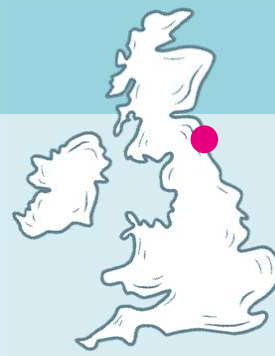


PHYTOLITH ANALYSIS FOR EXPLORING HOLY ISLAND'S VEGETATIONAL HISTORY

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Holy Island

is a tidal island off the coast of Northumbria and has an **eventful history**.

- AD 635 Lindisfarne **Monastery** founded by King Oswald
- AD 793 One of the first **Viking raids** on the British Isles
- AD 875 Partial abandonment (?)
- AD 1093 Resurgence as religious centre
- 18th cent large-scale **industrial** activity - quarrying, lime production



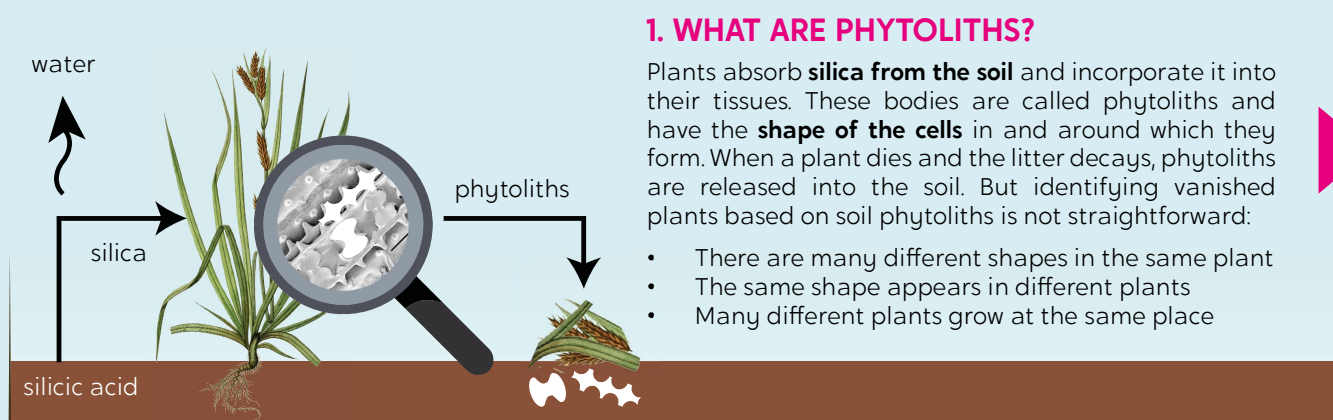
How are these changes reflected in the landscape?

ARCHAEOLOGY AND PAST ENVIRONMENTS

Archaeologists study of the human past using primarily **material sources**. We are interested in interactions between **people** and their **environments**:

- Which resources were exploited?
- How was the landscape modified?
- How was the land used?
- Were there unintended consequences?

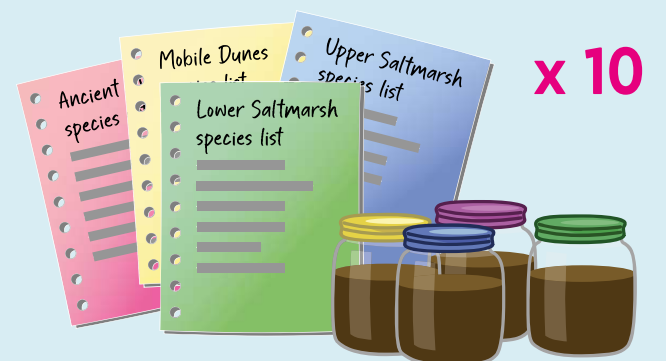
Reconstructing past vegetation is the first step for answering such questions; but there is a major challenge: Organic **plant remains** decay over time unless they are charred or waterlogged. But there might be a solution: mineral **plant microfossils** or "phytoliths". Literally translated from Greek, the word means "plant stone" - and just as stones, they can survive in the ground for centuries and millennia.



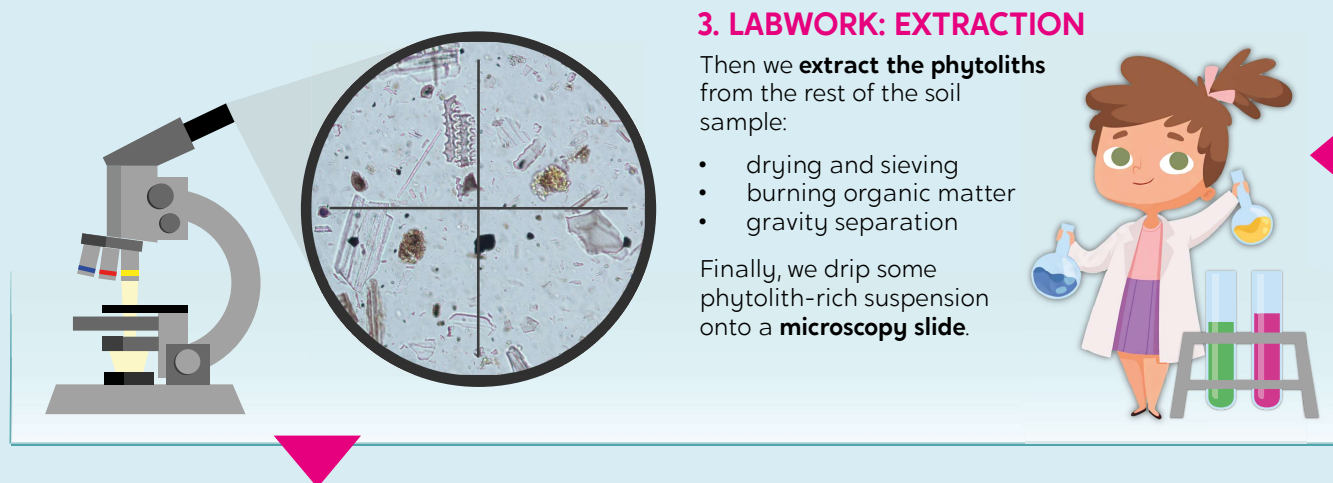
2. RESEARCH DESIGN & FIELDWORK

To overcome these challenges, we

- use multivariate **statistics** rather than looking for diagnostic phytolith shapes
- identify the phytolith **fingerprints** of soils beneath **coastal plant communities** rather than studying individual species.

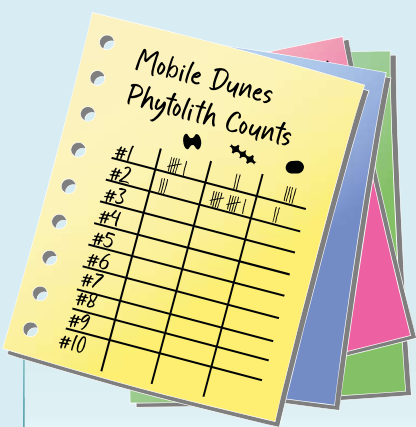


In the field, we produce detailed descriptions of plant communities on Holy Island and other coastal areas in north east England and take samples from the soil underneath. We repeat this procedure for every community at 10 different locations.



4. COUNTING PHYTOLITHS

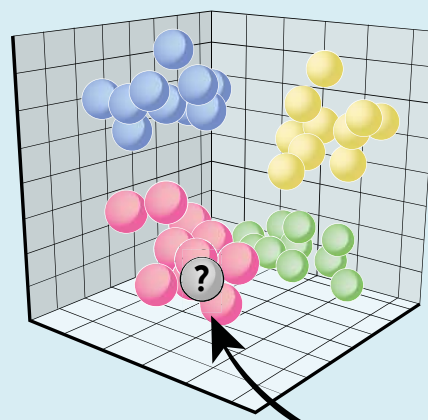
For every sample, we count the numbers of phytoliths of each shape until **at least 200** were counted.



5. STATISTICS

As our dataset is very large, we need a **computer** to find out which combinations of shapes are distinctive for a soil beneath a certain plant community. We use eight of our ten samples to create this **fingerprint**. We don't expect that each sample from the same community has exactly the same values. So if we picture it on a chart, we will end up with a **"cloud" of points** for each plant community rather than just a single point.

We then ask the computer to predict where the rest of the samples come from. If the **predictions** are correct and these samples are assigned to the right cloud, we consider the fingerprints reliable. The method we use is called "Linear Discriminant Analysis".



6. PREDICTING PAST ENVIRONMENTS

If we have reliable fingerprints of modern soils, we will work with buried soils that we have found on Holy Island by excavating **test pits** or drilling **boreholes**. These samples are processed just like the modern ones, and the computer will try to assign it to a cloud. It will also tell us how confident it is about its decision.



We will also date these samples. By combining this information we will be able to **reconstruct Holy Island's vegetational history**, including the development of land use practices.

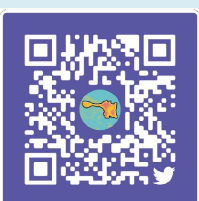
Why is this important?

- Our environments are changing at an unprecedented pace on global, regional and local scales.
- Links between human values, attitudes, and activities have always been powerful, and remain so today. We need to study past human land-use to better understand how today's environments evolved
- Understanding the mechanisms behind these links in the past can pave the way to more sustainable futures.
- To tackle global environmental changes, we have to think in time scales of several decades and centuries. Environmental Archaeology can help us to grasp such long-term developments.
- There are only very few soil phytolith studies in the UK and in temperate Europe in general. The collected reference data will be immensely useful for other researchers.

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