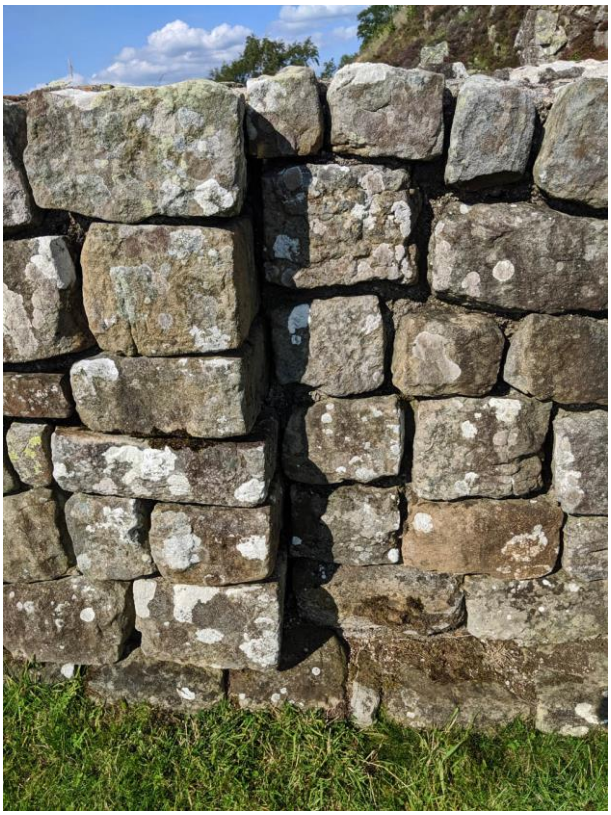

INVESTIGATING WALL STONE (1)

Introducing the Method

ABSTRACT

Introducing the method used to investigate where the wall stones on Hadrian's Wall have been sourced from and how to recognise them where they have been reused in post Roman buildings

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Introduction

The success of the Stone Sourcing and Dispersal Project, a part of the Hadrian's Wall Community Archaeology Project, is dependant on volunteers discovering the fascination and value of geology in understanding the raw materials - stone and mortar - used to construct Hadrian's Wall. It also requires the volunteers to learn a method to observe and record information about the stone. This guide introduces and summarises this method. It also points to a series of other guides which have been written to give further detail on the method and to further explain how the variation observed in the stones came about from a geological point of view.

Why Collect Wall Stone Information?

The overall aim of the Stone Sourcing and Dispersal project is to be able to categorise Wall-stones such that it is possible to work out where they were quarried from and to be able to identify Roman stones where they have been re-used in post-Roman buildings.

Useful information to help understand this can be found using purely archaeological methods. For example, where distinctive marks have been made by human hand, this may help identify blocks of stone as being Roman. These marks include holes made for lifting blocks, tool marks from dressing stone and carvings including lettering and figurative work. The shape and size of the blocks may also be distinctive.

There are however limits to how much this archaeological information can tell us. A stone dressing style may not be limited to Roman times and stone shape and dimension can only be suggestive rather than definitive identification of Roman material. Little can be learned about the source of the stone from purely archaeological research.

By adding geological information to the archaeological information to create a larger data set for the Wall stones, it is anticipated that a more reliable way can be found for identifying re-used Roman stones as well as understanding more about where they have been quarried from. It is also anticipated that taking this intersectional approach will make for a broader and more interesting perspective on the development of the Wall as well as the communities around the wall.

Using geological information to characterise Wall-stone is a big challenge as the Wall is almost entirely made of sandstone, and sandstones are not easy to distinguish one from another. There are,

nonetheless, many different types of observation which can be made and recorded of the stones which may allow for this type of discrimination.

Rocks are made up of a variety of different materials arranged in different patterns. It is the detailed observation of both the materials and the patterns into which they are organised which may make it possible to differentiate one Wall-stone from another and Wall-stone from non-Wall-Stone.

Observing and Recording Wall Stone Data

Below is a list of the data which can be collected for each stone which is observed on Hadrian's Wall. Because the condition of stone is very variable and accessing the stone to get a good look with a hand lens may well be problematic it will often only be possible to collect a subset of this data. Some data is better than no data, so that this list is designed to act as a prompt for things to look for and how to describe them. An A5 version of this list has been made so that it is easy to take out into the field.

To be clear, it won't be possible to record this detail for *every* stone as there is not enough time to do this, and for many stones it won't be possible to observe all these categories. For each section of wall observed, it will become clear that much of the stone used is the same and that where possible this data should be recorded for this 'typical' stone in any given short length of wall for 2-3 stones. Where stones are found which are not typical of this section these should be specifically noted, and data recorded (where possible).

More information about each of the different sorts of data to collect along with explanations about what this data tells us about the source rock in terms of geological process is given in a series of guides, listed later in this guide.

Colour – ideally a Munsell chart number or in absence, colour descriptors such as white, yellow, grey, buff etc

Grain size – coarse, medium, fine

Grain shape – angular, sub-angular/sub-rounded, rounded.

Grain shape – low sphericity, high sphericity

Grain sorting – well sorted, moderately sorted, poorly sorted

Grain types – quartz, feldspar, mica, lithic fragments, mud flakes, metal oxides

Cement – quartz, calcite, iron oxide.

Veins and diagenesis – quartz, calcite, iron oxide

Sedimentary textures – bedding (note scale): none, planar, cross-bedded.

Fossils – these are not common on the Wall. If you find something that you think is a fossil, record what it is preserved in (carbon, calcite) or whether it is just a shape. Identify it if possible and photograph it, with a scale.

This list is not exhaustive. Anything which cannot be categorised using the above should be noted and a good quality picture taken and sent in.

Observing and recording data in the Laboratory

Much information can be gleaned from a visual inspection of stone with the naked eye and using a hand lens. However, more detailed, and more quantitative information can be obtained back at the lab. Two further techniques will be used as part of the Stone Sourcing and Dispersal Project: polarising microscopy using thin sections, and geochemical analysis. A summary of these techniques is given here, but more information can be found in "Investigating Wall-Stone (7): Taking Things Further".

The Polarising Microscope and Thin Sections

One of the issues which becomes apparent with sandstones (and many other rocks) when you start trying to identify mineral grains is how difficult this is to do with a hand lens. This is partly because the grains are often small but also because the one small face of the grain you can see may not give sufficient features to be able to definitively identify it.

Thin sections and a polarising microscope allow for much better identification of mineral grains and for the observation and identification of finer grains including the material cementing the grains. They also allow for a more rigorous analysis of the shape of grains, how the grains relate to each other, the percentage of different mineral types and the amount and type of pore space.

Once a specimen has been examined in thin section it then makes it easier to see what is happening in a hand specimen and to improve one's technique for identifying minerals and rock texture in the field.

This is a powerful technique used by geologists in almost every field of work. Whilst it will not be practical to ask volunteers to do this sort of work, workshops will be organised for volunteers to see how this works and what rocks look like down a microscope. The technique is also limited in its use as it is destructive of the stone samples.

Geochemical Analysis

There are a variety of techniques which allow for the accurate measurement of the percentages of different chemical elements to be found within a rock. Chemical elements in rocks are referred to as either major elements (those commonly found in rocks) and trace elements (those only found in small quantities).

X-ray Fluorescence Spectrometry (XRF) is a reliable method of obtaining measurements on a wide range of major and trace elements. The most accurate measurements are made on a lab-based machine, where samples are taken from fresh rock (with no weathering) which has been finely crushed in a contaminant free environment. Good but more qualitative measurements may be taken using a portable device. To enable the measurement of Wall-stones in situ the portable device (pXRF) is clearly essential.

As with the thin sections it is not practical for volunteers to carry out this work, not least because radiation training and dosage measurement is required. Volunteers will be shown how this analysis is carried out and will have access to the data which this work produces.

The Set of Guides to Wall Stone Geology

Along side this introductory guide a series of additional guides have been written to further describe this geological work. The full set of guides are as follows:

1. **Investigating Wall Stone (1): Introducing the Method**

   A summary of the rational and approach being taking to understanding the stones used in Hadrian's Wall.

2. Investigating Wall Stone (2): Explaining why geological process creates variation

   There are many subtle differences to be observed in the stones which make up Hadrian's Wall, but what caused that variation? In this guide the geological processes that cause this variation are explored.

3. Investigating Wall Stone (3): Categorising Grain Sizes and Shapes

   A more detailed description of how grain size and shape vary in sandstones and how to go about observing them

4. Investigating Wall Stone (4): Categorising Sandstone Minerals

   A more detailed description of the different types of minerals to be found in sandstones and how to go about observing them

5. Investigating Wall Stone (5): Categorising Sandstone Textures.

   A more detailed description of the different types of textures to be found in sandstones and how to go about observing them

6. Investigating Wall Stone (6): A Glossary of Terms

   A list of technical terms used in the guides and a definition for each of them

7. Investigating Wall Stone (7): Taking things further

   A guide to taking your understanding of the geology of the Hadrian's Wall area further. This includes a resources list including further reading.

8. Investigating Wall Stone (8): An A5 Checklist for fieldwork

   A concise summary of the information to be observed in an A5 format for use in the field.