Ancient Mediterranean polychrome stones

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The Romans, like the Egyptians and much more than the Greeks, used polychrome stones for decorative purposes in architectural elements, floor and wall facings and statuary. Throughout their Mediterranean provinces they systematically searched for and exploited a very large number of beautiful lithotypes, many of which they distributed to all corners of their empire. The most important of these stones were often re-used later in medieval-to-modern times; some of them are still offered on the market. They include granitoid rocks (granites, granodiorites/tonalities, gabbros, quartz-monzonites), a few lavas, many metamorphites (impure marbles, metabreccias and metandesites) and several sedimentary rocks (limestones, lumachellas, conglomerates, calcareous alabasters/travertines). The 40 most important and widespread of these lithotypes are considered here as regards their origin, the history of their use and their minero-petrographic characteristics, which can contribute to better knowledge of single species, to determination of the original quarries and to archaeometric solutions of several provenance problems.

1. Introduction

Anyone travelling along the coasts of the Mediterranean Sea or in the interior of many countries belonging in antiquity to the Roman Empire (which included non-Mediterranean areas such as Britannia, the Atlantic coasts of Iberia and Gallia, and central Europe), will often come across beautiful coloured stones in monuments of the Roman or later periods. The use of such stones started at the end of the Republic when the Romans conquered Greece and Carthage, and inherited the kingdom of Pergamum in Asia Minor; they thus became acquainted with the famous marble monuments of the most important towns of Macedonia, Attica and Peloponnesus, and they first discovered the decoration of the Hellenistic palaces with coloured stones. It was, however, under Augustus (27 BC–14 AD) that the stones were imported on a large scale, so that the appearance of Rome changed considerably: we know from Suetonius that Augustus was very proud to have received (from Julius Caesar) a city made of bricks and tufa, and to have left it built of marble. This goal became possible especially after the conquest of Alexandria and Egypt (30 BC) and the consequent access to the very numerous Pharaonic and Ptolemaic stone-quarries of the Eastern Desert and of the Aswan area (Gnoli, 1988). The expansion of the empire, often called the ‘Romanisation’ of the
Mediterranean during the *pax romana*, and later on, saw the start of the parallel phenomenon of ‘marbleing’ of Roman towns, first of all in public buildings such as the forum and basilica, the theatre and amphitheatre, the *macella* and temples, etc., which were the subjects of the evergetism of emperors and of rich benefactors. Beautiful coloured stones were imported, often from distant and impenetrable parts of the ancient world, to serve as an expression of imperial *munificentia* and *propaganda* (Pensabene, 2014). This phenomenon was soon accompanied by the use of precious and exotic stones by wealthy private individuals, who employed marble as a status symbol of their success and power: floors and walls faced with thin slabs of coloured stones, called *opera sectilia*, were far more expensive than mosaics, and proudly exhibited to friends and visitors. The demand for beautiful stones from the most exotic places in the empire increased considerably amongst the ruling classes, and became a substantial source of income for the emperors who owned the most important quarries, such as those of the red porphyry and the granites of Aswan and *Mons Claudianus* (Gebel Fatira) in Egypt, of the breccias of Chios and Larisa, as well as of the *cipollino verde*, in Greece, and of *africano* in Asia Minor. Starting from the 1st century AD, efficient exploitation-production of blocks, columns, pillars, and other semi-finished artefacts in the largest quarries was followed by a sophisticated transport and distribution organisation allowing big columns to cover very long distances, e.g. from Aswan in Egypt to Italica, near Seville, in Spain. The most important quarries (*officinae, metalla*) like those of red porphyry, of the granite of *Mons Claudianus*, and of *marmor carystium, chium, luculleum, numidicum* and *phrygium*, were imperial property (*patrimonium caesaris*). They were well organised into sectors (*bracchia, loci*), and these into cuts (*caesurae*), so as to be able to identify the provenance of a block with precision. Other quarries were owned by municipalities, or by private individuals. In each case there was a person with overall responsibility (*procurator montium*), usually a freed slave (*libertus*) with experience in the rational exploitation of stones, and a technician (*machinarius*) for the most difficult task, the moving of blocks and large monoliths in the quarry and for shipment. Slaves (*damnati ad metalla*) or paid workers (*lapicidae*) did the hard work of cutting and the initial shaping of artefacts in the quarry. In most cases transport took place on carriages drawn by oxen or donkeys as far as the nearest harbour, where ships (*naves onerariae*), often purpose-built to carry single monoliths, transported their cargoes of marble to the various Mediterranean destinations. When not covered by a specific order, the marble was stockpiled in great store-yards (*stationes marmorum*) like those of Ostia (Italy), Alexandria (Egypt), Nicomedia and Miletus (Izmit and Balat, Turkey, respectively), which operated as distribution centres for the empire (Lazzarini, 2002c, 2007; Pensabene, 2014).

As a consequence of this efficient organisation, we know that the majority of the most prestigious and expensive coloured stones (those listed in Diocletian’s Edict on maximum prices of 301, Gnoli, 1988: the green and red porphyries, the *cipollino verde*, the *africano*, the *giallo and rosso antico*, etc.) are almost ubiquitous in Roman towns, at least as small slabs (Lazzarini, 2007, 2009): when not present, we often find them imitated by fresco paintings or replaced by similar local stones.
From the very beginning the use of polychrome stones was limited mostly to small, irregular slabs inserted into mosaic floors called *scutulata pavimenta*. Later on, larger slabs of geometrical shapes were joined together for facing floors and walls, and architectural elements such as capitals and columns were introduced in public and private buildings. The use of polychrome marbles was then extended, especially from the 2nd century AD on, to statuary, tubs and furniture.

Towards the end of the Roman empire, with the implosion of its organisation including the ‘logistics’ of the marble market, and under the pressure of barbarian invasions, many quarries were abandoned, sometimes also because of the excessive quantity of stone accumulated at several *stationes marmororum*, and because of the reuse of marble pieces formerly installed in ruined buildings, a practice that was already underway in the 3rd century. Such reuse became almost the rule in the western Middle Ages, and lasted for centuries, often until modern times: Roman monuments were spoliated and new buildings, such as Christian churches, erected and/or decorated using ancient columns, capitals and other elements, often re-cut and reworked. The same phenomenon occurred in the East, in some instances, especially in Early Byzantine times, with the addition of new coloured lithotypes. In both cases the reuse of ancient marbles led to their further spread and distribution, so that we now find typical Roman polychrome stones almost everywhere in the Mediterranean area, in archaeological sites as well as in churches, mosques, castles and palaces: hence the importance of the determination of their original quarries. Such a determination may give immediate information on the provenance and economic value of an artefact (a statue or a part of a monument); it may help in reconstructing ancient commercial traffic and trade routes (the identification of marbles forming part of sunken cargoes enables ancient routes to be reconstructed quite precisely); the location of the quarry from which a damaged marble came makes it possible to find sound material for the purpose of replacement, restoration, copies, etc. Dated artefacts and monuments, in turn, may help in fixing the interval of use of a certain quarry and related stone. The precise identification of the provenance of white and coloured marbles used in antiquity remains an issue of fundamental interest for archaeologists, architects and art historians, and continues to engage scientists of various disciplines, but especially of Earth sciences.

The identification of coloured stones is, in general, much easier than that of white marbles (Lazzarini, 2004) because for most of them it may be determined through what we may call a ‘visual connoisseurship’, which can be acquired after systematic visits to ancient quarries (where one can observe the colour and texture variation of a specific stone), studies of ancient stones in monuments, museums and archaeological areas, as well as in historical lithological collections (Mielsch, 1985; Price, 2007). Once a possible area of origin of an unknown stone is determined, local inquiries with regional geologists and people working in marble factories may prove extremely useful, as can observation of the stone used in modern buildings as, very often, ancient materials have been re-exploited in modern times. This integrated provenancing method (Lazzarini, 2002a) has been applied successfully in the identification of several hitherto unknown ancient quarries (*e.g.* the granite from Mysia, and various breccias). When this method
fails, then a much more time-consuming and not always successful methodology is applied, starting from a scientific approach with laboratory analyses. Ultimately, the establishment of a reference database is of fundamental importance. This is now, in large part, available thanks to the numerous specialist studies performed over the last 40 years, although its development is not comparable with the much more detailed database established for white, pure, marbles (Antonelli and Lazzarini, 2016). A database is also a pre-requisite for solution of the most difficult identification problems deriving from macroscopically very similar coloured lithotypes.

2. The archaeometric problems of polychrome stones

As cited above, the positive identification of several coloured stones that look alike macroscopically may be reached only with an archaeometric approach. It is worth mentioning here the problems related to some of the lithotypes considered here: first of all the magmatites, then the impure marbles, some breccias and finally the calcite alabasters:

- the pinkish variety of the Aswan granite may (to some extent) be confused with the granito sardo (Sardinian granite) and the Egyptian granite from Fawakhir/Wadi el-Sid (Gnoli, 1988; Brown and Harrell, 1995; Klemm and Klemm, 1991, 2008): a distinction may be based on the K/Rb and Ba/Zr ratios (Galetti et al., 1992);
- the grey tonalite of Mons Claudianus (granito del foro) is macroscopically identical to the granite from Nicotera (province of Cosenza, Italy) used in Roman times in central and southern Italy for columns and pillars, probably as a substitute for the more famous (and expensive) Egyptian counterpart. The macroscopic distinction of these two lithotypes is very difficult, and identification should be based on the petrographic analysis of a thin section: the two-mica granite from Nicotera is quite distinct from the classical one-mica (biotite) tonalite of Gebel Fatira (Antonelli et al., 2010);
- the granito elbano (Elba granite) is very similar to the Mysian granite: a first differentiation may be based on the presence of large (centimetric) white plagioclase megacrysts in the former, and on that of small (millimetric) hornblende prismatic crystals in the latter: both may be detected by an expert naked eye (or with a magnifying lens in the case of hornblende). A more reliable identification, however, may be based on the presence of traces of muscovite and tourmaline in the Elba granite, both of which are missing from the Mysian granite, and on the larger Rb, Zr and smaller Ba and Sr contents of the former with respect to the latter (De Vecchi et al., 2000);
- the quartz-monzonite from ancient Troas (marmor troadense) is very similar to a quartz-monzonite from Corsica. Although used only in the Renaissance (by the Medici family), and thus posing no problems of
confusion with ancient Roman usage, the latter can be distinguished by its coarser crystals (megacrysts of 2–4 cm) of grey-violet K-feldspar;

- the exact determination of the original quarry of sarcophagi made of *lapis sarcophagus* is of considerable importance because they could have been made at Assos (now Behramkale, province of Ayvakkı, Turkey), in the nearby island of Lesbos, or in the further away town of Pergamum (now Bergama). Petrography and geochemistry combined may solve provenancing problems using an existing reference database (Lazzarini and Visonà, 2009);

- it is very difficult to separate the uniformly red variety of *rosso antico* quarried in the Mani peninsula (Greece) from the equivalent variety of *cipollino rosso* exploited near ancient Iasos in Turkey. Differentiation criteria are grain size (a little bit larger for the latter) and Fe/Ni ratio (Gorgoni *et al.*, 2002). It is worth mentioning the existence on the island of Rhodes (Greece) of a red limestone which is macroscopically very similar to both marbles [*rosso antico* and *cipollino rosso*], and which is also used for statuary and architectural elements from Hellenistic to Roman times (Herrmann, 1988): differentiation is possible, again by the microscopic examination of thin sections;

- the separation of the *cipollino verde euboico* of the district of Karystos from that of Styra, and of these *cipollini* from that of Mani (*cipollino verde tenario*) may be achieved from the analysis of their stable C and O isotope ratios (Lazzarini, 2007);

- it is often difficult (especially in small artefacts) to distinguish between some varieties of the *breccia di settebasi* (quarried in the Island of Skyros, Greece) from the *breccia medicea* of the Apuan Alps (Tuscany, Italy), a stone which is sometimes used as a substitute for it: the presence of chloritoid, easily determined in thin section, is indicative of an Italian origin for the artefact in question (Lazzarini, 2007);

- the difference between the very common *verde antico* (*marmor thessalicum*) and *verde di Tinos* (Tinos green), which was much more rarely used in Roman times, may be based on the brecciated fabric and presence of white marble clasts in the former, lacking in the latter (Lazzarini, 2007; Melfos, 2008);

- the distinction of the *giallo antico brecciato* from the *breccia dorata* (originating in the Montagnola Senese, Italy: Bruno and Lazzarini, 1999) may be achieved through a petrographic study: the former is made up of clasts of micrite/microsparite and frequently contains plagioclase among the accessory minerals; the latter are composed of clasts of slightly recrystallized calcite belonging to a low-metamorphic-grade marble, without plagioclase;
the identification of the many calcite alabasters used by the Romans, mostly at a regional level, and their differentiation from the common Egyptian alabaster remains unresolved: the best contribution towards the solution of this problem at present is obtained from the determination of the $^{87}\text{Sr}/^{86}\text{Sr}$ ratio (Barbieri et al., 2002; Lazzarini and Çolak, 2002; Lazzarini et al., 2006, 2012).

3. The coloured stone catalogue

The present chapter is intended to make a general contribution towards the establishment of a basic database of the most important coloured stones introduced by the Romans for building and/or decorating public and private buildings through an overview of the provenance, periods and typologies of use together with an essential minero-petrographic characterization. Those considered here are the really ‘international’ lithotypes that travelled in antiquity from their home country, often to reach most (if not all) of the provinces of the Roman Empire. Given the considerable number of stone species that were distributed widely by the Romans, a choice has been made of the 40 most commonly used lithotypes. They have been grouped according to their petrographic nature into the three great classes of magmatites (granitoids and lavas), metamorphites (excluding the white and grey, pure crystalline marbles) and sedimentary rocks (breccias, limestones, lumachellas, alabasters/travertines). Note that several other ‘international’ stones were used by the Romans, the origin of many of which, especially of breccias and alabasters, remains unknown.

For each of the stone species considered here are given:

- a photograph of the holotype showing the typical colour and texture of the rock (in a few cases, when it features considerable macroscopic variation, more than one specimen is shown): this photo is sufficient in most cases to allow the identification of coloured lithotypes used in Mediterranean antiquity in Roman or later monuments.
- the Latin name of the stone (when known from ancient sources)
- a photomicrograph of a thin section of the holotype. This photomicrograph taken between crossed polars at different magnifications (according to the grain-size of the rock) may be of considerable help in confirming the macroscopic identification of stones of uncertain provenance
- two definitions, one with known ancient and modern synonyms of the stone (some of these are quite old Italian names, traditionally used since the Early Renaissance and still employed internationally by archaeologists and art historians), the location of its quarries (also located on a map, see Figs 1 and 2), the period and typology of use (the latter referred only to antiquity), the distribution in the ancient world (only through bibliographical references), an indication of the frequency of ancient use (according to the experience and direct
Figure 1. Geographic location of the quarries of magmatic extrusive (red) and intrusive (blue) rocks reported in the catalogue.

Figure 2. As for Fig.1, but for sedimentary (red) and metamorphic (blue) rocks.
knowledge of the present writer); and another with the geological age (when known), petrographic classification, type of macro/microtexture and grain size (fine = up to 2 mm; medium = 2–5 mm; coarse = >5 mm), and mineralogical composition, with a semi-quantitative evaluation of the main (primary, and/or characterizing) minerals and an indication of the accessory minerals. Both definitions also record the relative important bibliographic references.

Note: where scale bars are provided, each black or white rectangle is 10 mm in the long dimension. ‘Field of view’ applies to the horizontal dimension of the image.

Acknowledgments and dedication

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Stone 1 **LAPIS PORPHYRITES**  
*LITHOS ROMAIOS, PORFIDO ROSSO ANTICO*  
*Mons porphyrites, Mons Igneus, Gebel Abu Dokhan, Eastern Desert, Egypt* (1 in Fig. 1)  
Late Ptolemaic period-mid V c. AD, then reused.  
Lazzarini (2009).  
Slabs for opera sectilia >> columns > tubs and vases > statuary >> sarcophagi  
Maxfield and Peacock (2001); Del Bufalo (2012).

Stone 2 **LAPIS HIERACITES**  
*PORFIDO VERDE EGIZIANO*  
Eastern quarries of the Gebel Abu Dokhan, Eastern Desert, Egypt (1 in Fig. 1)  
Roman Imperial period (I-II c.), then reused.  
Slabs for opera sectilia >> small columns > vases > statuary  

Stone 3 **LAPIS LACEDAEMONIUS**  
*KROKEATIS LITHOS, VERDE DI LACONIA, SERPENTINO, PORFIDO VERDE ANTICO*  
Stefanià, Krokea, Peloponneseus, Greece (2 in Fig. 1)  
Minoan-Mycenaean times; Late Republican-Late Imperial periods, then reused; Lazzarini, 2007  
Seals and vases (Min.-Myc.); Slabs of opera sectilia >> small columns and capitals >> statuary >> cuticularae  
Gnoli (1988); Lazzarini (2007).  

Proterozoic (~600 Ma)  
Weak-to-medium grade metamorphic andesite/dacite (metandesite/metadacite)  
Porphyritic, with small (mm) white/pink phenocrysts in a purplish aphanitic groundmass  
Plagioclase >> hornblende/oxyhornblende > biotite > accessories (magnetite, hematite, apatite, piemontite); the main minerals often (severely altered) into secondary minerals  
Brown and Harrell (1995); Klemm and Klemm (2008); Makovicky et al. (2016a,b).  
Field of view = 2.2 mm

Proterozoic (~600 Ma)  
Medium-grade metamorphic / metasomatic andesite/dacite  
Porphyritic, with small (mm) white phenocrysts in a green-greenish aphanitic groundmass  
hornblende and biotite, (severely altered to chlorite, epidote, iron oxides) >> accessories and secondary minerals as above  
Field of view = 1.3 mm

Mid-Triassic  
Metasomatized basaltic andesite/trachyandesite  
glomeroporphyric, with green aphanitic groundmass, often with amygdales of blush/red/brown chalcedony  
hornblende and biotite, (severely altered to chlorite, epidote, iron oxides) >> accessories ( titanite, magnetite and other iron oxides, pyrite, calcite)  
Field of view = 1.7 mm
Stone 4  
**LAPIS SARCOPHAGUS**  
Greek Archaic period—IV c. AD  
Ancient Assos (Troad), now Behramkale, Turkey (3 in Fig. 1); Lazzarini and Visonà (2009).  
Sarcophagi (also used locally as building material)  
Ward-Perkins (1992); Lazzarini (1994).

Late Miocene  
Andesite/trachyandesite  
Glomeroporphyric, medium-grained, porous, with microcrystalline/aphanitic brown groundmass  
Plagioclase >> pyroxene (clino and ortho) >> biotite >> accessories (Fe-Ti oxides, apatite)  
Lazzarini (1994); Lazzarini and Visonà (2009)  
Field of view = 4.5 mm

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Stone 5  
**GRANITO BIGIO, GRANITO A MORVIGLIONE, ESTERESELLITE**  
Saint Raphael, Boulouris, Dramont, province of Frejus, France (4 in Fig. 1); Mazeran (2004).  
II—V c. AD, then reused  
Slabs for opera sectilia >> columns  

Oligocene  
Dacite  
Porphyric/glomeroporphyric with grey microcrystalline groundmass  
Plagioclase (often zoned) >> quartz, biotite, hornblende >> accessories (apatite, titanite, Fe-oxides/hydroxides)  
Brentchaloff and Mazeran (1999); Rehault et al. (2012).  
Field of view = 2.2 mm

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Stone 6  
**LITHOS PYRRHOPOECILOS, LAPI S THEBAICUS, LAPIS SYENITES**  
SIENITE; GRANITO ROSSO EGIZIANO  
Immediate SE outskirts of the town of Aswan, Egypt (5 in Fig. 1)  
II Dynasty—V c. AD, then reused, Lazzarini (2009).  
Still quarried  
Columns and Pillars >> statuary >> obelisks >> tubs >> slabs for opera sectilia >> sarcophagi  
Gnoli (1988); Kelany et al. (2007); Klemm and Klemm (2008).

Proterozoic (~565 Ma)  
Normal-to-slightly alkaline granite to monzogranite granular, mostly inequigranular, coarse-grained; a fine-grained equigranular variety is rare, although used since pharaonic times  
K-feldspar (perthite) >> plagioclase >> quartz >> biotite >> hornblende >> accessories (Fe-ores, titanite, apatite, allanite, zircon)  
Field of view = 3.5 mm
Stone 7
DIORITE EGIZIANA, GRANITO NERO
Gebel Nagug and immediate SE outskirts of the town of Aswan, Egypt (5 in Fig. 1)
III Dynasty-III c. AD, then reused, Lazzarini (2009).
Still quarried
Statuary > columns and pillars > tubs > slabs > mortars and millstones

Proterozoic (~580 Ma)
granodiorite, passing to tonalite in the darker varieties
inequigranular, medium-to coarse-grained
Hornblende > plagioclase > biotite > K-feldspar (perthite) >> accessories (apatite, allanite, titanite, chlorite, calcite)
Kelany et al. (2007); Klemm and Klemm (2008).
Field of view = 7.0 mm

Stone 8
LAPIS OPHYTES
GRANITO VERDE DELLA SEDIA, OFITE
Wadi Umm Vikala, Eastern Desert, Egypt (6 in Fig. 1)
Pre-Early Dynastic periods; Imperial times (end of 1c. BC-III c. AD), then reused; Lazzarini (2009).
Funerary vases; slabs for opera sectilia >> tubs and vases > small columns > trapezophoroi > cuticularae
Gnoli (1988); Ashton et al. (2000)

Precambrian
Metagabbro
Equigranular, fine-grained (sedia di S.Lorenzo variety)
to inequigranular medium-grained often with pegmatitic zones (sedia di S. Pietro variety)
Plagioclase (pervasively altered to saussurite) = pyroxene (= altered augite) > hornblende (mostly chloritized) >> magnetite >>> accessories (uralite, secondary quartz)
Field of view = 1.7 mm

Stone 9
GABBRO EUFOTIDE, GRANITO VERDE PLAS-
MATO
Wadi Maghrabiya, Eastern Desert, Egypt (6 in Fig. 1)
Pre-Early Dynastic periods; Imperial times (end of 1c. BC- end of 1 c. AD)
Funerary Vases; small slabs for opera sectilia > small objects (furniture)
Gnoli (1988); Harrell et al. (1999).

Precambrian
Metagabbro
Inequigranular, medium- to coarse-grained, with pegmatitic zones
Plagioclase (labradorite), altered significantly to saussurite = pyroxene (augite), much altered to uralite and chlorite
Harrell et al. (1999),
Field of view = 2.35 mm
Stone 10 **MARMOR TIBERIANUM**  
GRANITO BIANCO E NERO  
Wadi Barud, Eastern Desert, Egypt (7 in Fig. 1)  
Pre-Early Dynastic periods; Imperial times (end of 1 c. BC- end of 1 c. AD), then reused  
Funerary vases; slabs for *opera sectilia* > columns  

**Proterozoic (~680 Ma)**  
Quartz diorite: medium-to-mainly coarse-grained (Santa Prassede variety); fine-grained (“del Cairo” variety)  
Inequigranular  
Plagioclase (oligoclase-andesine), somewhat altered = hornblende (often chloritized) >> quartz >> biotite  
>> accessories (apatite, magnetite, titanite and zircon)  
Field of view = 7.0 mm

Stone 11 **MARMOR CLAUDIANUM**  
GRANITO DEL FORO  
Mons Claudianus, Gebel Fatira (tonalite), Wadi Umm Huyut (tonalite-gneiss), Eastern Desert, Egypt (7 in Fig. 1)  
I–IV (?) c. AD, then reused; Lazzarini (2009)  
Columns >> tubs > slabs for *opera sectilia*  
Gnoli (1988); Brown and Harrell (1995); Peacock and Maxfield (1977); Harrell et al. (1999); Maxfield and Peacock (2001); Klemm and Klemm (2008).

**Proterozoic (~680 Ma)**  
Tonalite/tonalite-gneiss  
Inequigranular, with clamps of intergrown hornblende and biotite; fine-to-medium grain size  
Plagioclase (oligoclase) >> quartz >> hornblende > biotite>> K-feldspar (microcline) >> accessories (apatite, magnetite, titanite and zircon)  
Brown and Harrell (1995); Harrell et al. (1999); Klemm and Klemm (2008).  
Field of view = 3.5 mm

Stone 12 **GRANITO DELLA COLONNA**  
Wadi Umm Shegilat, Eastern Desert, Egypt (8 in Fig. 1)  
Pre-Early Dynastic periods; I–II c. AD, then reused  
Funerary vases; Columns >> trapezoforoi > slabs for *opera sectilia*  

**Proterozoic**  
Pegmatitic diorite-to-gabbro  
Inequigranular, very coarse grain size  
Plagioclase, strongly altered to clay and sericite > hornblende, altered severely to chlorite (clinochlore) and iron oxides >> magnetite  
Field of view = 3.5 mm
Stone 13
GRANITO VERDE FIORITO DI BIGIO
Wadi Umm Balad, Eastern Desert, Egypt (8 in Fig. 1)
Pre-Early Dynastic; I–II c. AD, then reused
Funerary vases; slabs for opera sectilia > columns > tubs and vases

Proterozoic
Quartz diorite
Equigranular, homogeneous fine grain size
Plagioclase (oligoclase-andesine), moderately altered into clay, sericite, epidote and calcite >> biotite, often altered severely to chlorite and iron oxides >> quartz >> accessories (apatite, magnetite, titanite and zircon)
Field of view = 3.5 mm

Stone 14
MARMO MISIO, GRANITO MISIO
Kozak Dağ, province of Bergama, Turkey (9 in Fig. 1)
II–VI (?’) c. AD, then reused; Lazzarini (2009).
Columns >> slabs for opera sectilia > sarcophagi

Early–Middle Miocene
Amphibolic granite/granodiorite
Equigranular, with fine and homogeneous grain size
Plagioclase > K-feldspar > quartz > biotite >> hornblende >> accessories (magnetite, zircon, allanite, titanite)
De Vecchi et al. (2000).
Field of view = 3.5 mm

Stone 15 MARMOR TROADENSE
GRANITO VIOLETTRO
Çğri Dağ, province of Ezine, Turkey (10 in Fig. 1)
II–VI c. AD, then reused; Lazzarini (2009).
Columns >>> pillars > slabs for opera sectilia

Miocene (~21 Ma)
Quartz-monzonite
Inequigranular, medium grain size, often with
K-feldspar megacrysts (2–4 cm)
K-feldspar = plagioclase > hornblende = quartz >> biotite >> accessories (apatite, magnetite, titanite, epidote, chlorite)
Lazzarini (1987); Birkle and Satir (1994).
Field of view = 1.7 mm
Stone 16
GRANITELLO, GRANITO ELBANO
Seccheto, Cavoli, ecc. Southern area of Monte Capanne, Elba Island (Italy) (11 in Fig. 1)
Late Augustan Age–Late Middle Ages, often reused; Lazzarini (2009). Still quarried
Columns >>> slabs for opera sectilia > tubs

Stone 17
GRANITO SARDO
Capo Testa, Marmorata, Bocche di Bonifacio (San Bainzo), N Sardinia, Italy (12 in Fig. 1)
II–IV c. AD, then reused; Lazzarini, 2009. Still quarried
Columns > pillars >> slabs for opera sectilia > tubs

Stone 18 LAPIS HEXAKONTALITHON, LAPIS HEXAKONTALITHON
CENTOPIETRE, BRECCIA VERDE EGIZIANA
Mons Basanites, Wadi Hammamat, Eastern Desert, Egypt (13 in Fig. 2)
Early Dynastic; New Kingdom; Late Augustan Age-IV c. AD (?), then reused
Sarcophagi, vases; columns > slabs for opera sectilia
Gnoli (1988); Harrell et al. (2002); Klemm and Klemm (2008).

Late Miocene
Granodiorite
Equigranular, fine grain size, often with single large white, euhedral, plagioclase crystals (porphyroblasts); plagioclase (oligoclasic/andesinic) > quartz > K-feldspar, biotite >> accessories (apatite, titanite, zircon, chlorite, tourmaline, muscovite)
Marinelli (1965); De Vecchi et al. (2000).
Field of view = 3.5 mm

Late Carboniferous–Permian
Monzogranite
Inequigranular, medium- to coarse-grain size
K-feldspar > plagioclase > quartz> biotite >> accessories (apatite, titanite, zircon, chlorite, Fe oxides)
Maccioni et al. (1968).
Field of view = 3.5 mm

Late Precambrian
Polymictic metaconglomerate
Clastic, with pebble-to-cobble size (3–30 cm across), often inbricicated and isoriented
Volcanic/metavolcanic rocks (tuffs, lavas, mostly sialic) >> sedimentary rocks (greywackes, siltstones, rare chert and limestones) = plutonites (felsic granitoids, rare tonalities and diorites) >> metamorphites (serpentinites) and quartz
Willis et al. (1988); Hassan and Hashad (1990); Harrell et al. (2002).
Field of view = 1.7 mm
**Stone 19** BEKHEN, LAPIS BASANITES
BASANITE
Mons Basanites, Wadi Hammamat, Eastern Desert, Egypt (13 in Fig. 2)
Pre-Dynastic – 1 c. AD
Small objects (palettes, scarabs, etc.); statuary (portraits)
Lucas and Rowe (1938); Andrew (1939); Gnoli (1988).

**Late Precambrian**
Greywacke/metagreywacke-to-siltstone
Arenaceous, laminated; siltitic
Metagraywacke = quartz in a calcite-sericite-chlorite-epidote matrix, with tourmaline and zircon as accessories;
Siltstone = quartz, in an intergrown sericite-chlorite-calcite matrix, with epidote and zircon as accessories
Willis *et al.* (1988); Hassan and Hashad (1990); Klemm and Klemm (2008).
Field of view = 0.9 mm

**Stone 20** MARMOR CARIUM, MARMOR LASSENSE
CIPOLLINO ROSSO, AFRICANONE, veined variety (right), brecciated variety (left)
Kiykislaci (ancient Iasos), province of Mula, Turkey (14 in Fig. 2)
II c. BC; III c.–Early Byzantine period, then reused;
Lazzarini (2009).
Slabs for *opera sectilia* > columns > table tops
Gnoli (1988); Andreoli *et al.* (2002).

**Cretaceous (Campanian-Maastrichtian)**
Hematite-marble/metabreccia, with white/grey veins/clast in a matrix coloured red by hematite
granoblastic-heteroblastic, elastic, fine-to-medium grain size
calcite >>> hematite > quartz, plagioclase > muscovite, chlorite
Gorgoni *et al.* (2002).
Field of view = 1.7 mm

**Stone 21** MARMOR TAENARIUM RUBRUM
ROSSO ANTICO
Prophylis Elias, Pagania, Lághia, Kokkinogchia, Mianes, etc., Mani peninsula, Peloponnesus, Greece (15 in Fig. 2)
Middle Minoan–Mycenaean period; Late II c. BC–Late Roman Empire, then reused; end of XIX c.–~1960;
Lazzarini (2007).
Slabs for *opera sectilia* > cornices > statuary > columns > table tops > vases and tubs
Gnoli (1988); Lazzarini (2007).

**Senonian–Priabonian**
Impure marble coloured red by hematite
granoblastic-heteroblastic with fine grain size
calcite >>> hematite > quartz, plagioclase (albitic) > muscovite, chlorite > accessories (Fe hydroxides, apatite, epidote, piemontite)
Calogero *et al.* (2000); Lazzarini (2007).
Field of view = 0.9 mm

Natural polychrome stones used in Mediterranean antiquity
Stone 22 *MARMOR CARYSTIUM, MARMOR STYRIUM*
CIPOLLINO VERDE EUBOICO, CIPOLLINO BIGIO EUBOICO
Styra-Karystos, southern-western Eubea, Greece (16 in Fig. 2)
Late II c. BC–Middle Byzantine period, then reused; end of XIX c. to date; Lazzarini (2007).
Columns > slabs for *opera sectilia* >> tubs > statuary
Gnoli (1988); Lazzarini (2007).

Stone 23 *BRECCIA DI SETTEBASI, SEMESANTO* (variety with mm clasts)
Aghios Panteleimon, Valaxa, Treis Boukes, Koprissies (also for semesanto), Skyros Island (Greece) (17 in Fig. 2)
Late I c. BC–IV c. AD, then reused; end of XIX c. to date; Lazzarini (2009).
Slabs for *opera sectilia* >> columns > tubs > statuary
Gnoli (1988); Lazzarini (2007).

Stone 24 *MARMOR LUCULLAENUM AFRICANO*
Sigacik (ancient Teos), province of Izmir, Turkey (18 in Fig. 2)
Early I c. BC–Late II c. AD, then reused; Lazzarini (2009).
Slabs for *opera sectilia* >> columns >> tubs > statuary
Stone 25 *Marmor Thessalicum, Lapis Atracius*

Verde Antico
Mount Mopsion, Chasabali, province of Larisa, Greece
(19 in Fig. 2)
Beginning of the II c. AD–Middle (?) Byzantine period;
Columns > Slabs for opera sectilia >> tubs and vases >
Statuary
Gnoli (1988); Lazzarini (2007).

Stone 26 *Marmor Chalcidicum*

Fior Di Pesco
Eretria, Island of Eubea, Greece (20 in Fig. 2)
III–I c. BC (local); I–IV (?) c. AD, then reused
especially in the Baroque period; 1950 to date
Slabs for opera sectilia >> columns > tubs >
Trapezophoroi, sculptures
Lazzarini (2007); Russell and Farchard (2012).

Stone 27 *Lapis Knekites?*

BRECCIA ROSSA E GIALLA
Wadi Imu and Wadi Abu Gelbana, province of Sohag,
East Bank, Egypt (21 in Fig. 2)
Pre-Dynastic–Early Dynastic; I–II c. AD ?, then reused.
Funerary vases and other small objects; sarcophagi and
tubs, slabs for opera sectilia
Klemm and Klemm (2008); Lazzarini (2002b).

Late Triassic
Ophycalcite breccia
Clastic, with mm–dm angular to subrounded clasts of
dark green antigorite/antigoritic serpentine and white
marble in a mixed antigorite-calcite matrix
Antigorite > calcite >> magnetite >> accessories (Fe
oxides/hydroxides, chromite, tremolite, asbestos, chlorite,
talc, epidote, millerite)
Lazzarini (2007); Melfos (2008).
Field of view = 1.7 mm

Trias
Cataclastic limestone, slightly metamorphosed
Cataclastic, with many recrystallized areas and cavities
of stromatolite type
Mudstones (with rare fossils: ammonoids, corals,
filaments)>blastic calcite areas;micrite >> accessories
(hematite, sericite, chlorite, quartz, plagioclase,
K-feldspar, zircon)
Lazzarini (2007).
Field of view = 4.5 mm

Late Miocene?
Polygenic carbonatic breccia
Clastic, mm-cm subangular to subrounded pale-yellow/
yellow and grey clasts
Mudstone to packstone clasts, composed of microsparite
in a micritic-clayey cement with peloids containing rare
reworked microfossils and detrital quartz, coloured by
Fe hydroxides/oxides
Field of view = 2.35 mm

Natural polychrome stones used in Mediterranean antiquity
Stone 28 **MARMOR SAGARIUM**
BRECCIA CORALLINA, BRECCIA NUVOLATA, BROCCATELLONE (variety)
Vezirhan, province of Bilecik; Balikliova, Toprak Alimmis, Karga and Azmak Tepe, Karaburun Peninsula, Turkey (22, 23 in Fig. 2)
Late I c., BC–V (?) c. AD, then reused; newly quarried from 1980 to date; Lazzarini (2009).
Slabs for opera sectilia >> columns > tubs > statuary
Gnoli (1988); Lazzarini (2002c); Bruno et al. (2012).
Cretaceous
Monogenic carbonatic breccia
Clastic, with angular to subangular cm–dm clasts
mudstone sometimes with peloids; micrite >> accessories (quartz, muscovite, hematite, Fe hydroxides)
Lazzarini (2002c).
Field of view = 2.2 mm

Stone 29 **MARMOR CHIUM**
PORTASANTA
Latomi, Chios town, Island of Chios, Greece (23 in Fig. 2)
IV c. BC–XI c. AD (with interruptions in the Late Antiquity–Early Byzantine periods), then reused;
Lazzarini (2007).
Slabs for opera sectilia >> columns > tubs > bases > statuary
Lazzarini (2007).
Early–Middle Trias
Tectonic carbonatic breccia, mono/digenic
Clastic, with cm–dm angular/subangular clasts, with small amounts of matrix and veins of secondary calcite
mudstones (sometimes with filaments) >> grainstone
(often with peloids and rare bioclasts) >> dolostone; micrite >> dolomite >> accessories (quartz, plagioclase,
muscovite/illite, chlorite, hematite)
Lazzarini (2007).
Field of view = 1.7 mm

Stone 30 **BRECCIA DI ALEPPO**
Kariés, province of Chios (town), Island of Chios,
Greece (23 in Fig. 2)
Late I c. BC–Late I c. AD, then reused
Slabs for opera sectilia > columns > trapezophoroi, stelae, statuary
Lazzarini (2007).
Early–Middle Trias
Multicoloured polygenic breccia
Clastic, with cm–dm grey, red, yellow angular to subrounded clasts, sometimes fossiliferous (ammonoids, corals, etc.), in a grey/red cement
mudstones >> bufflestones; micrite >>> accessories (quartz, sericite, Fe oxides/hydroxides)
Lazzarini (2007).
Field of view = 2.2 mm
Stone 31  
**MARMOR CELTICUM**  
MARMO DI AQUITANIA, BIANCO E NERO ANTICO, GRAND ANTIQUE  
Aubert, Cap de la Bouiche, Pyrenees, France (24 in Fig. 2)  
III AD–Protobyzantine period, then reused; 1844–1940; Lazzarini (2009).  
Slabs for opera sectilia >> columns  
Lazzarini (2005).

**Early Cretaceous**  
Tectonic, carbonatic breccia  
Clastic, formed by black mm–dm angular clasts of a black carbonaceous limestone in a white sparitic cement mudstone/wackestone with abundant microforams, rare bivalves and brachiopods >> dolostone; micrite >> dolomite >> accessories (carbonaceous matter, Fe hydroxides)  
Lazzarini (2005).  
Field of view = 0.05 mm

Stone 32  
**MARMOR NUMIDICUM**  
GIALLO ANTICO  
Djebel Chemtou, Chemtou (ancient Simitthus), Tunisia (25 in Fig. 2)  
II c. BC–IV c. AD, then reused XX c.; Lazzarini (2009).  
Slabs for opera sectilia >>> columns > statuary > tubs and vases  

**Jurassic**  
Limestone/carbonatic breccia  
More or less clastic with yellow, pink angular to subrounded clasts in a yellow/brown/red cement Mudstone/sparstone with micrite >> sparite >> accessories (Fe oxides/hydroxides, plagioclase, quartz, illite/ muscovite)  
Zagrami et al. (2000).  
Field of view = 1.7 mm

Stone 33  
**LAPIS NIGER**  
BIGIO MORATO (variety of NERO ANTICO)  
Djebel Aziz, province of Tunis, Tunisia (26 in Fig. 2)  
I c. BC–V (?) c. AD, then reused; 1980 to date  
Slabs for opera sectilia > statuary  
Gnoli (1988); Lazzarini et al. (2007).

**Early Trias**  
Carbonaceous limestone  
Oolitic/ooid crystalline, grain supported, with abundant veins of sparitic calcite grainstone, locally passing to packstone with ooids/ooliths in a micritic/orthosparitic cement, with rare, much reworked microfossils and abundant carbonaceous matter  
Agus et al. (2007).  
Field of view = 1.7 mm
Stone 34
CIPOLLINO MANDOLATO, GRIOTTE, MARBRE CAMPAN
Campan (Haute-Adour), Pont de la Taule (Coufles, Seix), Pyrenees, France (27 in Fig. 2)
Late I–V c. AD; XIX c. to date; Lazzarini (2009).
Slabs for opera sectilia >> small columns
Antonelli and Lazzarini (2000); Antonelli (2002).

Late Devonian (Famennian)
Nodular limestone, with rarely preserved macrofossils
(Goniatites sp.)
Microsparitic nodules in a clayey-micritic matrix coloured green by chlorite, or red by hematite
Sparite >> K-mica/illite, chlorite >> accessories
(quartz, plagioclase, titanite, pyrite, Fe oxides)
Antonelli and Lazzarini (2000); Antonelli (2002).
Field of view = 1.1 mm

Stone 35 MARMOR TRIPONTICUM
OCCHIO DI PAVONE
Kutluca, province of Izmit, Turkey (28 in Fig. 2)
III–VII c. AD, then reused; 1950–90; Lazzarini (2009).
Slabs for opera sectilia >> columns >> tubs and vases >> sarcophagi
Gnoli (1988); Lazzarini (2002c).

Cretaceous
Fossiliferous (Rudists) limestone (lumachella)
Biolastic
Micrite >> sparite >>> (hematite, Fe hydroxides, quartz)
Lazzarini (2002c).
Field of view = 2.2 mm

Stone 36
LUMACHELLA ORIENTALE, LUMACHELLA D’EGITTO, PIETRA PIDOCCHIOSA
Djebel Oust, province of Tunis (29 in Fig. 2)
Late I c. BC–III c. AD, then reused
Slabs for opera sectilia and tabletops >> statuary >> tubs
Gnoli (1988); Lazzarini and Mariottini (2012).

Late Jurassic / Early Cretaceous
Fossiliferous (Rudists, Bivalves, Foraminifera) limestone
Biolastic
Micrite >> microsparite >>> quartz >> accessories
(glauconite, Fe hydroxides/oxides)
Lazzarini and Mariottini (2012).
Field of view = 1.7 mm
Stone 37
BROCCATELLO DI SPAGNA, JASPI DE LA CINTA
La pedrera de la Cinta, Els Valencians, province of Tortosa, Spain (30 in Fig. 2)
Middle I–V c. AD, then reused; XVI–XX c.; Lazzarini (2009)
Slabs for *opera sectilia* >> columns >> inscribed stelae
Gnoli (1988); Roda (1997); Falcone and Lazzarini (1998); Muñoz i Sebastià and Rovira i Gómez (1997).

**Cretaceous** (Aptian)
Fossiliferous (Rudists, Echinids, Algae, etc.) limestone (lumachella) (Rudstone)
Bioclastic
Micrite >> sparite >> accessories (hematite, goethite, Fe hydroxides, quartz)
Field of view = 3.5 mm

Stone 38 LAPIS ALABASTRITES
ALABASTRO MELLEO, ALABASTRO COTOGNINO, ALABASTRO EGIZIANO
Hatnub, Wadi Gerrawi, Wadi Sannur, Zawiet Sultan, etc., Middle Egypt (31 in Fig. 2)
Late Neolithic to date; Lazzarini (2009).
Small objects, vases (*alabastra*) >> slabs for *opera sectilia* >> columns >> statuary

**Quaternary**
Calcite alabaster/travertine
Concretionary with thick radial-fibrous/dendritic levels of sparite alternated with thin micritic ones
Sparite >> micrite >> micritic aragonite
Barbieri *et al.* (2002); Klemm and Klemm (2008); Pentecost (2010).
Field of view = 2.2 mm
References


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