Fact sheet 1

Rock characterisation

The scientific characterization of the rocks that have been the subject to quarrying is important for connecting a stone resource with its place of consumption (rock provenance), and as a tool for understanding selection criteria and technology in ancient quarrying activities. The first step is the simple, visual inspection of the rocks (macroscopic examination) and classification of it. In many cases, rocks employed have unique and recognisable features (minerals, structure and colour) visible to the eye that are sufficient to determine provenance. In other cases, combinations of more sophisticated methods are needed, depending on the rock type in question and the nature and size of available samples (see below). In addition to finding provenance, the investigation of mineral composition, texture and physical properties may provide important input to the interpretation of the quality of the stone for specific purposes, being tools or sculptures.

Simplified classification scheme for rocks

Main class	Subclass	Examples
Igneous rocks	Volcanic (Extrusive)	Basalt, Dacite, Andesite, Rhyolite, Trachyte, Latite, Obsidian
	Pyroclastic (Extrusive)	Tuff, Ignimbrite, Agglomerate, Lapilli, Pumice
	Plutonic (Intrusive)	Gabbro, Diorite, Anorthosite, Granite, Granodiorite, Syenite, Tonalite, Monzonite, Aplite, Pegmatite, Peridotite
	Dyke (Intrusive)	Diabase (UK), Dolerite (US)
Metamorphic rocks	Thermal	Hornfels
	Dynamothermal	Slate, Schist, Phyllite, Marble, Quartzite, Gneiss, Amphibolite, Serpentinite, Greenschist
Sedimentary rocks	Clastic	Claystone/mudstone, Siltstone, Sandstone, Conglomerate, breccia
	Carbonates	Limestone, Dolostone/dolomite, Travertine, Tufa
	Chemical and biochemical	Gypsum, Chert, Jasper, Phosphates
Fault rocks	Brittle	Fault breccias, Cataclastite
	Ductile	Mylonite, Phyllonite

Examples of methods for establishing rock provenance

METHOD	TYPE OF ANALYSIS	PARTICULARLY USEFUL FOR	COMMENTS
Mesoscopic examination	Structure (sedimentary, igneous, metamorphic	All rocks	Many rocks can be distinguished on mesoscopic features alone
	Colour, weathering		
	Minerals and grain size		
	Fossils	Limestone, mudstone, sandstone	Fossils can be diagnostic to certain beds/layers in rock units
Microscopic examination (thin section)	Mineral content	Igneous and metamorphic rocks	Quantitative mineralogy useful for certain groups of igneous rocks. Diagnostic minerals can be highly important for metamorphic rocks
	Mineral fabric	Igneous and metamorphic rocks	Microfabrics can In rare cases be unique
	Microstructures	Igneous and metamorphic rocks	
	Microfossils	Limestone, mudstone	Can allow very detailed identification of strata, also within deposits
Whole rock geochemistry	XRF main and trace elements	Igneous and metamorphic rocks	
	ICP-MS Rare earth elements	Igneous and metamorphic rocks	Particularly for igneous and metamorphic igneous rocks
Mineral geochemistry	SEM/Microprobe	Igneous and metamorphic rocks	For minerals which commonly display large variations in chemistry
Cathode luminescence		Limestone, marble, quartzite, sandstone	Can identify growth generations, recrystallisation patterns and source of quartz grains
Isotopes	d13C/d18O (Sr)	Limestone and marble	Can in some cases give unique signatures
	Sr-Nd	Mafic and ultramafic igneous rocks	Particularly useful for intermediate to mafic volcanic rocks
Radiometric dating	Zirkon U-Pb	Igneous rocks	Can give accurate dating of the rock
	Ar-Ar	Micaceous rocks (metamorphic)	Can give cooling age of mica in metamorphic rocks
Petrophysics	Magnetic susceptibility	Igneous rocks	In rare cases can be diagnostic
	Palaeomagnetism	Igneous rocks	Rocks can be linked to geological provinces by palaeomagnetism (indirect dating)
Physical properties	Various mechanical tests	Particular cases	