

Employment of serpentinite rock in architecture

Abstract

The serpentinite rock is formed by minerals of the serpentine group, such as antigorite and lizardite, and can be found in several countries around the world. It has several commercial applications, among them its use as an ornamental rock. It can be found in numerous constructions, such as churches, houses and buildings. However, trade names are adopted for ornamental rocks, making it difficult to identify and confirm the existence of the specific rock in buildings. Using bibliographical research, the present work aims to study the use of serpentinite as an ornamental rock, identifying its first applications in the world and presenting commercial names adopted for this rock, allowing a better understanding of the relevance of this rock in world architecture. More than sixty commercial names of serpentinites used as ornamental rocks, in different applications, throughout different civilizations, were found.

Keywords: serpentinite, ornamental rock, architecture

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Introduction

Serpentinite is a metamorphic rock that has a light to dark green color and is used as an ornamental rock.¹ It is made up of approximately twenty minerals, mostly from the serpentine group, with an emphasis on antigorite and lizardite. Serpentinite is present throughout the globe with an estimated reserve of 200 million tons.² Its formation is believed to have occurred 3.9 billion years ago.³ The occurrences have complex petrogenesis, with multiple geochemical and tectonic factors that influenced their evolution and consequently their behavior, depending on the degree of serpentinization and mineralogical transformations. Thus, these rocks can present different textures that will translate into different physical and mechanical properties.⁴

In the Greek Civilization, it was known as Ophite, from the Greek Ophus, a snake, due to the similarity of its texture with the skin of snakes;⁵ in the Italian language serpent means snake, hence the term serpentinite.¹ Serpentinites have been used since antiquity as a raw material for the construction of objects for domestic use and for religious purposes. One of the first evidences is the example of the three frogs carved in serpentinite and that were excavated in the settlement of Nea Nidomedia, in Greece, from the seventh millennium BC. The use of this material is also documented in Mesopotamia: one example is the sculpture of a bison with a human head, dated from the second dynasty of Lagash, 2.100 BC.⁶ The oldest stone sculpture is believed to be the Venus of Galgenberg, discovered in Austria; its age is estimated at 30.000 years, has a size of 7.2 cm, is made of serpentinite and is now on display at the Museum of Natural History in Vienna.⁷ This would be the first known application of serpentinite rock in the world.

The maximum use of serpentinite as an architectural decoration material in Italy can be found in the religious architecture of Tuscany in the 11th century AD and its use was mainly dictated by local availability.¹ In this sense, it was explored between the years 1720 to 1931 in the state of Pennsylvania, in the United States of America.⁸

In Sweden, this rock is called the Kolmården marble, and has been used as far back as in the 13th century. But it was mainly due to the start of the building of the Royal Castles in Stockholm in the 17th century when the stone became more extensively used. One can also find this stone in many exclusive places all over the world (e.g. the

Paris Opera House, League of Nations building in Geneva, Leeds University Library, Uppsala University, Rockefeller Center, etc). The importance of this stone in international architecture, the good physical and mechanical behavior observed in its emplacements and the possibilities of preservation of some of the quarries makes the Kolmården marble a good candidate as Global Stone Heritage Stone.⁹

Currently, the serpentinite most used as an architecture material comes from India, Pakistan, Guatemala and Egypt, mainly due to the large volume of exploitable rock, but also because of the cheaper extraction prices in these countries.⁴ In Italy serpentinites are not mined because they have been practically exhausted, after their indiscriminate use as aggregates – gravel for civil construction.¹

However, commercial names are adopted for ornamental stones produced for architectural use, making it difficult to identify the use of serpentinite rock in certain constructions. For example, Verde Prato which originates from the city of Prato, is the result of the serpentinization process of a peridotite, therefore being a serpentinite.¹⁰ Another example is the so-called Verde Antique, which is found in texts in the year 1745, or Marmor Thessalicum – in this case, due to its origin, in the region of Thessaly, Greece.¹¹

Using bibliographical research as methodology, this work presents a survey of rocks used in architecture with different commercial names, but which are indeed serpentinites. It also presents some examples of applications and constructions that use this rock, but without association with the term serpentinite.

Results

Table 1 presents the different commercial names found in the literature for the serpentinite rock.

Table 2 presents some examples of applications for serpentinite rock from an architectural point of view.

Some websites of architecture companies and ornamental stone producers may present other different names for serpentinite: for example, Verdi Polcevera, from the region of Genoa, Italy; Verde Aver, Verde Patrizia, Verde Sant Denis and Verde Gressoney, sourced from the Aosta Valley, Italy.¹² From this region comes the serpentinite used in the United Nations General Assembly Room, in New York city, USA, specifically the wall behind the table of the President,

Secretary and Undersecretary of the Assembly.¹³ The Baptistery of Florence, the Duomo of Prato – both outdoors – as well as the San Federico Gallery of Turim, are other examples of serpentinites used.¹⁴

Table 1 Serpentinite commercial and traditional names from the literature

Green marble of Prato	Verde Antique Georgia
Green serpentine	Verde Antique Vermont
Marmor Ligusticum	Verde Antiques
Marmor Thessalicum	Verde Antiques
Ophite	Verde Chiaro Cippolino
Ranocchiaia	Verde D'Egitto
Serpentina Brecciata Nera	Verde de Alps
Serpentina Comune	Verde di Genes
Serpentina Fiorita	Verde di Genova – serpentine
Serpentina Granatifera	Verde di Levante
Serpentine Breccia	Verde di Levanto Marble
Thessaliam Marble	Verde di Mugnone Marble
Vedr Antico Pallido Brecciato	Verde di Pagliocco Marble
Vedr Antico Picchiettato	Verde di Pegli
Vedr Antico Smeraldo Picchiettato	Verde di Ponsevera Chiaro
Verd Antico Chiaro	Verde di Prato (serpentine)
Verd Antico Cipollino	Verde di Pratolino Marble
Verd Antico Cupo	Verde di Suza Marble
Verd Antico di Firenze Greccia Picchiettato	Verde di Voltri Marble
Verd Antico di Firenze Picchiettato	Verde Listato Alabastro
Verd Antico di Firenze Susa Picchiettato	Verde Rannochia Chiaro
Verd Antico Minuto	Verde Rannochia Giallastro
Verd Antico Ondato	Verde Rannochia Lineare
Verd Antico Pallido	Verde Rannochia Macchiato Marble
Verd Antico Pallido Minuto	Verde Rannochia Ondato Marble
Verd Antico Sanguigno Picchiettato	Verde Rannochia Orbicolare Marble
Verd Antico Scuro Picchiettato	Verdi Alpi
Verde Antico	Verdi di Ponsevera Marble
Verde Antico Biancastro Minuto	Verdi Macael
Verde Antico Serpentine	Verte Issorie
Verde Antique	Kolmården marble

Table 2 Serpentinite applications for the architectural point of view, from the literature

Artifacts	Wagner and Schubert ¹⁵
Sculptures	Bednarik ⁷
Regular flooring blocks	Dorchester ⁸
Regular blocks for walls	Fratini ¹
Regular blocks for mosaics	Fratini ¹
Irregular blocks for mosaics	Fratini ¹
Columns	Fratini ¹
Pillars	

Serpentine rock can also be found in marbles such as Connemara Marble,¹⁵ which is a rare form of marble found in Connemara Co. Galway in the west of Ireland. It is a calcite marble which contains large amounts of serpentinite. Its many uses are described e.g. as a dimension and ornamental stone, gemology/ jewelry and souvenirs.¹⁶

Below are Photographs 1–6 of examples of architecture applications for serpentinite in external and internal environments.



Photograph 1 Roman forum, Rome, use as floorings, outdoors.



Photograph 2 Roman forum, Rome, serpentinite column, outdoors.



Photograph 3 Santa maria in ara coeli, Rome, Church interior.



Photograph 4 Sestriery, Fountain, Italy.



Photograph 5 Armeria reale, Turin, Italy.



Photograph 6 Museum of metropolitan art, New York, USA.

Discussion

The present work presents the relevance of the serpentinite rock from an architectural point of view, being used in different countries, civilizations and in different applications. The oldest stone sculpture is believed to be the Venus of Galgenberg, made of serpentinite, in around 30.000 years old. Thanks to its availability, with occurrences in all continents, from Mesopotamia, through Egypt, Greece and the Roman Empire to the present day, this rock has been used in different applications, almost always being little recognized by people. Several commercial names have been adopted for serpentinites from different origins, with more than sixty names for this rock being presented here. Possibly other names can still be found in new searches. This diversity of names makes it difficult to identify the serpentinite rock in architectural uses, and as well as its cultural value.

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Conflicts of interest

There is no conflict of interest.

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