstead Miners who lost their lives in the mine disaster that occurred here.; More information; http://miners.b43.co.uk/history.html

Geosite 17 Castle Hill and Zoological Gardens (SINC- Regionally important)

Castle Hill is both a major geological geosite but is also a very important historic landscape feature. It includes important cultural history associations, both as the home of the barons and lords of Dudley but also n more recent times as a mined landscape innovatively restored as zoological gardens. These include special architectural features in the form of the 'Tecton' Structures which are twelve listed buildings, seven Grade II and five Grade II*, erected in 1937 of architect Lubetkin. This 40-acre (16 ha) zoo is located within the grounds of the medieval Dudley Castle. The Zoological Gardens opened to the public on 18 May 1937. Most of the zoo buildings are art deco in style. The site has a wide range of visitor and hospitality facilities and there are plans to expand and enhance these. In January 2013, regeneration work began on this site with the help of ERDF funding. This linked the many heritage features of Castle Hill along its eastern flank and provided new entrances to the zoo , Black Country Living Museum and the Dudley Canal & Tunnel Trust. It also provided enhanced parking capacity and a visitor hub associated with the new pathway network. Geological interpretation is part of the regeneration works for the hill and Geopark signage is planned for the site . Further information is available at; http://www.dudleyzoo.org.uk/ and http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&ved=0CCUQFjAAahUKEwji9Kylvu3HAhVJ6RQKHVe9CRE&url=http%3A%2F%2Fwww.dudley.gov.uk%2FEasySiteWeb%2FGatewayLink.aspx%3FalId%3D220116&usg=AFQjCNGwCxcrYfMwQdMi0QbwP-4giXZ56Q

Geosite 18 Black Country Living Museum

One of the finest and largest open-air museums in the United Kingdom, this site is twenty six acres that includes a recreated Victorian industrial village, Racecourse Colliery, an underground coal-mining experience called 'into the thick' and a working full scale reconstruction of the world's oldest effective steam engine for mines drainage (The Newcomen Engine) . This was constructed 1712 and first put into productive steam in 1714. The site is a cluster of special architectural structures saved from many parts of the Black Country with, ironworks and restored canal arms and lime kilns. The site has a full range of exhibitions, conference facilities and hospitality with a wide range of activities and educational programmes. For further information visit; http://www.bclm.co.uk/

Geosite 19 Red House Glass Cone and the Crystal Mile

The glass heritage attractions of the Crystal Mile celebrate one of the most unique aspects of the Black Country's industrial heritage. They are located in the southern area of the Black County as a direct consequence of the underlying geology at the southern tip of the coalfield. The glass making history of the Black Country is world-renowned and provided its products to homes both royal and humble all over the world. Once harbouring 50 glassworks the 'Crystal Mile' – (an area of land between Kingswinford and Stourbridge) was once a landscape of glass cones and factories unlike anywhere else on earth. Of the few remaining traces of this once thriving industry the Red House Glass Cone is the most complete remaining example and interprets the story of the Black Country's Glass making heritage. The main feature of this site, built around 1790, is a 30m high glass Cone (only one of 4 remaining such structures in the UK). This site offers a full range of visitor facilities, exhibition spaces and educational services. This site and nearby Ruskin Glass Centre feature some of the leading British studio glass artists. It was formerly the home of internationally famous Royal Doulton Crystal and Webb Corbett. The site has recently completed a £1.4million refurbishment, where visitors can now view a wide range of craft studios, glassmaking processes and techniques. This is the locus of the current artisan glass making industry with a range of studios that aim to encourage and support the next generations of glass manufacturers and contemporary glass artists. For further information visit http://www.dudley.gov.uk/see-and-do/museums/red-house-glass-cone/ and http://ruskinglasscentre.co.uk/

Geosite 26 Leasowes Park, Halesowen

The Leasowes is a historic landscape integrated into the terraced hillside of sandstones of the Halesowen Formation. The sandstone units that have a profound effect on the geomorphology here by introducing ledges or steps in this south facing slope of the River Stour valley. The historic landscape is Grade 1 listing and is ranked amongst the most significant historic parks and Gardens of in England. The site was designed by the poet William Shenstone between 1743 and 1763. As such it was one of the most important and influential landscapes of the 18th Century and considered to be one of the first natural landscape gardens in England. It is the diverse landscape of wooded valleys, open grasslands, lakes and streams created by Shenstone that makes the site so important for wildlife. The site has been managed with nature in mind since the mid 18th Century and as such provides a wealth of different habitats for birds, mammals, invertebrates and locally uncommon plant species. The site has wardens, a classroom, many footpaths and is connected to other geosites by footpaths and canals along the Coombswood Valley and beyond. Further information is available at; http://www.dudley.gov.uk/resident/environment/countryside/nature-reserves/leasowes-park-/

Geosite 27 Northycote Farm and Country Park, Wolverhampton

This is the best example of a tudor period farmstead in the Black Country. Its fields are strewn with large numbers of glacial erratics which can be seen around the site and permit a picture of the ice sheet movements during the Pleistocene to be understood. The farmland itself and the surrounding Country Park offer an insight into farming practices and some rare breed farm livestock are present. There are many informal walks through the country park and opportunities to view or photograph a wide variety of wildlife, in their natural habitats**.** The farmhouse itself is not always open to the public, but throughout the year, it is opened to the public for tours and other events.

B4. Natural, cultural and intangible heritage sites and how they are integrated within the proposed Geopark

These sites are an integral part of the Black Country story. By its very nature, the Black Country is a compact geological area with a wide variety of features in very close proximity to each other. A visitor cannot get between the geological geosites without encountering links to the related heritage that is a direct consequence of the geology or its exploitation on the way. It is our intention that they will be intimately linked into the geological story and seamlessly promoted with the geological geosites. There are obvious synergies between some of these that will be grouped to offer themed geopark experiences. Canals for example, which so perfectly link geological, industrial heritage and cultural heritage together in a series of linear waterways/cycleways/footpaths within the proposed geopark, Road networks connect everything, so themed motor tours which link them and themed days out are intended. These will include mining heritage, mining geoart, fireclay and glass heritage of the 'Crystal Mile', and the 'boulders trail' of erratics sites, and 'engineering wonders '. We intend to develop and promote a long distance walking route across the area – The Black Country Global Geopark Way. The guided walks, lectures and presentations currently being carried out will be extended with new ideas for the future to further include the industrial and cultural heritage themes. Such products will be extended and augmented with the new initiatives for the geopark.

The geology of the Black Country is only known and exposed in today's landscape because of man's exploration of the land and its resources. The story of their discovery, variety and abundance of economic minerals, their extraction and use in the heavy industries is a fundamental attribute of the geopark. This imparts a unique character to this special landscape. The industrial landscape is quite different to most other geologically special areas within the geoparks network. Key industrial heritage sites and derelict sites (sometimes naturally reclaimed by nature) are essential to explaining the Black Country's unique urban/geological landscape. Carefully selected biodiversity, industrial archaeology and cultural sites are included in the geosites listing of the geopark for this reason. They constitute a vital aspect of the area's story and offer some of the most inspirational and compelling heritage experiences of the Black Country Geopark Project. Of the non-geological heritage sites listed, the canal heritage is particularly special. The canals are an extensive network of inland waterways that thread through the urban landscape connecting many geosites together. They provide access ways for walking, boating and cycling between geosites and contain superlative industrial heritage which is a direct consequence of the geological story and its exploitation. Many engineering structures were constructed of 'blue brick' made from the extensive Etruria Formation clay pits of the area which now provide a special character to the look and 'texture' of the place. The canal story is so completely interwoven with the geological heritage and its exploration that they are inseparable. The non-geological geosites described below represent the best and most accessible industrial and cultural amenities that compliment and complete the geological story of this special place.