



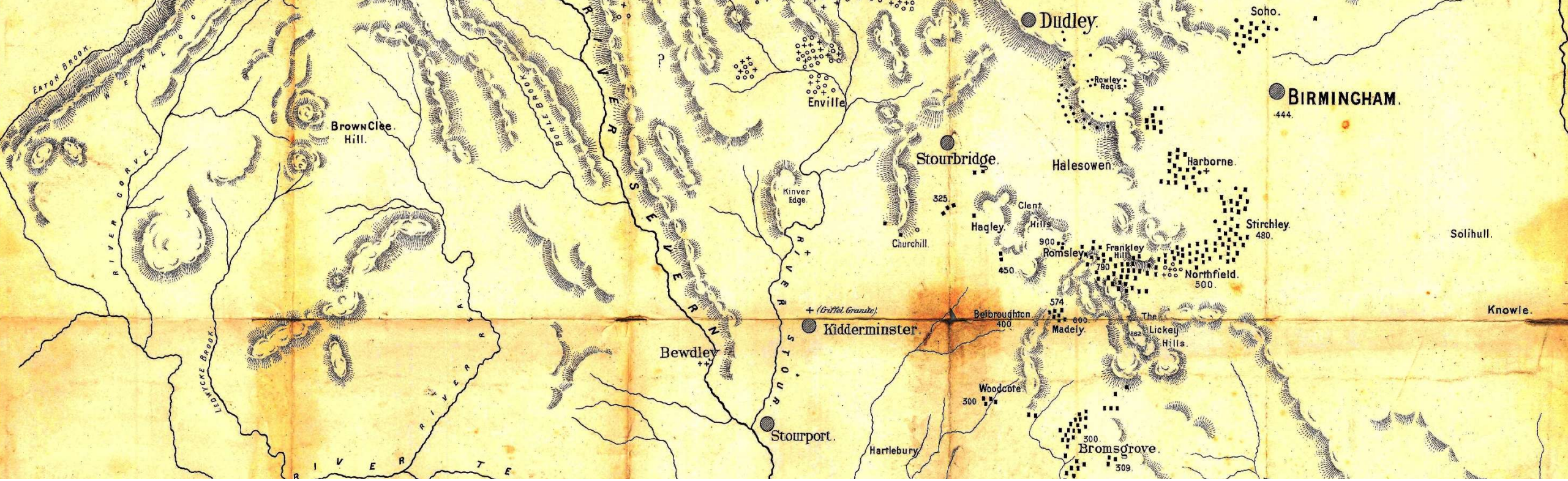
Birmingham's Erratic Boulders  
Heritage of the Ice Age

# Birmingham's Erratic Boulders Project

**Beth Andrews - Project Manager**







# Project Background



# What is an "erratic boulder?"

- Throughout SW Birmingham and N Worcestershire numerous large boulders can be found.
- They are unlike the local sandstones and mudstones.
- Most of these 'erratic' boulders were formed 450 million years ago from volcanic eruptions in the southern hemisphere.
- They were brought to the area by glaciers.





# Project Background

- The boulders were known to the Victorians, who showed great interest in their origin.
- The project is a culmination of years of work by Roland Kedge and others, as well as a National Lottery Heritage funded history project at Cotteridge Park in 2017.
- Our objectives are to engage the public with this visible Ice Age heritage.



Photo: W.J. Harrison. British Geological Survey, P236744



# Our Project Partners

We received a £112,900 grant from the National Lottery Heritage Fund.

The project started in July 2021 and will end in September 2023.

This is a partnership project between:

Herefordshire and Worcestershire Earth Heritage Trust

Birmingham Open Spaces Forum

The Lapworth Museum (University of Birmingham)

The Black Country Geological Society







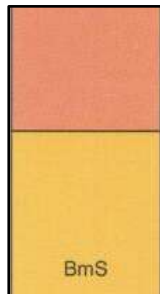
# Geology: From Fire to Ice



# Local Geology Solid and Drift

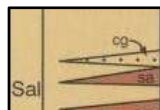
PLEISTOCENE		Glaciofluvial Deposits (including Glaciofluvial Terrace Deposits (T): yellow and orange sand and gravel
		Glaciolacustrine Deposits: yellow to brown stoneless clay and silt
		Interglacial Deposits, undifferentiated: laminated clay and silt, locally with peat; not exposed at surface; Hoxnian in age
		Till: brown or red-brown pebbly clay
		Sandy Till: brown or red-brown, sandy, pebbly clay with lenses of sand and gravel

## Triassic (Middle)

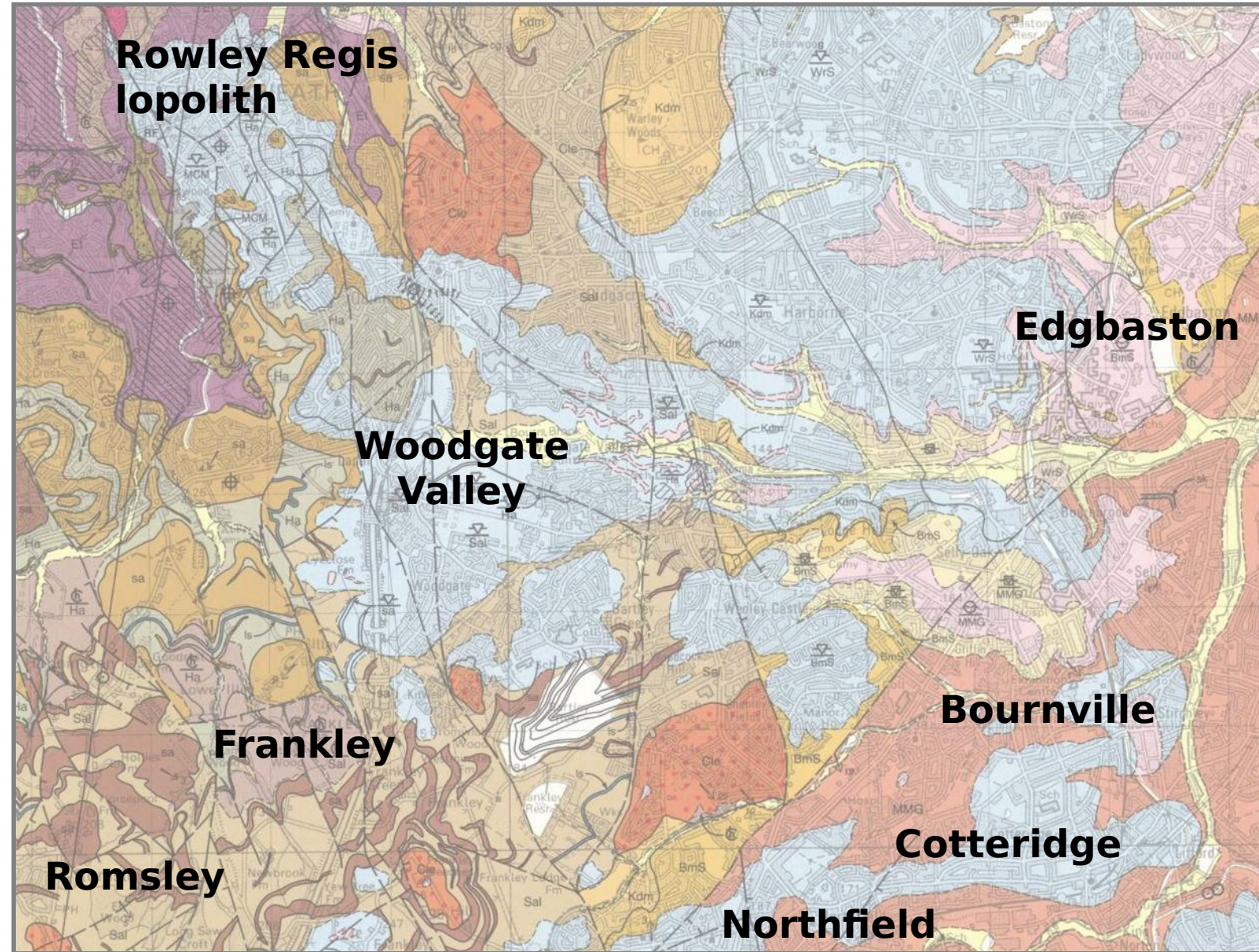


Mercia Mudstone Group and Bromsgrove Sandstone Formation

## Carboniferous (Upper)



Salop formation - mudstone and sandstone





# Theories about the Boulders

- Theories about the boulder's origins have included being brought by the Biblical Flood, by giants and that they were meteorites!
- Through the late 19<sup>th</sup> century, scientists began to unravel the real story of their glacial origins.





# Geology of the Boulders

This map by Fred W. Martin from 1890 shows us the distribution of erratics, their geology and probable source.

The information was based on fieldwork and tracing the boulders back to source on the ground.



<i>English Lake District are indicated thus</i>	— ○
<i>M<sup>ts</sup> Criffel and South Scotland</i>	— +
<i>M<sup>ts</sup> Arenig and North Wales</i>	— ■
<i>as Rowley Basalts and Sandstones</i>	— •
<i>levels are indicated by figures</i>	— 519.

Martin, 1890



# The Erratic Blocks Group

Founded in 1873 and ran until World War 1.

It reported annually to the British Association for the Advancement of Science.

It was tasked with finding and recording details of the erratics.

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REPORT—1873.

*Report of the Committee, consisting of Professor RAMSAY, Professor GEIKIE, Professor J. YOUNG, Professor NICOL, Dr. BRYCE, Dr. ARTHUR MITCHELL, Professor HULL, Sir R. GRIFFITH, Bart., Dr. KING, Professor HARKNESS, Mr. PRESTWICH, Mr. HUGHES, Rev. H. W. CROSSKEY, Mr. W. JOLLY, Mr. D. MILNE-HOLME, and Mr. PENGELLY, appointed for the purpose of ascertaining the existence in different parts of the United Kingdom of any Erratic Blocks or Boulders, of indicating on Maps their position and height above the sea, as also of ascertaining the nature of the rocks composing these blocks, their size, shape, and other particulars of interest, and of endeavouring to prevent the destruction of such blocks as in the opinion of the Committee are worthy of being preserved. Drawn up by the Rev. H. W. CROSSKEY, Secretary.*

As the dispersion of boulders cannot be traced to one single period, neither can it be referred to *one single cause*.

The agency of land-ice, the direction in which icebergs would float during the depression of the land, the power of rivers in flood to bring down masses of floating ice, must be taken into account.

It will not be the office of this Committee to offer theoretical explanations, but to collect facts, although the bearing of these facts upon debatable geological problems may from time to time be not unjustly indicated.



The importance of the work undertaken by the Committee continues to be emphasized by the destruction which is constantly going on. War is waged upon the boulders (which in many cases are our only source of information respecting the epoch to which they belong) by agriculturists, and builders, and road-makers with unceasing energy. They are built into walls, buried in the earth, used as foundation-stones, and often blasted to pieces; their preservation is difficult to secure, on account of their interference with the culture of the land. In a few years it is not too much to say that the evidence of glacial phenomena will in many districts be almost effaced.

I have read Mr. Bradley's letter with great pleasure

It is most desirable that all large boulders, presumably glacial in the Birmingham District should, if possible, be preserved and protected for the benefit of Science and the people.

Letter from Charles Lapworth, 1912.



# Macintosh 1879 - Ice Flow

- Compilation of mapped boulders by Macintosh in 1879.
- Differentiation of source rocks and two directions of ice flow.
- One flowing south from the Lake District and Scotland
- One flowing south-east from Arenig.



**Birmingham**



# The two problems:

- The sources for the boulders were known but suggested that the directions of the ice must have crossed – this isn't possible. In 1880 Martin, was clear that this must have indicated two different Ice Ages.
- Was the transport by iceberg or glacier?
- In 1882 Rev. Crosskey saw these scratches, which he saw as evidence for movement by glacier.
- In 1905 an article described the boulders as "dropped by an iceberg while floating over the midland sea at a period when Great Britain was an archipelago of ice-clad islands.





# Arenig Fawr Geology

## Solid and Drift

### Quaternary



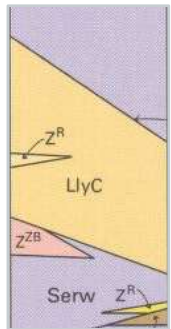
Till (Boulder Clay)

### Intrusive Igneous

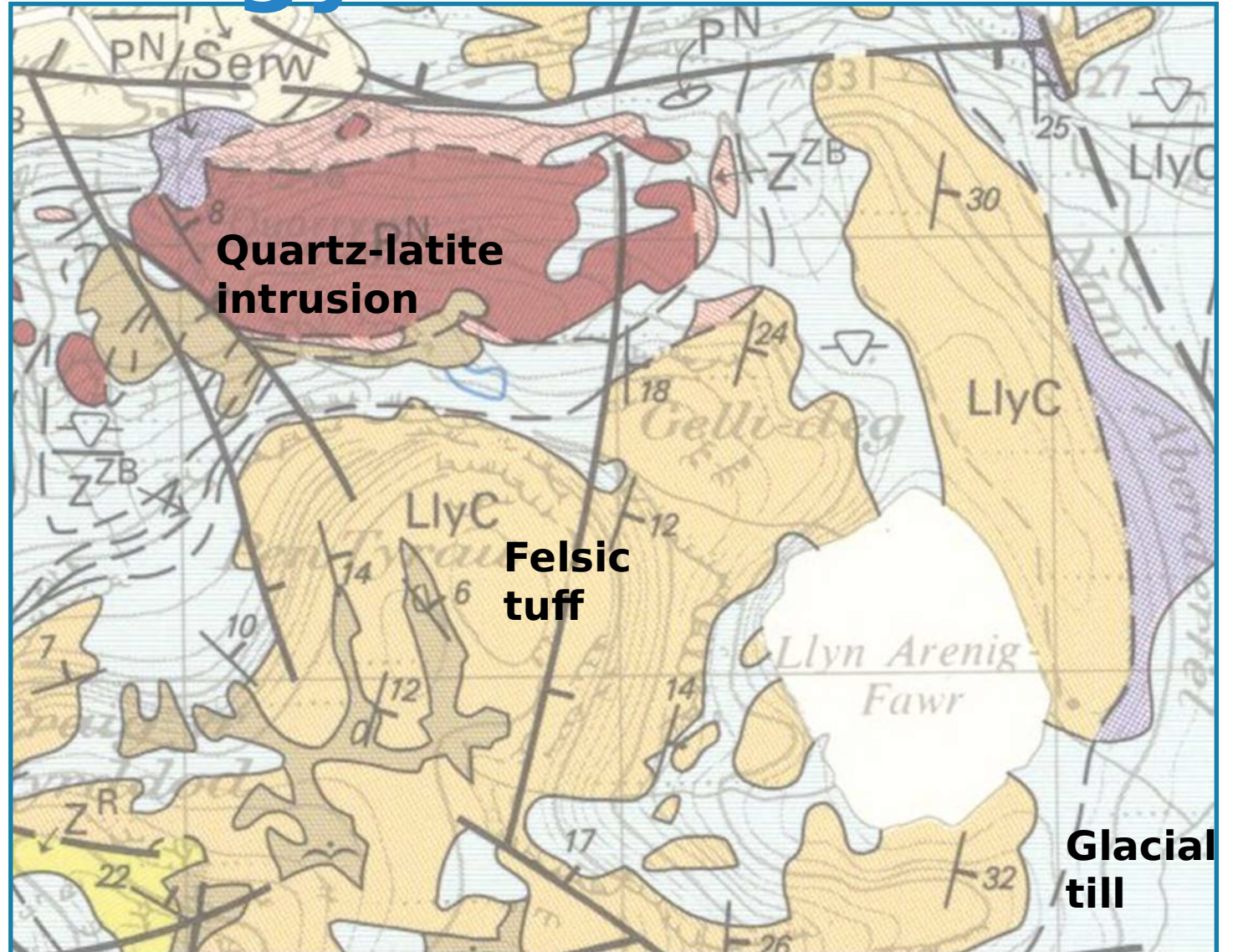


Quartz-latite

### Ordovician

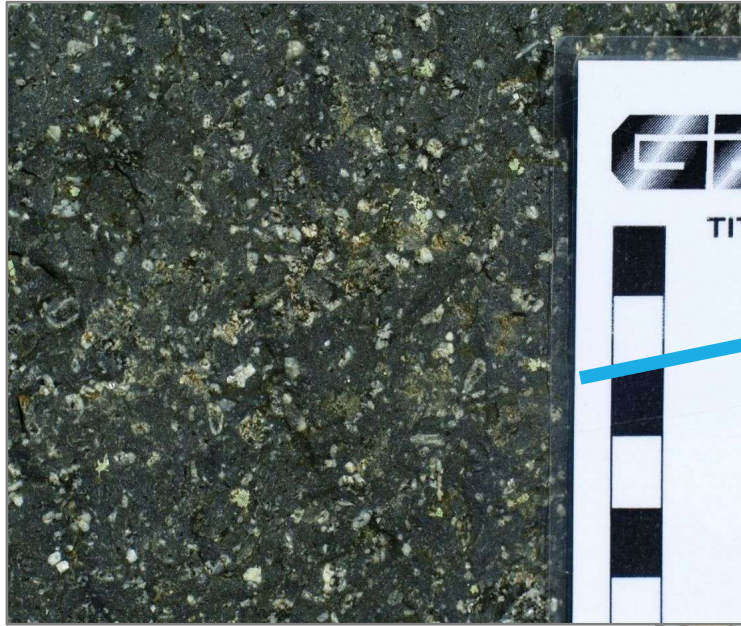


Acid air-fall tuffs, acid ash-flow tuffs, crystal tuffite

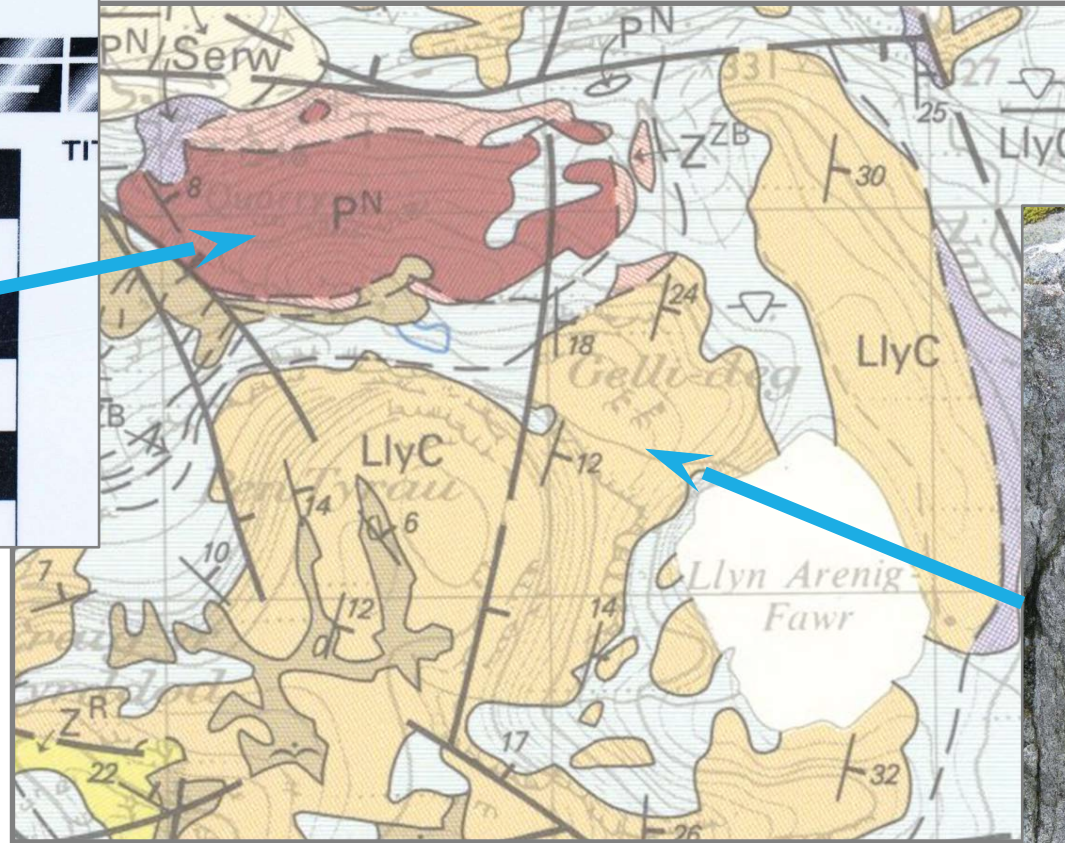




# Arenig Fawr Geology - Igneous Rocks



**Porphyry**  
Quartz-latite  
showing porphyritic  
texture



**Tuff**  
Air-fall and ash-flow  
tuffs

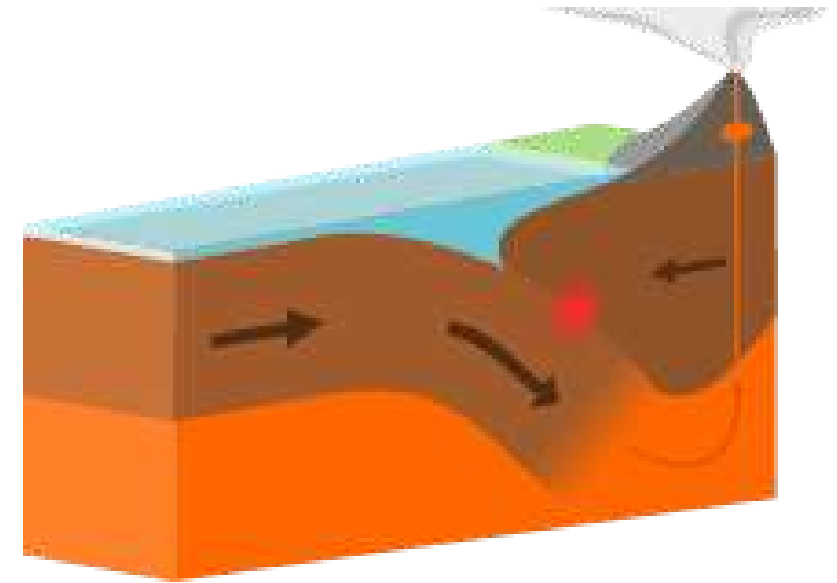




# Ordovician Period 485 - 445 Million Years Ago

Britain was south of the equator and partially under the Iapetus Ocean. Northern and southern Britain had not yet been joined together.

As the Iapetus closed, bringing the two halves of Britain together, there was dramatic volcanic activity.



Subduction of the ocean plate beneath the continent caused melting and explosive volcanic activity.

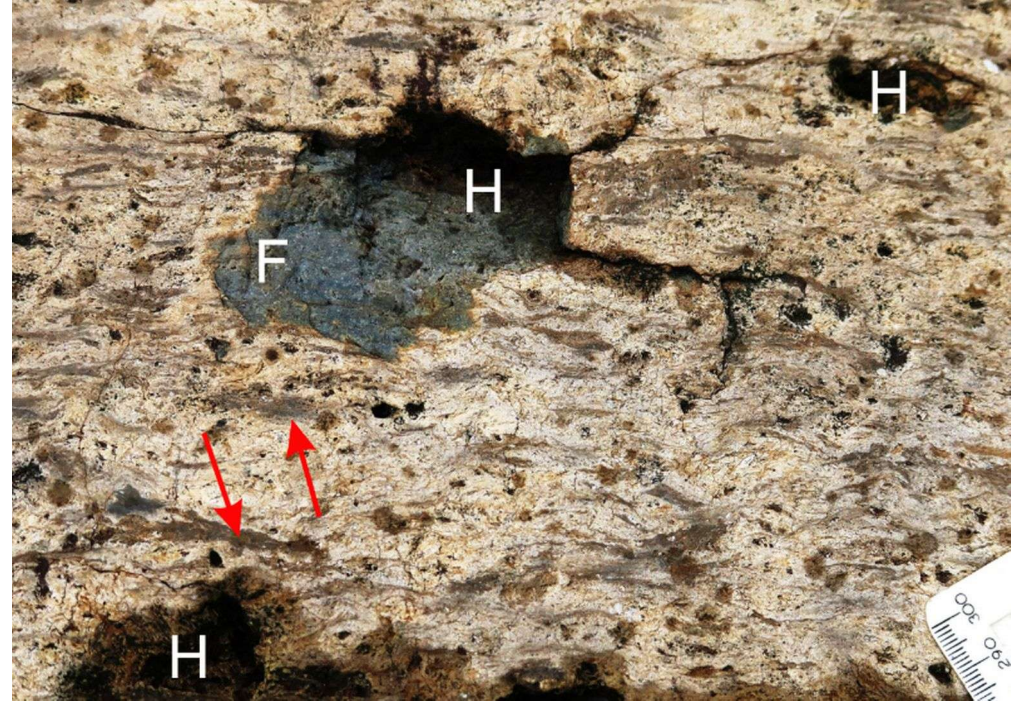


# Volcanic Textures and Interpreted Environments



## Finch End Farm

Distinctive layering can be seen in this huge boulder found on private land in Bromsgrove.



## Woodgate Valley

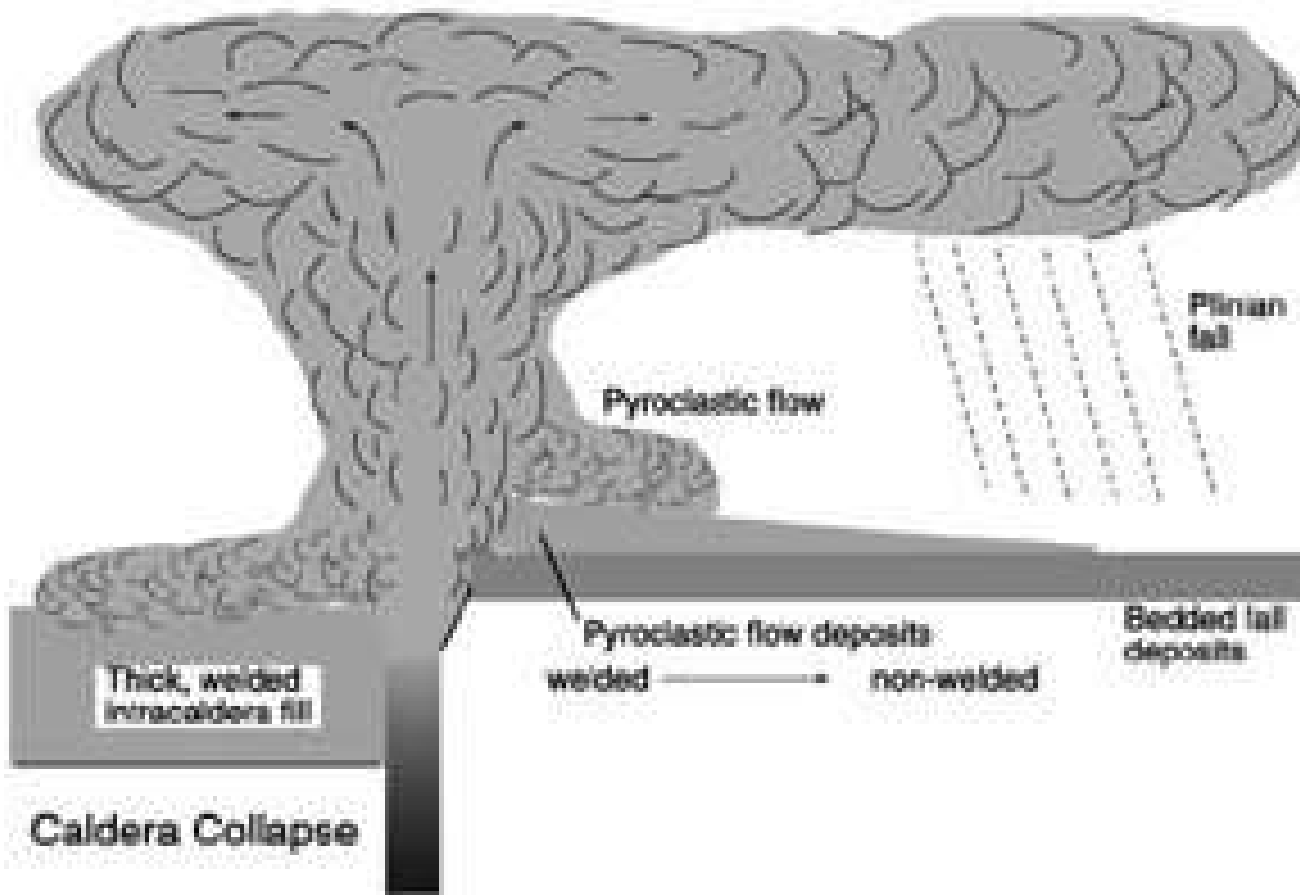
**F** – Fresh, dark green/grey rock.

**H** – Larger rock fragments have weathered out leaving holes of differing sizes.

**Red arrows** – Elongated dark fragments, originally clasts of pumice which became flattened by the weight of overlying deposits whilst still hot.



# Volcanic Textures and Interpreted Environments



## Pyroclastic Flows

The textures observed suggest formation as pyroclastic flows

- very hot, ground-hugging flows of rock debris and gas such as that which buried the Roman city of Pompeii.

Characterised by extremely violent eruptions with large quantities of material being flung out by explosive activity. Highly viscous lava.

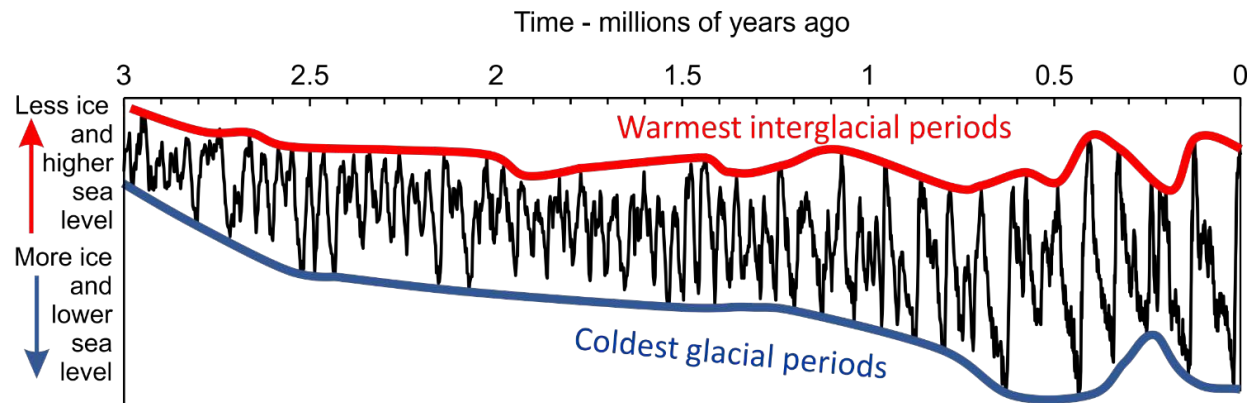


# The Ice Ages

There have been several Ice Ages over Britain. The largest was the Anglian around 450,000 years ago

The most recent was the Devensian around 27,000 years ago

Material eroded by the ice was left behind as the glaciers retreated, forming superficial deposits..



Variation in global climate over the last 3 million years, oscillating between colder glacial and warmer interglacial periods.

A Woolly Mammoth tusk discovered at a quarry just south of Worcester in 2016. It is thought to be about 50,000 years old.

**Explore the Past - Worcestershire Archive and Archaeology Service.**



# Possible Evidence of Glacial Transport



## Shape - mode of transport

Some of the boulders are angular in shape, some more rounded. Many have large, flat surfaces.

These different shapes might reflect differing modes of transport and/or position of transport within or on the glacier.

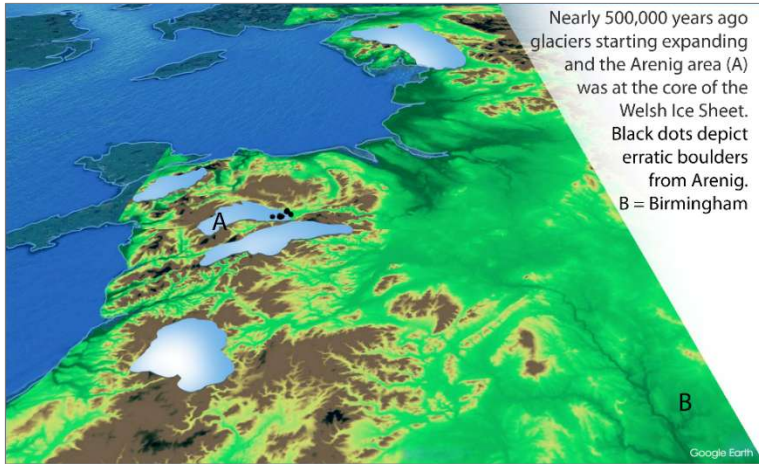
## Striations - scratch marks

Another distinctive feature of transport under the ice are scratches on the surface of boulders caused by finer debris rubbing against the boulder surface.

Such scratches are actually quite unusual.

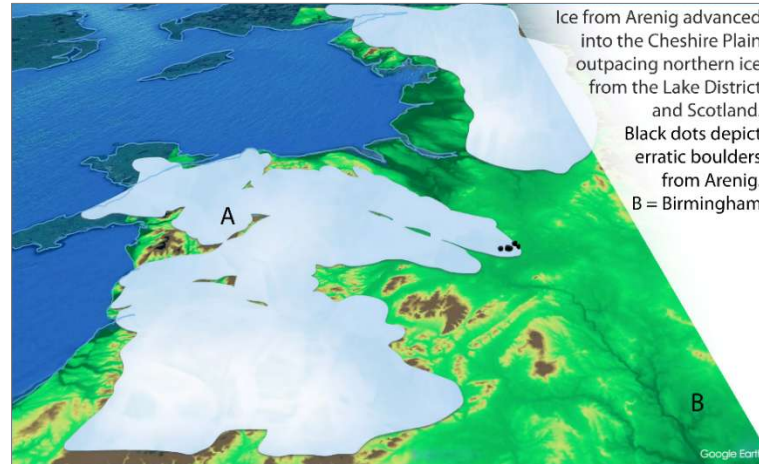


# Ice Age Events - Anglian Stage



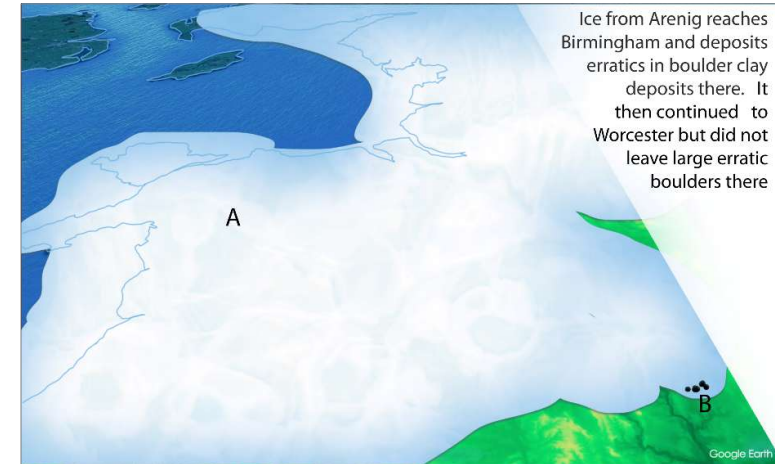
About 478,000 Years Ago

Development of the Welsh Ice Sheet. Ice sheets spread out eastwards from central Wales, along with ice moving southwards from the Lake District and southern Scotland.



450,000 Years Ago

Ice advanced to the Cheshire Plain, outpacing ice from the Lake District.

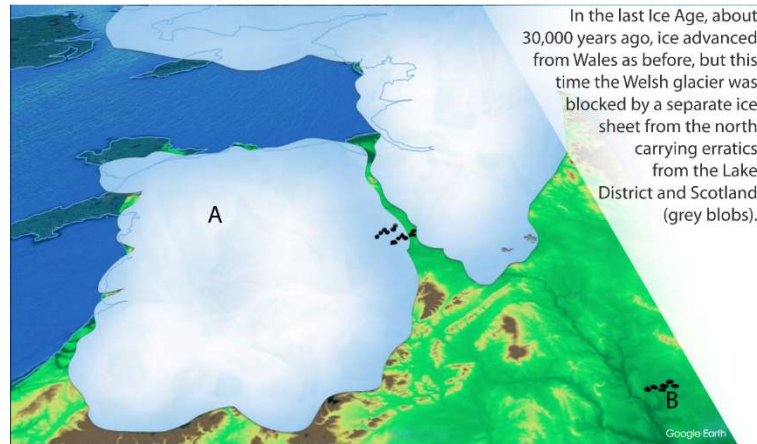


424,000 Years Ago

Ice moving out of Wales carried boulders of hard rock from Arenig Fawr as far south as Birmingham. Erratics were deposited there. Ice sheets retreated.

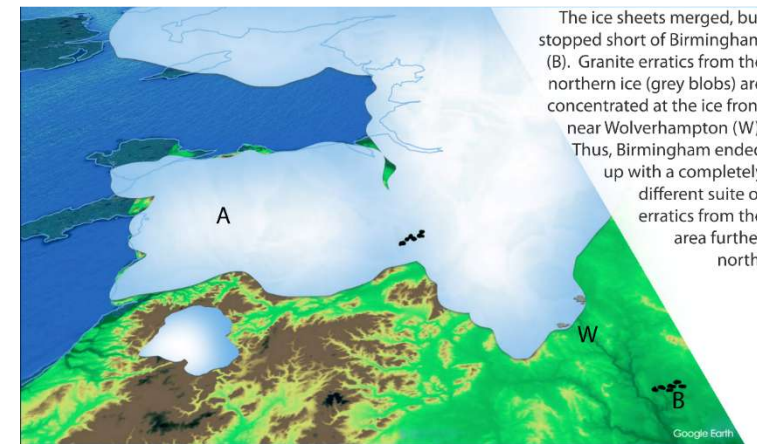


# Ice Age Events - Devensian Stage



33,000 Years Ago

Ice again advanced from Wales. This time, though, it was 'blocked' by an ice sheet from the north.



20,000 Years Ago

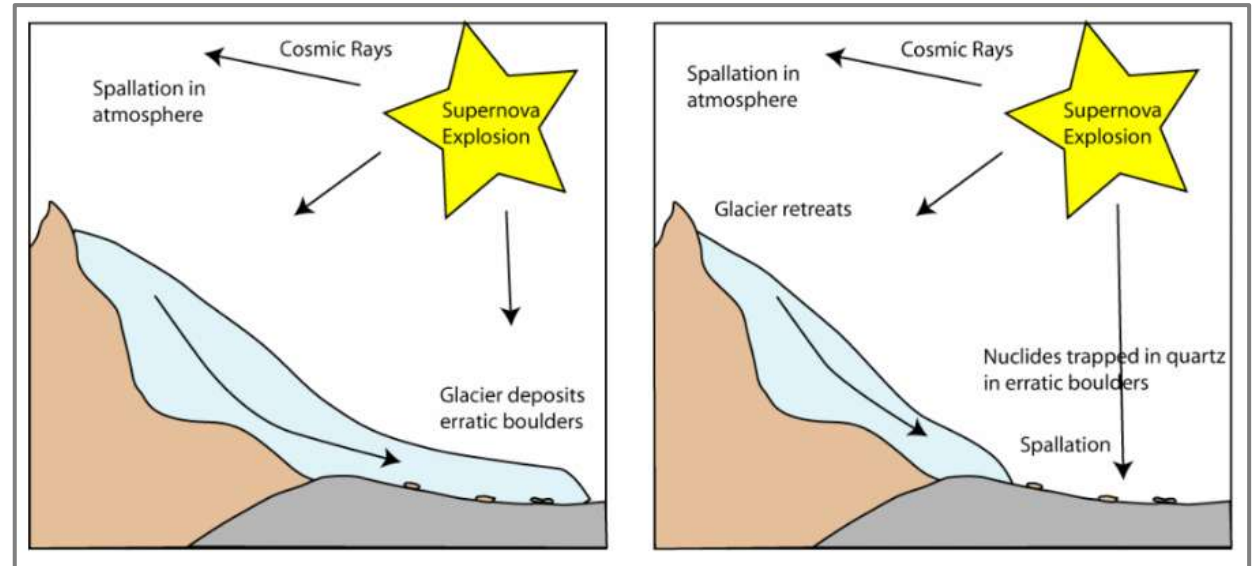
The ice sheets merged, but didn't reach Birmingham. Granitic erratics from Eskdale in the Lake District and Criffel in Scotland were deposited in Wolverhampton.



# Recent Research - Cosmogenic Nuclide (Exposure) Dating

Recent research work in the broader area has involved luminescence dating and exposure dating.

Cosmogenic nuclide or exposure dating has been used to date three boulders in our project area.



[www.AntarcticGlaciers.org](http://www.AntarcticGlaciers.org)

Bombardment of minerals by high-energy particles can dislodge protons and/or neutrons from the atom producing new isotopes called cosmogenic nuclides.

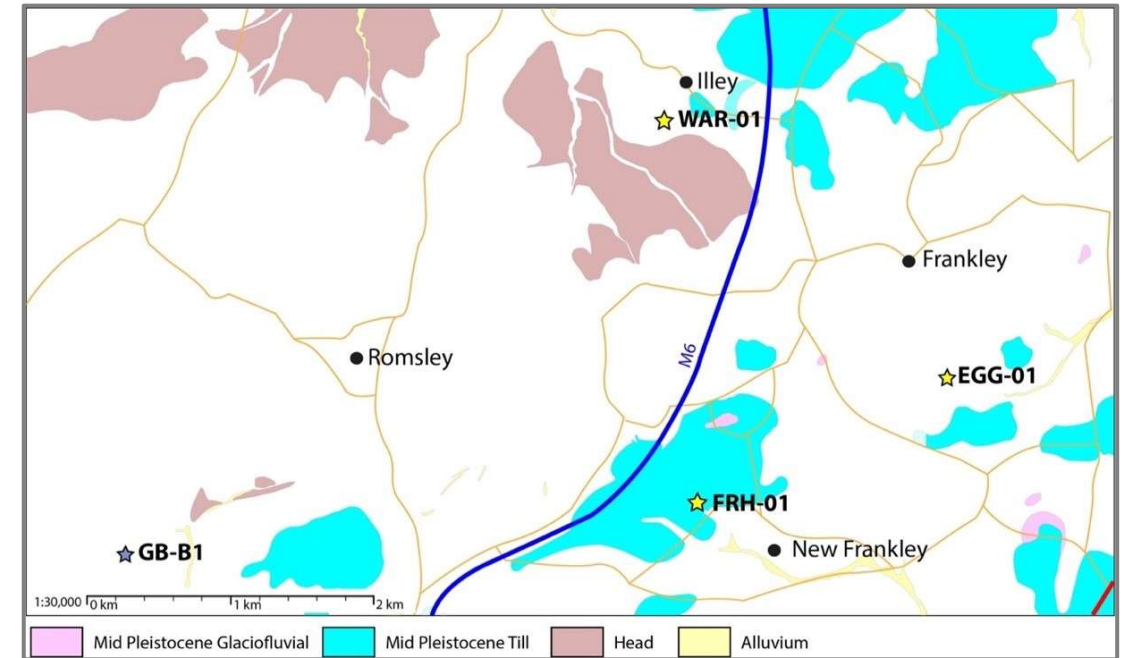
Nuclides are produced at a known rate and decay at a known rate.

# Cosmogenic Exposure Dating

New and revised exposure ages – Timing and dynamics of Late Wolstonian Substage ‘Moreton Stadial’ (MIS 6) glaciation in the English West Midlands, UK. Gibson *et al.* 2022.

Significant range of results suggesting some boulders may not be *in situ*.

Ages (generally) interpreted **to rule out deposition before Wolstonian Stage**. Luminescence data in glacial sediments considered more reliable.



sample	lab code	$[^{36}\text{Cl}]_n$ ( $10^5$ atoms $\text{g}^{-1}$ )	$[^{36}\text{Cl}]_c$ ( $10^5$ atoms $\text{g}^{-1}$ )	$P_K$ %	$P_{Ca}$ %	$P_{Cl}$ %	exposure age (ka)
EGG-01	ANU-C303-21	0.066	9.440	83	0	16	225 ± 7(21)
FRH-01	ANU-C303-23	0.084	8.901	90	0	9	115 ± 3(9)
WAR-01	ANU-C303-24	0.066	4.189	90	0	9	52 ± 2(4)
GB-B1 <sup>1</sup>		0.082	5.879	85	0	14	103 ± 13(15)
GB-B4A <sup>1</sup>		0.097	11.311	86	2	11	223 ± 18(26)
GB-B6 <sup>1</sup>		0.102	10.212	86	1	12	155 ± 10(15)

<sup>1</sup>Philips *et al.* [102]



# Cosmogenic Exposure Dating

## Limitations:

### **Inheritance - Prior exposure**

From source rock face, or previous glaciation. However sufficient erosion can remove any inherited signal.

Would result in **overestimate** of exposure age.

### **Partial exposure - Incomplete exposure**

Boulder has moved/rotated (through human or natural means);

Boulder has been repeatedly buried and exhumed;

Boulder has been covered by soil, snow or vegetation.

Would result in **underestimate** of exposure age.



# History and Heroes



# Charles Lapworth

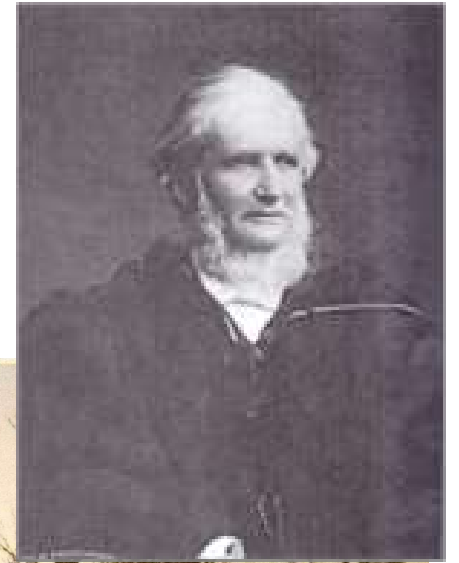
- Was 1st Professor of Geology at Mason College in 1881.
- Best known for pioneering work on the Silurian fauna – especially graptolites.
- Was in regular contact with Louis Barrow and other groups about erratic boulders and their origins and need for protection.



Photo of Lapworth, by Aston Webb Boulder in grounds of University of Birmingham, courtesy of Lapworth Museum.

# Reverend Henry Crosskey

- Was a Unitarian minister and key education reformer.
- Was founding member and secretary to the Erratic Blocks committee 1873-1892.
- Recorded and studied erratic blocks across the region.
- Ensured that the boulder at Cannon Hill Park was saved and displayed for the public benefit.
- Over 700 samples he collected from boulders are now in Lapworth Archives.





# Louis Barrow

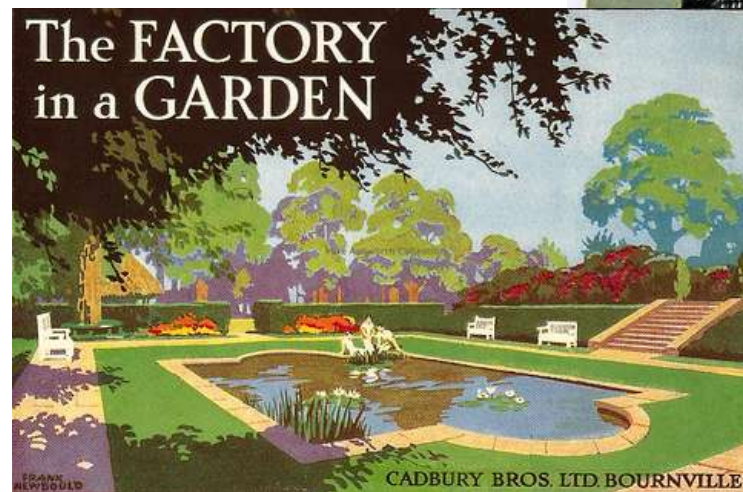
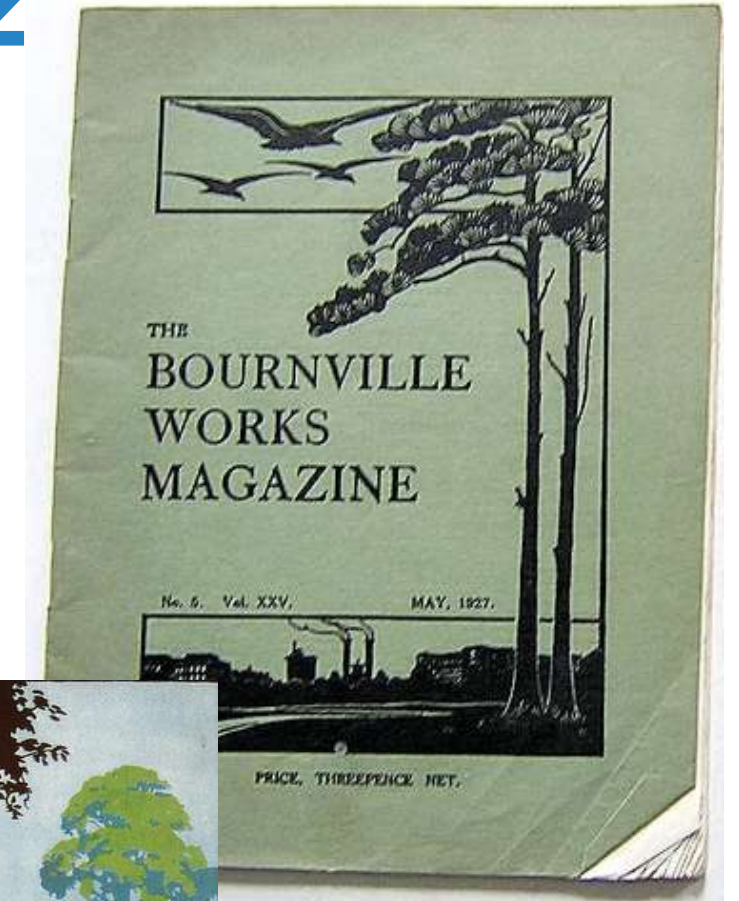
- Studied at Mason College (forerunner for University of Birmingham) including geology under Charles Lapworth.
- Appointed chief engineer at the Bournville works in 1900.
- Excavation of boulders found during expansion of the Cadbury site resulted in letters to Lapworth and relocation to boulders in local parks and by Bournville Station.



Top photo: A Century of Progress 1831-1931, Cadbury, Bournville, March 1931

# Bournville Works Magazine

- The Bournville Works Magazine (BWM) was established in 1902 and continued until 1968.
- Articles on many items including lace making, photography, sports and concerts.
- The first article about an erratic appeared in 1906 although most are from 1910 - 1913. Authors include Lapworth and Barrow.





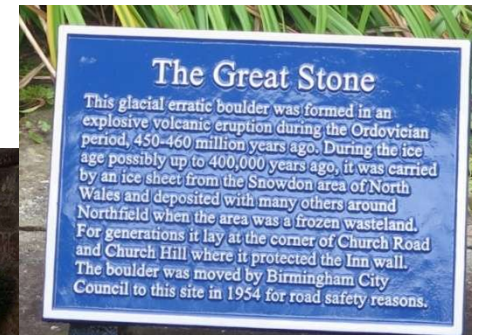
# Roland Kedge



The feet of generations of school children have polished the top surface of The Great Stone at Northfield. It was moved in 1954 from the pavement to the former animal pound of the Great Stone Inn.

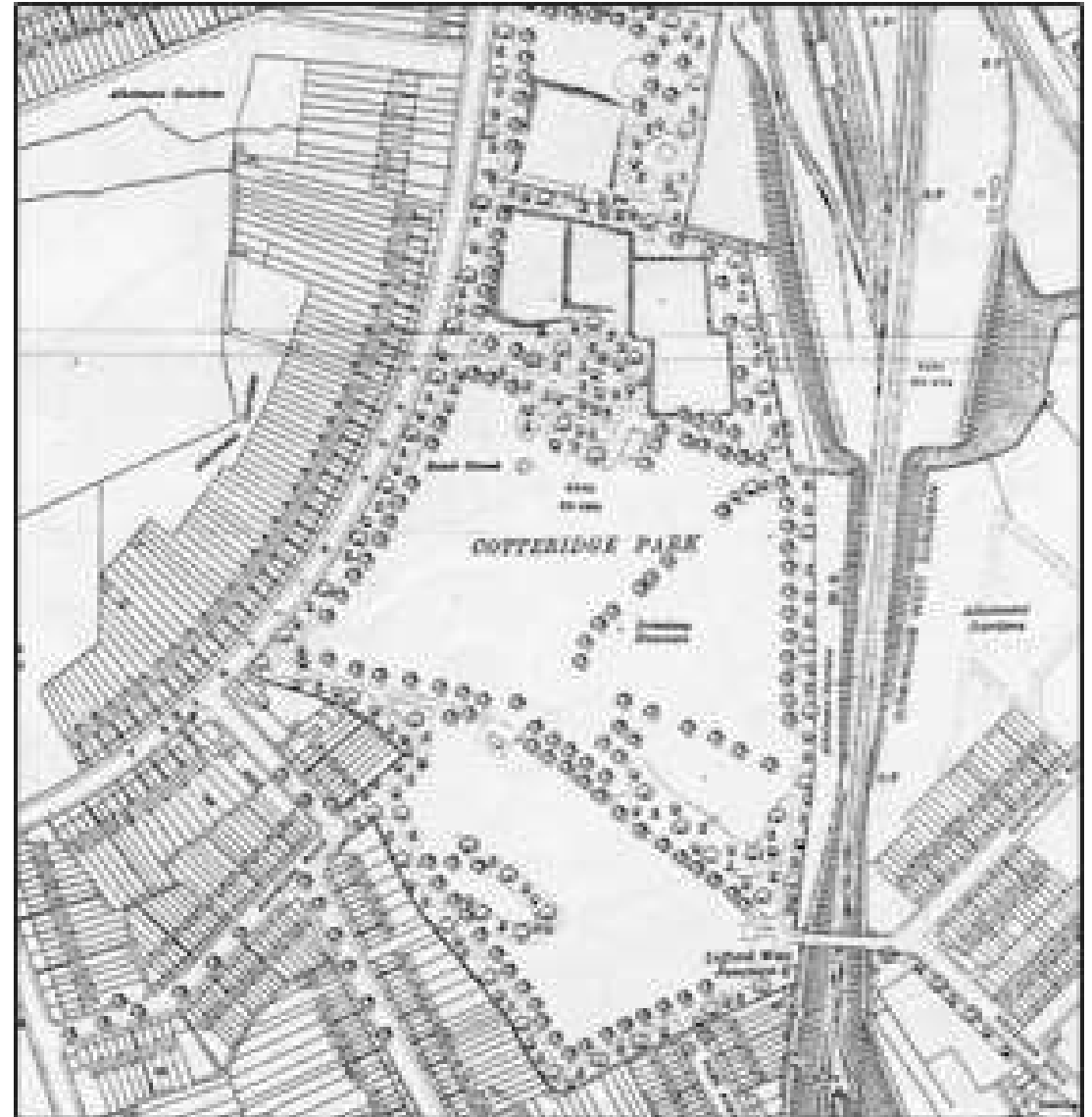
Thanks to the hard work of Roland Kedge, in 2016, a plaque was unveiled, documenting the significance of the boulder.

It's an excellent example of preservation and documentation that we'd love to replicate throughout the project.



# Cotteridge Park Boulders

- Land acquired by Kings Norton Authority in a series of purchases between 1905 and 1909
- Responsibility for the park was taken over by Birmingham City Council in 1911\*
- The total area of land was said to be 22 acres 3 rods 17 perches







View of part of the collection of boulders in the Cotteridge Park. The 8 feet diameter Arenig boulder removed from the Midland Railway Sheds is near the centre of the photograph.

Image: From  
Bournville Works  
Magazine, courtesy  
of Cadbury Archive,  
Mondelēz  
International.

# The Cotteridge Park Boulders

Part of a map by Louis Barrow showing where the erratics were found and where they were subsequently placed. BWM of 1912.

“At the Cotteridge Park the visitors examined the indicator which has been presented by Mr. Louis Barrow, and which consists of a glazed map set upon a stone pedestal. ... Mr. Barrow hopes that the indicator will give people a general idea of what England was like during the glacial period.”

- BWM August 1913 p. 263

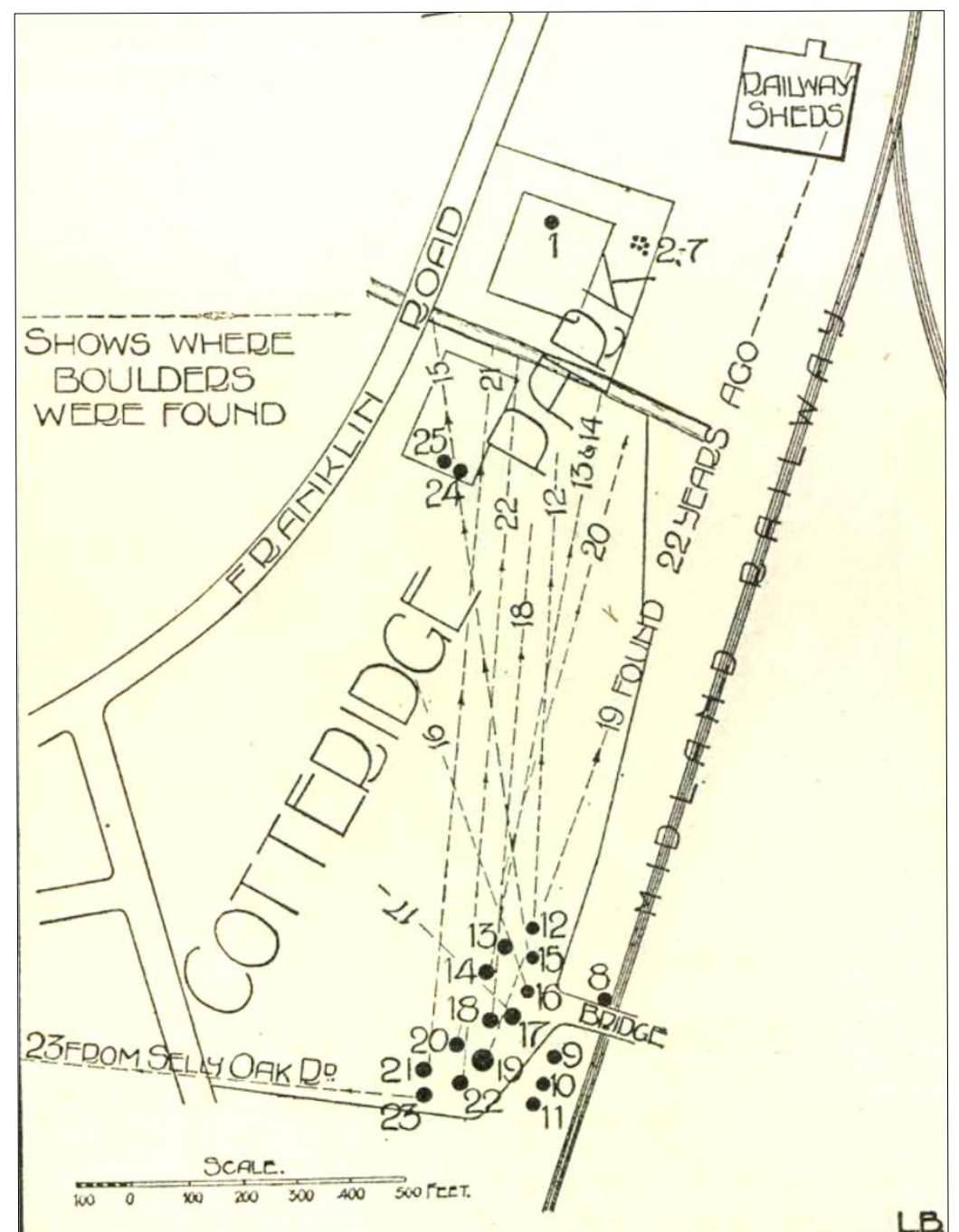


Image: From Bournville Works Magazine, courtesy of Cadbury Archive, Mondelēz International.



All the large boulders in this park were probably brought here by the ice sheets and glaciers of the great ice age from the Arenig Mountains in North Wales

Our largest Arenig boulder is at Warstone Farm near Halesowen. The next largest are here & close to the main entrance to Bournville Station”

“The large saucer shaped boulder is from the site of the Bournville M.R. loco shed, one is from Selly Oak Road & the remainder were found within the park”



Image: From Bournville Works Magazine, courtesy of Cadbury Archive, Mondelēz International.

# Cotteridge Park Boulders



Boulders and Indicator, Cotteridge Park.

From Bournville Works Magazine, 1913,  
courtesy of Cadbury Archive, Mondelēz  
International.



From 2016





# Birmingham's Erratic Boulders Project



# Walking and Cycling Trails

- 8 trails planned – 5 walking and 3 cycle trails.
- 3 walking trails and 1 cycle trail completed so far – please take some free leaflets!
- Trails are tested by our volunteers – it's a popular job!





# Moving and Displaying Boulders



Displaying and cleaning boulders at Selly Manor



Moving boulders to public areas at Woodgate Valley Country Park





# Boulder Clearing and Cleaning



Illey Pastures boulder clearance and assessment of extent



Steam cleaning at Woodgate Valley Country Park





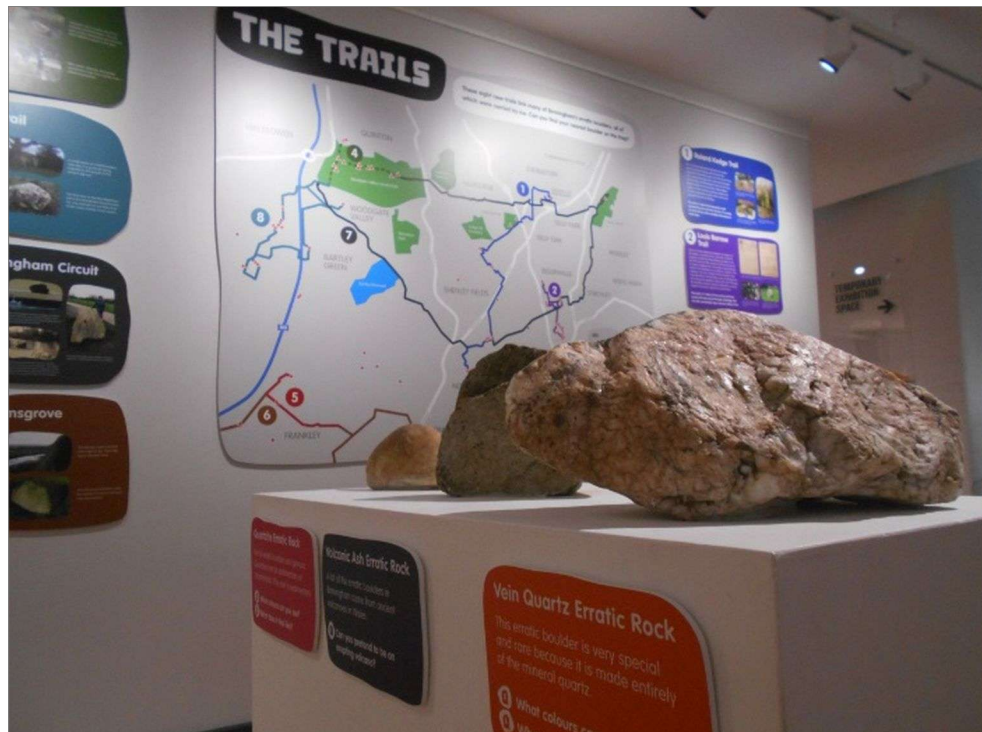
# Public Events





# Exhibition at Lapworth Museum

- Temporary exhibition ran from September 2022 to January 2023
- Approximately 16,000 visitors
- Soon to be moved to the Dudley Museum and Archives





# Our Unexpected National Publicity!

BBC Midlands Today

BBC Radio

BBC Website

The Telegraph

The Guardian

Children's Magazine  
First News



Birmingham's Erratic Boulders  
Heritage of the Ice Age

# MISSING

## Glacial Erratic Boulder



Last seen in 1923 during its excavation in Rowheath Grounds

**History:**  
Brought by ice 450,000 years ago and dropped here when the ice melted

**Dimensions:**  
8ft 6in x 5ft x 3ft  
(2.6m x 1.5m x 0.9m)





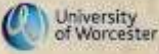
**Photo:**  
Bournville Works Magazine, April 1923.  
Courtesy of the Cadbury Archives, Mondelez International.

**Project:**  
For more information about the project go to:  
[erraticsproject.org](http://erraticsproject.org)



**Do you know what happened to this boulder?  
Can you help us find it?**

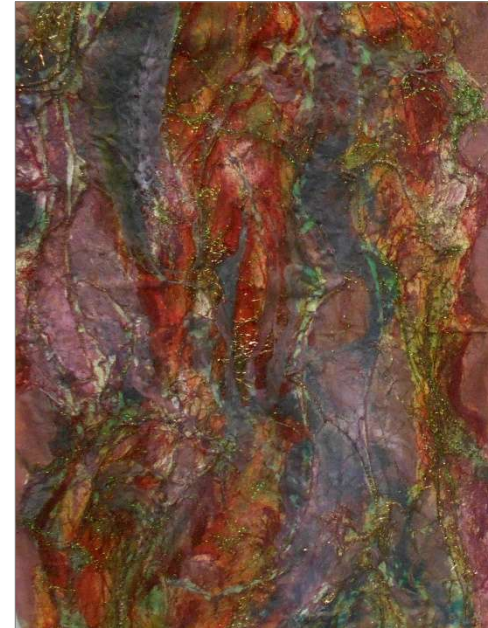
If you have any information or photos please contact the project team, email: [erraticsproject@worc.ac.uk](mailto:erraticsproject@worc.ac.uk)

Heritage Fund  Part of the  Earth Heritage Trust  LAPWORTH MUSEUM  BOSF  University of Worcester



# From Fire to Ice - Frankley Art Trail Community Artwork

Frankley  
Library Art  
Group



Textile Art  
Workshop





# Preservation of the Boulders

- At around the turn of the 20<sup>th</sup> century, publications and maps documented hundreds of erratic boulders. We knew the location of only about 50 at the beginning of the project.
- ‘Imposters’ – boulders brought in by landscapers – add to the problem.
- A key problem to address is lack of information available to the public.
- We hope to enlist and train ‘Boulder Champions’, who will continue our work beyond the life of the project.
- We also hope to formally designate some sites Local Geological Sites, which will ensure they are considered during any future local planning.



# Birmingham's Erratic Boulders Heritage of the Ice Age

## Thank you

[www.erraticsproject.org](http://www.erraticsproject.org)

 erraticsproject

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