INVESTIGATING WALL STONE (3)

Categorising Grain Size and Shape

ABSTRACT

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

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Introduction

This guide and the next two focus on what may be observed within the Wall stones and how to go about making observations of these different types of rock data. In this guide grain size and shape will be explored in more detail including how to observe and record these variables.

Grain Size.

Grain size is a useful piece of data to capture for any type of rock as it will help categorise the rock and provide one of several pieces of information to help identify the source of that rock. The answer to why and how grain size varies is explored in "Investigating Wall-Stone (2): Explaining why geological process creates variation".

Field measurements of grain size are constrained by the condition of the stone and what can be seen on its surface with a hand lens. More rigorous measurement requires thin sections of the stone to be made so that a cross section may be examined using a polarising microscope.

We are using the Wentworth classification system (as defined by Chester K. Wentworth in a 1922 article in The Journal of Geology: "A Scale of Grade and Class Terms for Clastic Sediments"). This is an internationally understood way of classifying clastic sedimentary rocks (that is sedimentary rocks composed of clasts (grains) – limestones and precipitated rocks such as evaporites are classified differently).

Wentworth first gives names to the major groups of clastic rocks according to grain size:

Name	**Grain size**
Boulder	>256mm
Cobble	64 - 256mm
Gravel	2 - 64mm
Sand	62.5µm* – 2mm
Silt	3.9 – 62.5µm
Clay	0.98 – 3.9µm

* µm – micrometre is 1 millionth of a metre. There are 1000 µm in a millimetre.

To be clear names like "cobble" are used here with specific geological meaning and refer to the grain size within a rock. A boulder in common parlance may contain sand grains, which will define it as a sandstone. For the purpose of classification that boulder would only be relevant if it was, say, a (very large) grain within a glacial till.

These major types are then subdivided, again according to grain size. For the purposes of WallCAP we are highly likely to be looking at sandstones. Sandstones are subdivided as follows:

Name	**Grain Size**
Very coarse sand	1–2 mm

Coarse sand	0.5–1 mm
Medium sand	0.25–0.5 mm
Fine sand	<.25mm

Grain size can be measured using a hand lens with a ruler graduated in millimetres. Grain size cards with a hand lens, are another good way of measuring grain size. These are available cheaply from places like Geo-supplies, UKGE and Geology Superstore:

https://www.geosupplies.co.uk/acatalog/Leicester-University-Grain-Card-647.html#SID=26

https://www.ukge.com/Product.aspx?ProductID=2796&strReferer=search&PPGR=0

https://www.geologysuperstore.com/index.php/grain-size-card.html

Grain Shape.

The shape of grains is variable and is another important way of classifying the sandstones' clasts. Some grains are angular with broken, rough surfaces and as they are progressively eroded their surface becomes progressively smoother. The aspect ratio of the grains is also important to note. Many grains will tend towards spheres in shape, but others may be more elongate. This too may be helpful in uniquely identifying a sandstone.

There are large numbers of ways to categorise grain shape. Here we will look at two primary axes, rounded v angular and spherical v elongated to classify Wall stones. Two figures are given here one more simplified than the other.

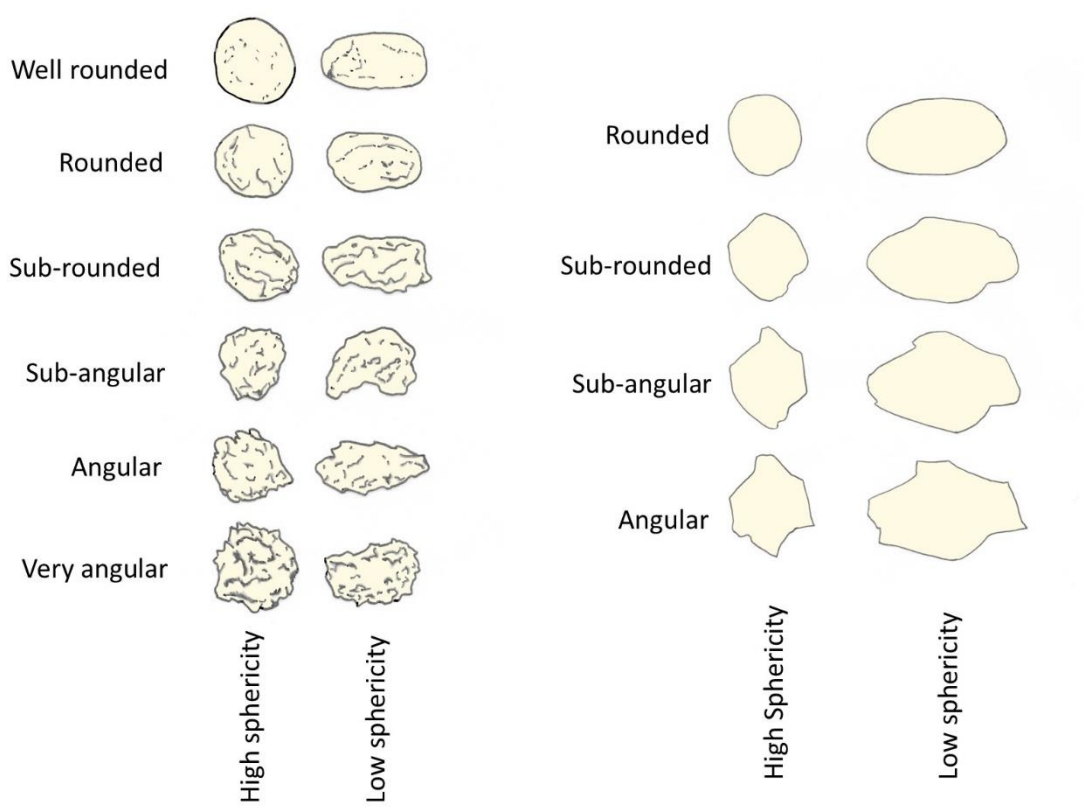

Figure 3: Diagram to categorise grain shapes.

Grain-shape may be observed using a hand lens. The surface condition of the stone and variability from grain to grain means these observations can be subjective. What we are aiming to achieve here is a sense of the shape and degree of smoothing in most of the grains. In practise categorising grains as one of rounded, sub-rounded/sub-angular or angular may be the best that can be achieved. More rigorous analysis can be carried out in thin section.

Sorting

The size of grains in a sandstone (or any clastic rock) are not necessarily all the same. In one extreme, glacial till has a mixture of clasts from boulder size down to clay size. At the other extreme, some aeolian sandstones have grains which are all similar in size. The amount of variation in grain size is referred to as the degree of sorting. Sorting is another useful way of categorising sandstones and may be observed in the field with a hand lens. The same caveats as with shape and size apply here, and rigorous analysis requires thin section work.

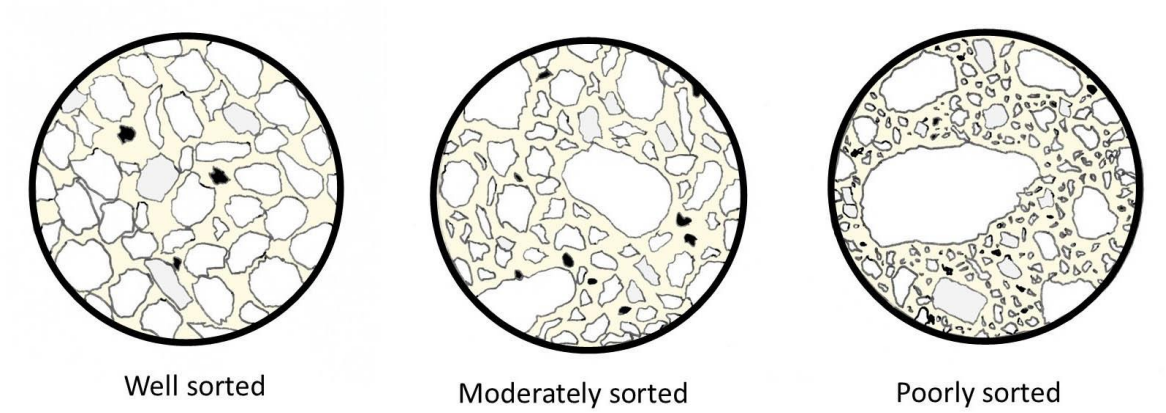

Figure 4: Diagram illustrating degrees of sorting in clastic rocks.

Well sorted sandstone will have almost all grains of roughly equal size and typically of the same mineral. Moderately sorted sandstone will have a range of grain sizes and mineralogical types clustered around a median grain size. Poorly sorted sandstones have a significantly diverse range of grain sizes and mineral types.