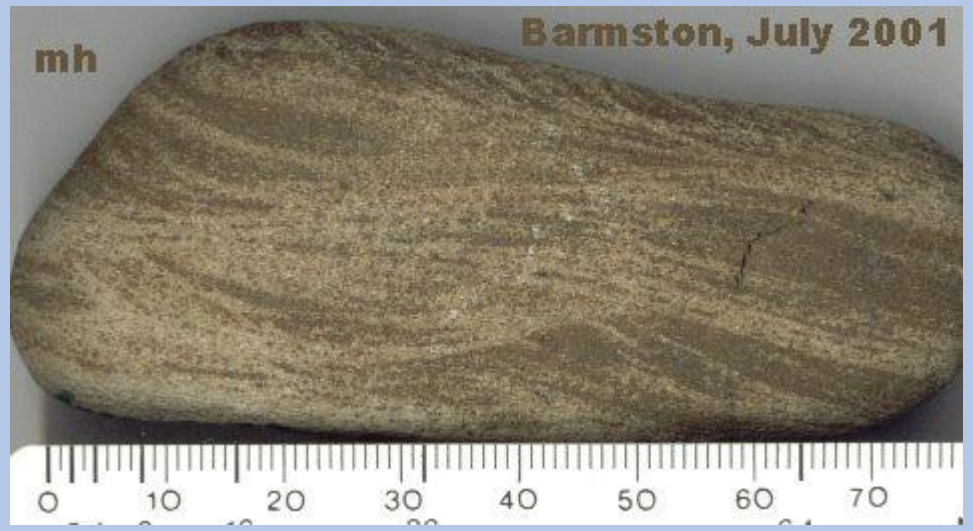
The Pebbles of the Ice Age Coast



Mike Horne FGS

Sorry, I do not have a webcam

Here is a picture of me instead!

Many of us start our study of geology by picking up pebbles off the beach.

I did – (for example)

A1 – slate, Teignmouth, Dorset
A4 – flint in Chalk, Beer, Dorset
A6 - Yellow quartz
A17- Forrest Marble, Dorset
A29 – Arnioceras, Lyme Regis, Dorset
A35 - Crinoids in Sandstone, Portishead, Somerset
A38 – Purple slate, Llanfairfechan, Wales
A63 – Rhyolite with quartz, Penmeinbach, Wales
A87 – granite, Britany, France
A90 – quartz, Britany, France
B1 – flow banded rhyolite, Britany, France
B12 – Tuff, Britany, France
B18 – schist, Holyhead, Wales

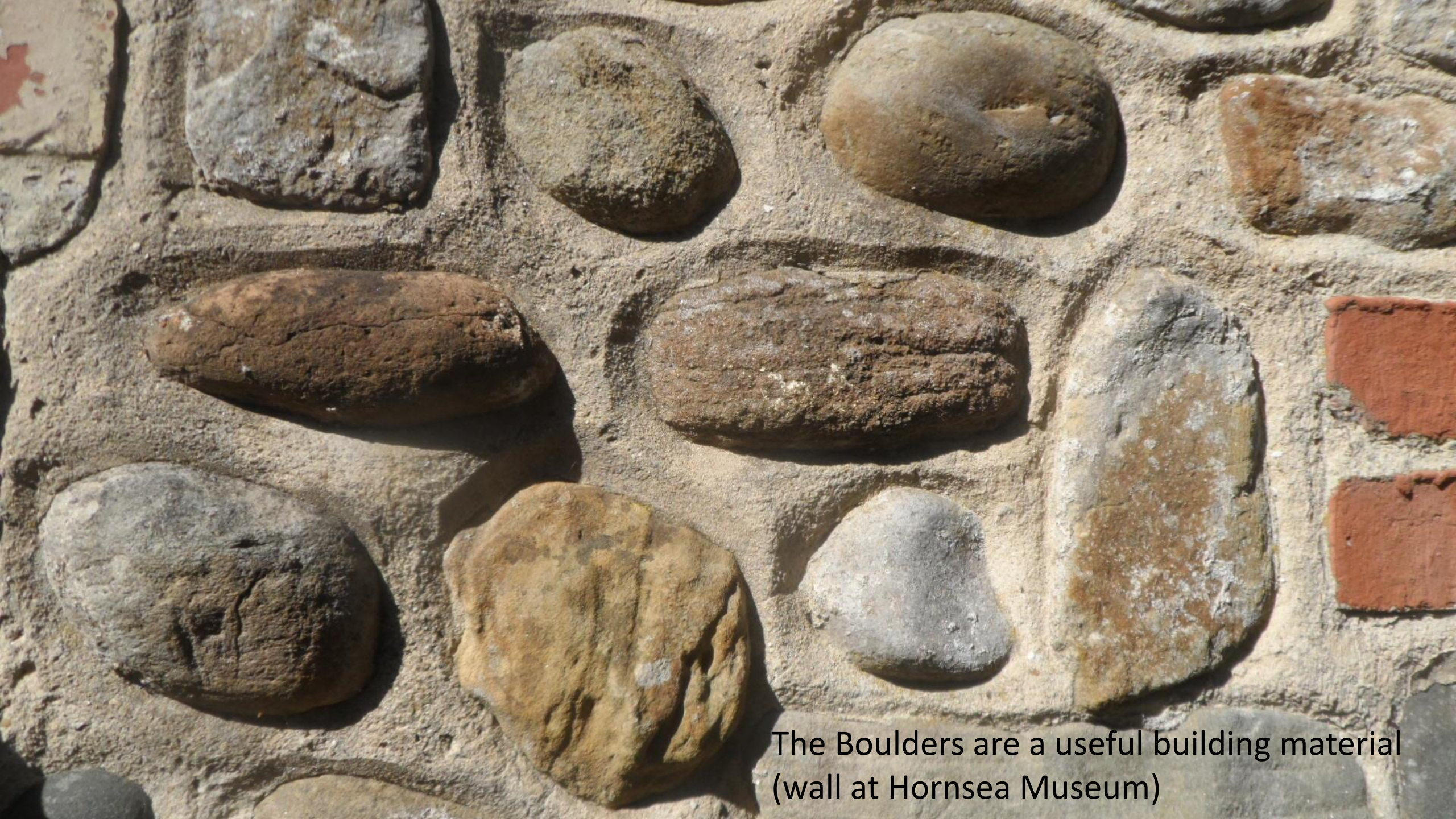
What are pebbles ?

Sedimentologists define them by clast size

Over 256mm = Boulders
64 to 256 mm = Cobles
4mm to 64mm = Pebbles
2-4 mm = granules
63 um to 2mm = sand
2um to 63 um = silt
Under 2um = clay

Pebbles fit nicely into your pocket and geology cabinet!

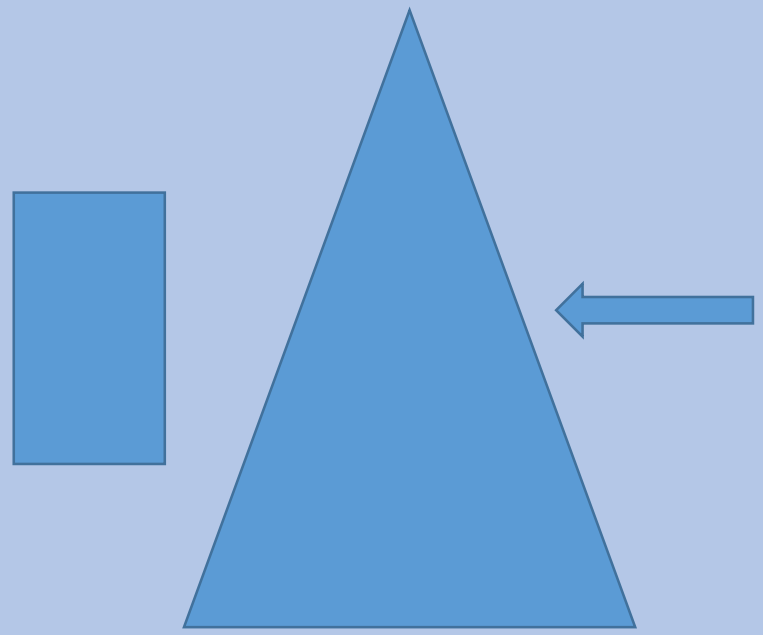
From the collection of Brenda and Jack Almond

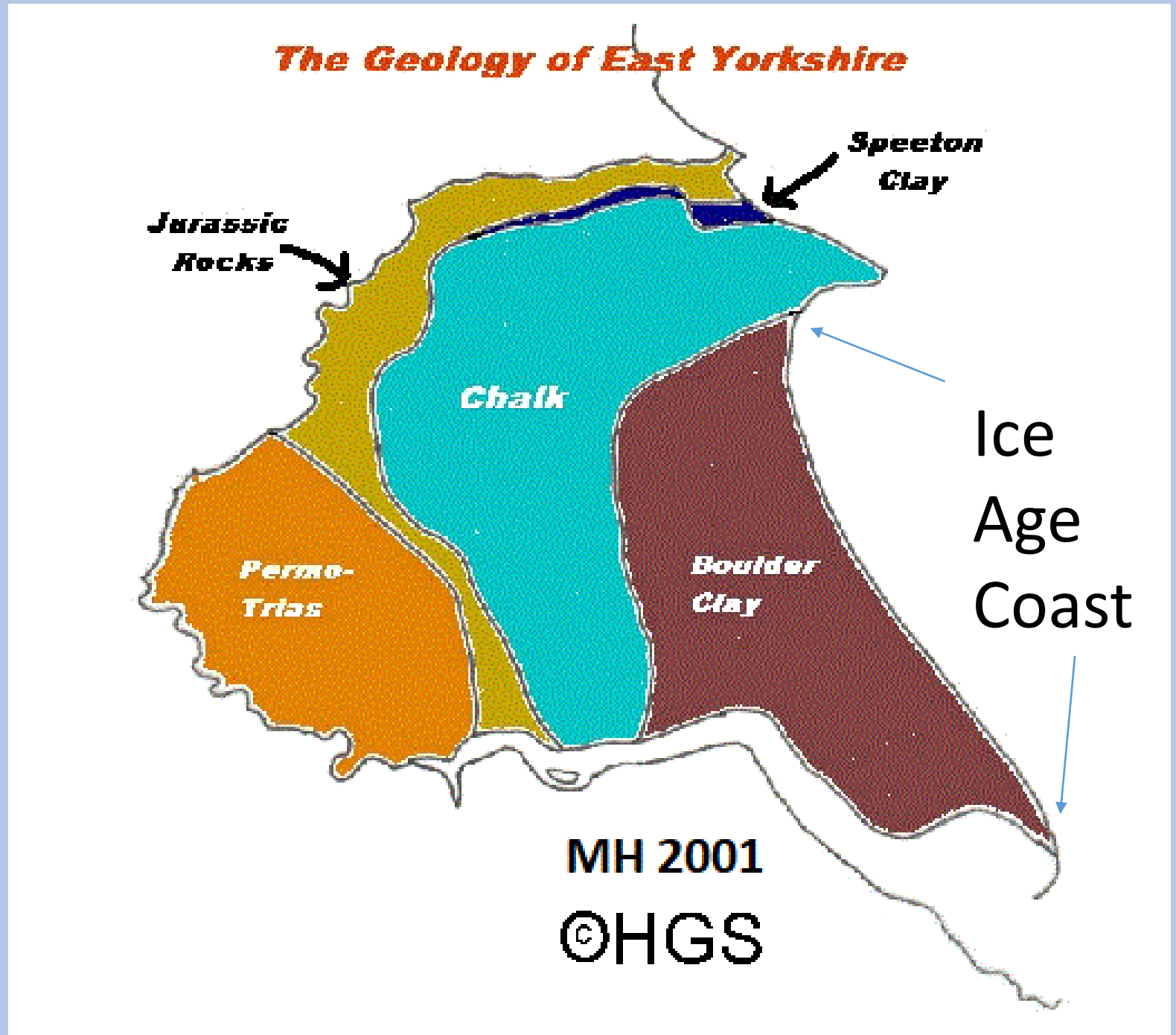


The Boulders are a useful building material
(wall at Hornsea Museum)

Where is the Ice Age Coast

It is the Holderness coast of East Yorkshire, UK




The Geology of East Yorkshire
Speeton Clay
Jurassic Rocks
Chalk
Boulder Clay
Permo-Trias
Ice Age Coast
MH 2001
©HGS


This is Boulder Clay
Or should it be called Pebble Silt?

The Boulder Clay cliffs are eroding at an average rate of 2m per year (1 mile per 1000 years)


DANGER
Cliffs subject to
coastal erosion
Do not proceed


Yes, there is also Ica Age material
in Norfolk – but the pebbles are
mostly black flints!

There are three Tills (Diamicts/Boulder Clays) in Holderness

Withernsea Till
Skipsea Till
Basement Till (or Tills)

Distinguished by the colour of their matrix
And we are still not sure about their ages


Glacial Erratics vary in size
MH 2011
A Chalk “Raft”

Crinoid fragments from the Till


20
30
40
50
60
70


Hornsea
mh
20
30

Scratch marks on Carboniferous Limestone


Borings into a Chalk pebble made when it was on a beach
mm
Very Large Pebbles
Large Pebbles

The Yorkshire Boulder Committee
of the Yorkshire Naturalists Union, formed in 1886.

(Boulders large than 12 inches in diameter.

Example from 1890 –

In the parish of Folkton, on the estate of Mr. J. W. Woodall, Scarborough, round a spring head at the N.E. side of West Flotmanby Hall, near Filey, there are several boulders which have been collected from the Carrs; the largest is
2 ft. 6 in. x 1 ft. 11 in. x 1 ft. 3 in. Mountain limestone.
1ft 7 in x 1 ft 4 in x 1 ft 1 in Diorite.
1ft 3in x 11 in x 8 in Diorite.
1ft 1in x 10 in x 8 in Whinstone.
1ft 0 in x 9 in x 8 in Sandstone.

BOULDERS TWELVE INCHES AND UPWARDS IN DIAMETER.

Some ten years ago Mr. G. W. Lamplugh counted and roughly classified the larger boulders of Flamborough Head and other selected localities on the Yorkshire coast, and published his results in the Proceedings of this Society. This work has been continued by members of the Hull Geological Society, who have, up to the present time, recorded nearly 4,000 boulders of twelve inches and upwards in diameter. To avoid possible error arising from the moving beach and other causes, only the boulders actually in place in the clays were noted, or such as had recently and obviously fallen from the cliffs. The whole of the coast-line from Spurn to Flamborough has been surveyed in this way, and also portions of the coast north of Flamborough as far as Saltburn. The lists thus compiled have been published from time to time by the Hull Geological Society and by the Erratic Blocks' Committee of the British Association.

J W Stather PYGS 14, 237-24. Read on 14 July 1900 to YGS

[Hull Geological Society]

REPORT OF THE EAST RIDING BOULDER COMMITTEE, 1893-4.

This Committee was formed early in 1893 for the purpose of observing and systematically recording the glacial phenomena of the district. The map of the Ordnance Survey Sheet 94 S.W. (new series 72) which embraces the district immediately to the N. and N.W. of Hull, for convenience in working, was divided into fifty-four squares…

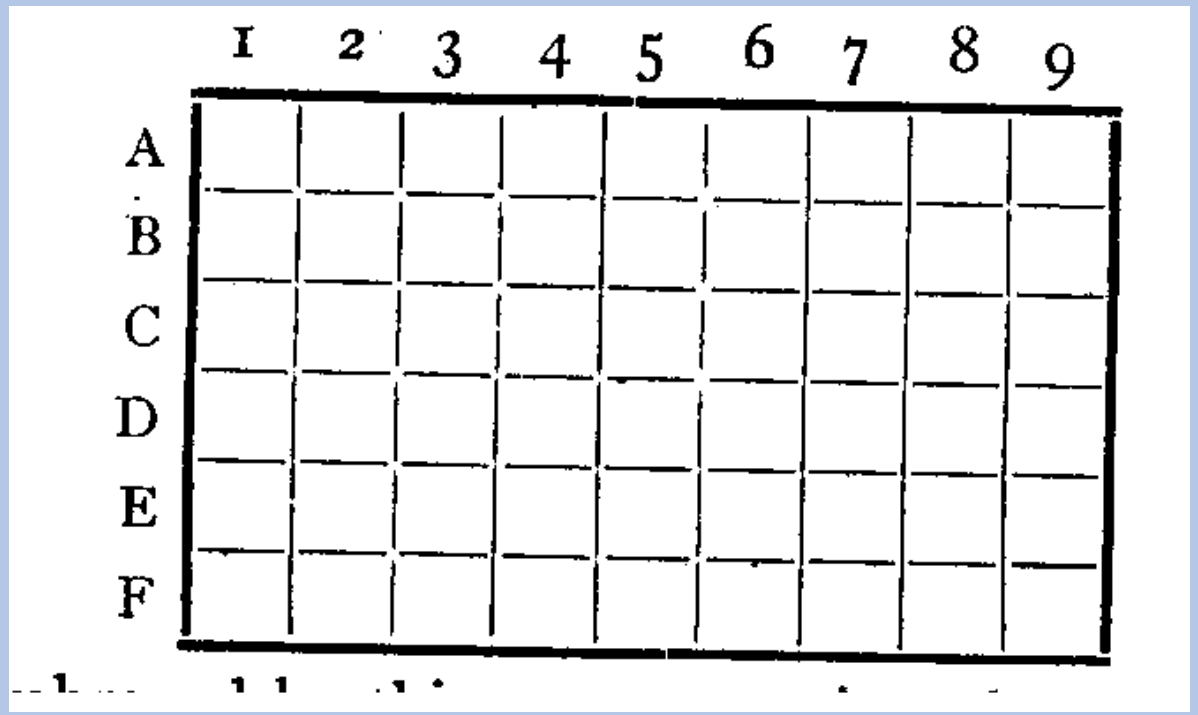


TABLE BB.

BOULDERS OF ONE FOOT AND UPWARDS IN DIAMETER.

	On the beach between Bridlington & Skipsea. T. Sheppard. Group I.	On the beach just South of Withernsea, J. Stears, M. Carmichael, W. S. Parrish. Group II.	On the beach near Earl's Dyke. T. Sheppard, J. W. Stather. Group III.	
Carboniferous limestone	12	52	210	
Sandstone, Grits, etc. (Probably all carboniferous)	134	9	40	
Lias	0	1	8	
Chalk and Flint.	In large numbers	1	3	
Other Mesozoic rocks	—	4	3	
Basalts, etc	2	42	485	
Granites, etc.	—	—	29	
TOTALS	148	109	778	1,035

EAST RIDING BOULDER COMMITTEE'S REPORTS. [1907-1909]

1908.

Reported by Mr. C: THOMPSON, B.Sc.

Aldborough. Large numbers of Lias Ammonites collected from the drifts of this locality, representing all the zones of the Lias but one, viz., the jamesoni zone.

1909.

Reported by Mr. H. E. DENHASL B.A.

Aldbrough. In the boulder clay of this locality a mass of shelly Lias limestone, *(Bucklandi* zone), containing the ammonite *Arietites scipionanus.*
The specimen measured 24 inches in diameter,
and is the largest recorded for Yorkshire, and possibly for the British Isles.

Reported by Mr. C. THOMPSON, B.Sc.

Hornsea. An ammonite from the jamesoni zone in the boulder clay.
All the Lias zones are now known to be represented in these drifts.
The work, so far, has revealed many new forms, about twenty species
having been found either new to Yorkshire records or only doubtfully inserted therein.
They include at least four species new to science.

Problems from the Boulder Committee Reports –

Precise locations – Where is the turnip field on Flamborough Head?

Definitions – Augite Syenite

Missing – very few examples of Larvikite

Size – they were recording boulders so generally small finds like fossils would be ignored ➔ bias

"The East Yorkshire Boulder Committee"
Report for the years 1987 to 1991
by Ron Harrison and Mike Horne

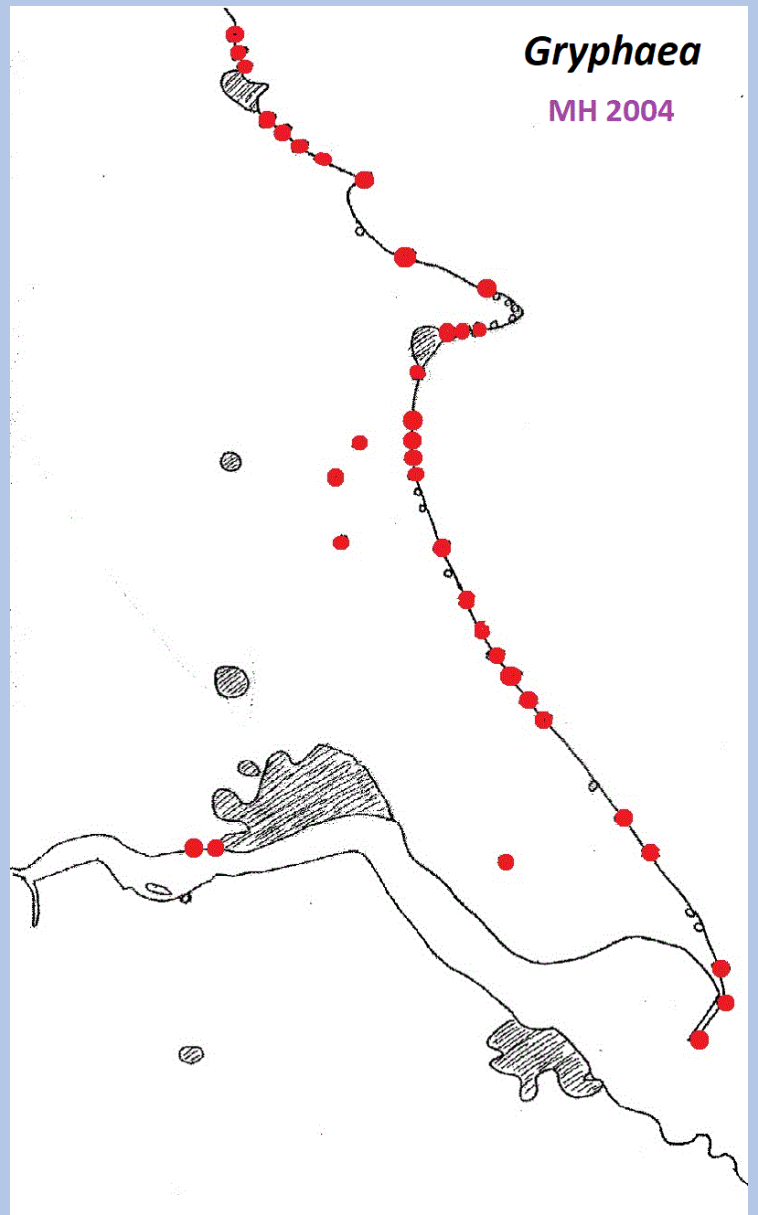
As well as boulders (clasts over 30cm in diameter), smaller erratics have been included

Barmston : granite, dolerite, red amygdaloidal andesite, Rhomb Porphyry, basalt, tuff from the Borrowdale Volcanics, gneiss, meta-quartzite, orth-quartzite, ice-scratched Carboniferous Limestone, *Lithostrotian*, red sandstone, Brockram, Magnesian Limestone, Deltaic Sandstone, septarian nodule, Chalky black flint, red flint.
Skipsea : granite, Rhomb Porphyry, dolerite, basalt, vesicular basalt, gneiss, schist, slate, meta-quartzite, jasper, Old Red Sandstone, ice scratched Carboniferous Limestone, *Lithostrotian*, Brockram, Jurassic shelly limestone, *Hildoceras bifrons*, septarian nodule, Cementstone from Speeton Clay, Deltaic Sandstone, Chalk, grey flint with Chondrites, brown flint, black flint, red flint.

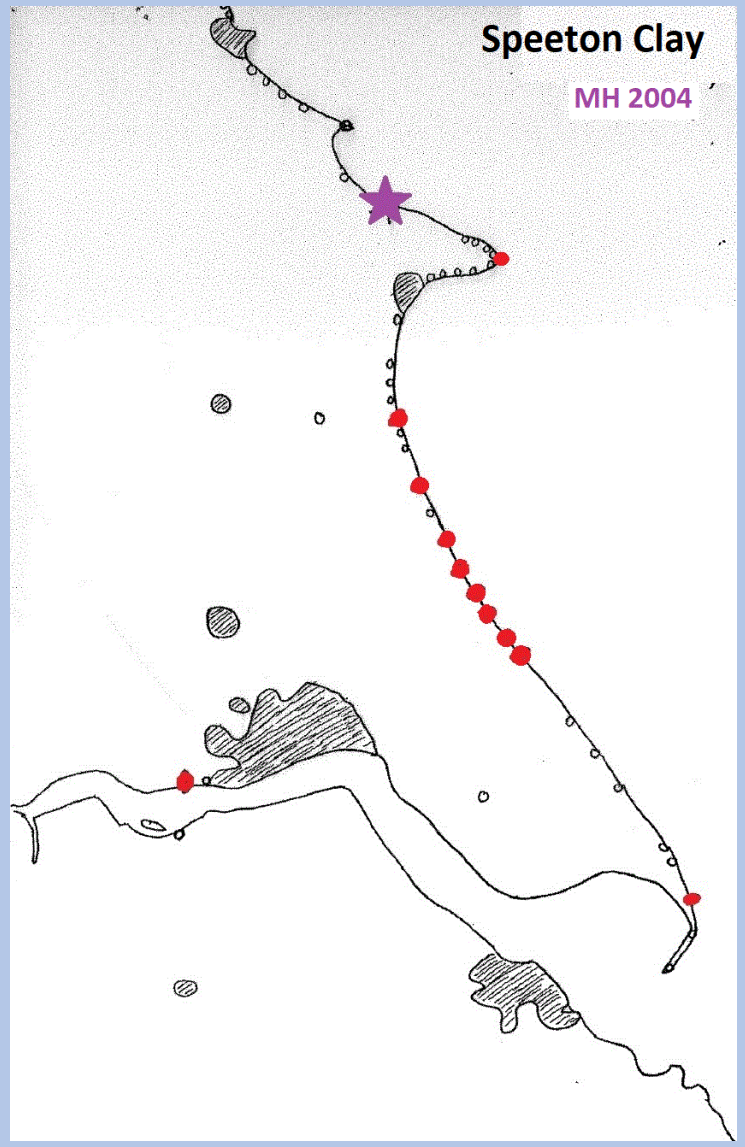
Humberside Geologist no 16

The distribution of some indicator glacial erratics in eastern Yorkshire

By Mike Horne*

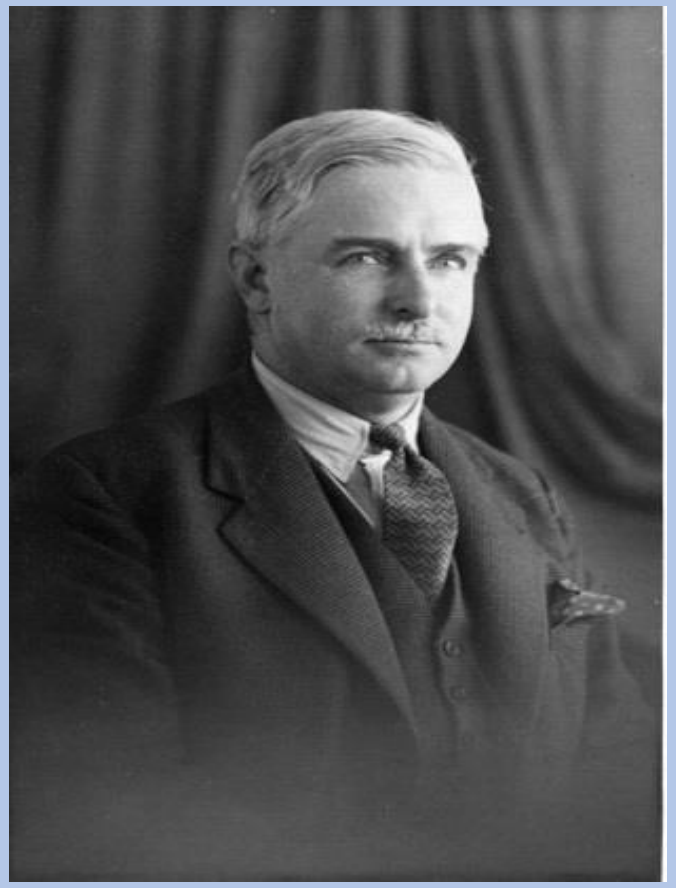


Some erratics were present at most coastal sites
Others had a more restricted distribution.



The Lewis Penny Collection at the University of Hull

The collection consists of Holderness erratics (some with thin sections), sub-fossils shells from Holderness, specimens from source areas and some archives. It was collected by Lewis Penny (1920-2000), John Catt (1939-2017), and Patrick Boylan. It was catalogued and dusted by Mike Horne, Rodger Connell in 2010 and 2012 and details were added to the University's electronic catalogue in 2019.



William Sawney Bisat, FRS
(1886-1973)

Between 1932 and 1952 Bisat walked the 56 kilometres of coastline between Easington and Sewerby. The 2nd World War caused him to drop his task for several years. He sketched and described the stratigraphy along this whole coast and finally at the end of his marathon walk he combined his findings onto a single sketch on a roll of paper 8.2 metres long.

The Bisat project

Sometime in 2014, Mike Horne had the idea that someone, or some people, may like to replicate Bisat's 1930s work on the Holderness coast.

At first there was a large response and a few groups got together on the beaches, but we quickly recognised the enormity of the task. After a few false starts Graham Kings agreed to take on the job. Rather than sketches, Graham, who is interested in photography, decided that he would take photographs of the whole of the coast and then somehow stitch them together once they were all taken. On 22nd April 2015 Graham took his first photograph, using the edge of the Sewerby Buried Cliff as his northern marker and a long scaling pole as his southern marker 30 metres to the south of the Buried Cliff. He positioned his camera, on a tripod, 30 metres out from the cliff. This pattern was repeated for the whole of the next 56 kilometres; more than 1514 photographs in total.

Report of the Bisat Project 2014 to 2019
By Dennis Haughey
Humberside Geologist 16

Bias in collecting “pebbles”

You might miss small fossils

You will not find rocks with big patterns as pebbles such as -

- Shap Granite
- Frosterly Marble

Pebbles off the beach are biased

- Long shore drift
- Disintegration of soft materials such as shale and young Chalk
- Materials sorted by density such as coal and pyrite
- Which Till did they come from?

Collecting from the cliff

- Can you identify the Till?
- Lots of boring erratics relative to the sexy ones


Kimmeridge Clay

Bias in the collecting and recording

The collector

- Tends to ignore the boring ones
- Tends to ignore the one that collector cannot identify

So need to collect methodically

➔ Creating a “type collection”

- Good provenance
- Record keeping
- Counting clasts in the field
- Picking one or two of each type
- Good curating
- Not worrying too much about identification
- Accessible to others

The Yorkshire Type Erratics Collection at the University of Hull

Geologists have been studying the erratics of Holderness for many years. The Hull Geological Society published its first Boulder Survey in 1893. There has never been a reference collection of the erratics that can been used by scientists for comparison with their own research. This project aims to start a collection at the Geology Department at the University of Hull, which can fulfil that role.

The groups of rocks in the collection are –

- Specimens from the Basement Till
- Specimens from the Skipsea Till
- Specimens from the Withernsea Till
- Specimens collected off the beaches of Holderness
- Specimens from earlier glaciations, collected from the Yorkshire Wolds
- Specimens which are not glacial erratics (man made, building stones or introduced by man for sea defences)
- Specimens from earlier glaciations, collected from Lincolnshire and Norfolk
- Specimens collected from the source areas of the erratics

number	locality	horizon	description	photo
HUYE001	Holderness	beach	Frosterley Marble	SAM4150+1
HUYE002	Barmston	beach	Conglomerate red	SAM 5280+1
HUYE003	Mappleton north beach	beach	Mygdaloidal volcanic rock, purple and green	SAM7695+6
HUYE004	Mappleton north beach	beach	Porphyry, pink in grey	SAM7705+6
HUYE005	Mappleton north beach	beach	Lithostrotian in brown limestone	SAM7703+4
HUYE006	Mappleton north beach	beach	green Jasper	SAM7701+2
HUYE007	Mappleton north beach	beach	Tilberthwaite Tuff	SAM7697+8
HUYE008	Mappleton north beach	beach	Coarse orange sandstone	SAM7699+7700
HUYE201	Withernsea south cliff	Withernsea Till	Coal	SAM1725
HUYE202	Withernsea south cliff	Withernsea Till	brown porphyry, phenocrsyt up to 6mm	SAM1740
HUYE203	Withernsea south cliff	Withernsea Till	pale brown sandstone, fine grained	SAM1738
HUYE204	Withernsea south cliff	Withernsea Till	grey sandstone, fine grained	SAM1737
HUYE205	Withernsea south cliff	Withernsea Till	soft red rock with borings	SAM1743
HUYE206	Withernsea south cliff	Withernsea Till	Chalk	SAM1722

Descriptions of distinctive erratics

Larvikite - coarse grained dark rock, shines blue in sunlight when wet. May have been described as Augite-Syenite in early boulder survey publications. Origin - Larvik in Norway.
Norwegian Porphyry* - yellowish phenocrysts up to 1cm in a red-brown matrix. Phenocrysts may be zoned. Origin - Oslo Fjord in Norway
Peterhead Granite - looks a bit like Shap Granite but the orthoclase phenocrysts are more of a tinned-salmon pink and not as domino shaped.
Rapakivi Granite - origin Aaland
Rhyolte - reddish-brown fine grained igneous rock. May exhibit flow banding and contain small phenocrysts. Origin - ?Cheviot Hills.
Shap Granite - pale granite containing distinctive large crystals of pale pink orthoclase (like pink dominoes), sometimes with obvious simple twinning. It is difficult to identify in small specimens because you need to see the phenocrysts, so it may be under-reported. Origin - Shap in Cumbria. There is a large boulder near the base of Sewerby Steps that can be seen when it is not covered with sand. In older publications it may be called Shap Fells Granite.

What can we find?

Yellow Quartz
White Quartz
Quartzite
Jasper
Schist
Gneiss
Green Sandstone
Basalts
Diorites
Granites

From Norway –
Larvikite
Rhomb Porphyry
Volcanics

What can we find –

Tertiary - ? Coarse sandstones from the North Sea
? Cleveland Dyke
Soft Chalk – Rowe Formation from the North Sea
Yorkshire Chalk
Red and pink Chalk
Speeton Clay
Kimmeridge Clay
Oxford Clay
“Deltaic” sandstones
Liassic fossils
New Red Sandstone
Magnesian Limestone
Whin Sill
Coal Measures
Carboniferous Limestone
Old Red Sandstone
Cheviot porphyry

Conclusions –

- Studying pebbles has provided a lot of fun for geologists for many years
- There is still more to learn about the glacial erratics and Tills of Holderness
- We can continue to add scientific accuracy to their study
- We should share our knowledge and make collections accessible.

For more information
Visit the Ice Age Coast website

http://www.hullgeolsoc.co.uk/holdhome.htm