



Centre of Stone
ASIEA

POWER OF STONE



Mount Kosciuszko, Australia

2,228 metres above sea level
formed 490-355 million years ago
Coordinates:
36°27'27"S 148°15'44"E

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JAKARTA STONE FAIR

Where stone meets ocean, find nature's potential through Jakarta Stone Fair!

Jakarta International Natural Stone Exhibition will take place 14-17 November 2018, Jakarta International Expo (JI Expo). As the appointed organizer, TG Expo International Fairs Co. have the mission to create a showcase to wide variety of natural stones and stone products, as well as introducing the latest technologies in stone industry.

Indonesia is a member of G20 major economies. The country's economy is mixed with private and public sector having equivalent importance. The Indonesian economy is the world's 16th largest by nominal GDP and the 8th largest by GDP at PPP. With population of 250 million people the government is focused on the country's productivity and growth. The progress of construction and building materials sector includes the completion of a number of megaprojects, such as bridges, railways and power stations.

The exhibition where products are displayed in categories such as natural stones, marble, granite, mosaic, stone products, packaging systems is an important point for companies seeking to expand into Asia market. The event is supported by local partners, including Indonesian governmental bodies. Exhibitors will have a chance to meet the host of buying committees and special B2B organisations in Indonesia.

There are also many country pavilions, including China, India, Italy, Greece and Turkey, already committed to this first year of the exhibition.

Why participate in Jakarta Stone Fair?

- To discover the potential of INDONESIA market
- To launch new products & technologies to the market
- To generate sales leads & build relationships with prospect buyers
- To take place in an important trade port for Australia and Oceania

About TG Expo

TG Expo International Fairs was founded in 2008 with 'Think Global' insight. Until today, TG Expo Group has organized exhibitions in France, Iran, the US, Qatar, Brazil, Egypt, South Africa, Nigeria, Saudi Arabia, the United Arab Emirates, Kuwait, the United Kingdom and India. TG Expo enables exporter companies to be introduced to new markets in many sectors such as healthcare, electricity, design, furniture and marble. TG Expo Group acts as the Turkish representative of many international fairs and national pavilions. It also organizes fairs in Turkey as well with highly experienced co-founders and an expert team.





JAKARTA STONE FAIR

International Natural Stone Exhibition

14-17 November 2018

RESERVE YOUR STAND NOW

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Indonesia today...

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- **4th** most populated country in the world
- **6th** biggest marble importer in the world
- Has **300** million USD nature stone import volume

Jakarta International Expo (JI Expo), Indonesia

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HISTORY OF STONE

Onyx

From one point of view, the name "onyx" comes from the Greek word "nail", because the layers in the mineral alternate in a similar way. Although from the point of view of other linguists, this name is associated with the Arabic word "sad", this is not surprising. Earlier in the Islamic countries onyx decorated tombs. But the ancient Egyptians used it in a completely different way, for the lining of pools and open baths.

Archaeologists, digging Assyrian cities and the territory of Babylon, discover onyx vessels, including vases. They knew this stone in the Middle East, where windows and decorative insets for the Jerusalem temple were made of it. Already the Middle Ages in Italy and France it was extracted in significant quantities. Also in the past, Mexico, the United States, Peru and Argentina occupied important positions. But with the development of easily accessible deposits, their role in the world market has become insignificant.

Mining

The highest quality onyx is mined in India, Uruguay and Brazil. The Arab countries and the United States also have good positions in the world market. There are deposits of this breed in different countries, but not everywhere they are generally suitable for export. Today, Iran occupies a very strong position in the international turnover of onyx. It is competing with Afghanistan, Pakistan, Turkey, Egypt. Only in these countries there are deposits, which it is advisable to develop at a modern level of technology on a really large scale.

The Pakistani stone is extracted by the state corporation, in 2001 the total withdrawal of aragonite and marble from the bowels reached 468 tons. The main buyers of Pakistani onyx are Spain, China and the countries of North America. Due to the complex military-political situation, the Afghan

onyx is practically not mined and is only potentially present on the market. From Iran, the company sends the stone to Italian, Indian, Japanese and a number of other customers. The new factories, which began work since the mid-1990s, are joint ventures organized by Chinese, Indian, Italian and Russian firms. The older organizations are state-owned.

Turkish and Egyptian organizations produce relatively small amounts of onyx, although in Turkey it is mined in large quantities. Egypt recently had undeniable leadership positions. The main importance in these countries is occupied by a factory near Pamukkale (Turkey) and the region of Aswan (Egypt), famous for its unique "honey" stone.



Block of onyx

Slab is a semi-finished product, which is the result of cutting stone blocks into large and flat slabs with untreated edges. Before cutting them into finished products (facing tiles, kitchen countertops, wall panes or facade panels), slabs can be exposed to various surface treatments of large faces.

Chemical and physical properties

According to its mineralogical nature, onyx is a subspecies of agate. It is a rock of stony origin. Its main component is aragonite or calcite. In structure, it is dense with fine grains or large crystals.

The main property of onyx, which is evaluated when it is examined is the thickness of the strips. The thinner they are, the more valuable the stone is, and the more expensive it is.



Onyx structure

Onyx chemical composition is silicon dioxide. Another kind of onyx is marble onyx. Marble onyx consists of calcite or aragonite of organic origin. Its structure is dense, fine-grained or coarse-grained, often with a layered or radially radiant structure. It is a dense sedimentary rock, a fibrous chalcedony variety of quartz with the presence of a small amount of impurities that create contrasting coloured layers of plane-parallel bands. This onyx differs from agate, in which the bands are arranged, as a rule, concentrically-zoned. A distinctive feature of onyx is the coloration, which is characterized by the presence of bands of different colours: red, white, brown, black and gray. The texture can be radiant-radiant or layered, with alternating layers of agate and carbonates. The background colour of onyx can be light green, brownish, dark green or pinkish and depends on the composition of the impurities included in it. So the impurities of magnesium and copper give a dark green colour, the mixtures of copper and iron are painted in a light green colour, the mixtures of iron oxides give a yellow, reddish or brown colour.

Onyx is a very dense stone. The degree of

transparency of marble onyx varies from translucent to transparent, the rays of light pass to a depth of up to 60 mm. Opaque onyx casts a glass shine.

- Density of 2650-2900 kg / m³,
- The compressive strength is 50-110 MPa,
- The abrasion is 1.0-1.8 g / cm²,
- Water absorption is 0.1-0.35%,
- The porosity is 0.35-0.95%.
- Hardness on the Mohs scale - from 6 to 7



Many types of onyx have high frost resistance. Thus, the physical and mechanical properties of onyx are similar to those of marble, and by some criteria even exceed them (frost resistance, water absorption, hardness).

Onyx this sedimentary rock is formed as a result of layered deposits of carbonate minerals in hot mineral springs. When the growth of calcite crystals is very fast, travertine is formed. But in some sources this process is slowed down. At relatively low temperatures, large, closely intergrown crystals of calcite form. This is a very dense translucent rock, in which radial needle crystals and patterned bedding are clearly visible. It is emphasized by inclusions staining the rock. Most often, calcite is coloured with an oxide iron, acquiring a light brownish-yellow hue with strips of the same colour as that of a real semiprecious chalcedony. But unlike the latter in this mineral, its calcite nature is emphasized, therefore it is called marble onyx. As the temperature rises, the same carbonate minerals acquire other physical properties and aragonite is formed. This mineral often also crystallizes in the marble onyx. Aragonite is usually less

transparent (and often not transparent), in most cases snow-white and polished worse than calcite. In view of the difficult conditions of onyx formation, its deposits are characterized by a small number of small blocks in the rock mass, insignificant reserves. Therefore, despite the prevalence of deposits, the world's reserves of marble onyx are very insignificant.

Application

The main application of onyx is serial and piece decoration products, such as plastic products, vases, candlesticks. Often you can find onyx countertops and even caskets. Such a wide application lowers the value of each particular specimen in aesthetics and connoisseurs of onyx. Although the value of

the stone is largely offset by a wide variety of overflows. Stability of onyx to a significant temperature and humidity allows you to confidently apply it even in kitchens. Cleaning of such finishing elements is not particularly difficult. But the external beauty of the mineral can be spoiled by the use of acids, alkalis and abrasive cleaners. The best option is wiping with a slightly damp sponge and blotting with a dry cloth until all traces of moisture have been removed. If necessary, in a more serious cleaning use a weak soap solution. From onyx, you can combine scenes of abstract and zoological content. But completely to form walls from it is possible only in bathrooms, in other places an overabundance of onyx finishing is undesirable.



A panel from onyx



Onyx in interior

HISTORY OF STONE

The Beauty of Amber

Nikolay Koltovoy

Amber is a fossil resin. Amber refers to minerals of the class of organic compounds, has an amorphous structure and does not form crystals.

The only deposit in the world where amber is mined industrially is located in the village of Yantarnoye, Kaliningrad region. The volume of reserves of this field is 90% of all world reserves of amber (Picture 1). There is Sakhalin amber (Picture 2), in Ukraine (Rivne region), in Poland, in Canada and in the USA (Picture 3). Dominican amber is very interesting (Picture 4). In bright sunlight, it becomes blue. The blue colour is explained by the fact that there are many ultraviolet rays in sunlight that cause blue fluorescence of amber. Blue fluorescence arises from the presence of specific impurities in the amber composition, which are not found in other types of amber.



Picture 1. Unprocessed raw amber.



Picture 2. Sakhalin amber.

A lot of information about the structure of amber, and the processes of its formation can be obtained by studying amber chips (Picture 5). There is a whole science - fractography, which studies the structure of the fracture surface of various materials.

There are various varieties of yangaria (fossil resins): succinite is the most common type of amber produced in the Baltic Sea, hedanite - wax-yellow amber, glessite - brown opaque amber, stentenite - black brittle amber. Sometimes black amber is called an



Picture 3. Raw amber.

The Corinthian portico is the protruding part of the building. This part is formed by columns of the Corinthian order with overlaps. Corinthian order is an architectural composition (a certain system), based on an artistically designed beam structure, which differs solemnity and rich decor. A distinctive feature is a high capital, decorated with stylized carved leaves of acanthus, which are arranged in two rows. The composition is made of non-precious materials, such as granite, marble, sandstone, etc.

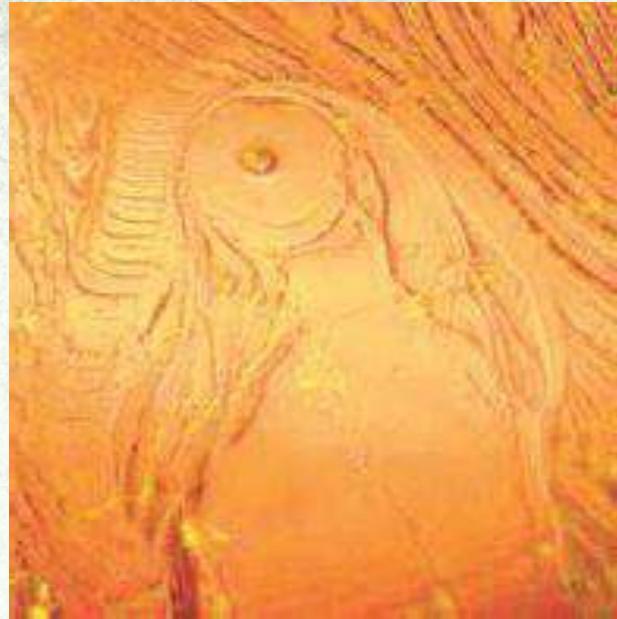


Picture 4. Dominican amber.

Ornamental rock, but it is similar in composition to that of coal, and is a variant of it (Picture 6).

You need to be very careful when buying products made of amber. Recently, many different ways of imitating and falsifying amber have appeared. For example, fused amber is used for making products, which is obtained by pressing and melting amber crumb.

Amber can be imitated with the help of epoxy resin and with the help of various types of plastics. For example, Bernit - artificial amber



Picture 5. Structure of amber.

made from various resins. In it, through special technology which called "micro-explosions,"

microcracks are created, which are very adorned with amber (Picture 7).

At the present time, special methods have even to determine in which deposit the amber was extracted. The methods for identifying amber are based on the study of the optical properties of amber. For this purpose, the absorption spectrum of amber in the optical and infrared regions is recorded. The most



Picture 6. Stertenite – black brittle amber.



Picture 7. Bernite – artificial amber.

been developed that allow not only to distinguish genuine amber from forgery, but informative was the study of the fluorescence spectrum of the samples. This is because the slightest difference in impurities has a significant effect on the amber fluorescence spectrum.

The most characteristic feature and value of amber are inclusions - various inclusions. When forming amber, when it was still a thick resin, various insects entered it. When the resin solidified, they were forever immured in a transparent piece. Very often, amber and mosquitoes are found in amber (Picture 8, 9, 10). (Beware of fakes, very often pour insects with epoxy, and give it away for amber).



Picture 9. Fossil ant in amber.



Picture 8. Fossil insect in amber.



Picture 10. Fossil mosquito in amber.



Picture 11. Jewellery with amber.



Picture 12. Jewellery with amber.

Amber is widely used to produce jewellery (Picture 11,12). Very beautiful products made from coloured amber (Picture 13). From amber also make whole pictures (Picture 14, 15).

The special beauty of amber, which very few people see, opens under a microscope. Jewellers and artists try to give an external beautiful shape to amber. But an immeasurably greater beauty is hidden inside amber. What kind of miracles nature has not created with its boundless fantasy. This is the new unknown worlds (Picture 16), and amazing amber characteristics are used to create different works of art (Picture 17).



Picture 13. Amber tea set.



Picture 14. Pictures from amber.



Picture 15. Pictures from amber.



Picture 15. Amber world.



Picture 15. Amber room in the Peterhof.

FRENCH STONE

English House

Paul Daniel

After William the Conqueror won the battle at Hastings in 1066. He ordered the construction of a large number of castles and other fortifications that became necessary to strengthen his position. He also organized the construction of 20 cathedrals in England. High-quality limestone for the construction of some buildings was brought from Cannes (France), which has been a reliable source of material since the Roman Empire. After more than 900 years, the stone from Cannes is still used to restore buildings and structures on both sides of the Channel.

Norman style of architecture

The Norman style of Romanesque architecture appeared in Normandy and England between the 11th and 12th centuries. The Church of Saint-Etienne in Cannes (the beginning of the construction - 1067) is an obvious example of the early Norman style and became the prototype of the Norman cathedrals, built throughout England. In an attempt to strengthen his position in England after 1066, Wilhelm ordered the building of many castles and fortifications, among them the Tower of London known as the White Tower.



Entrance to the underground mine (Santa).

These fortifications allowed the Normans to remain safe during the threat of uprisings. In the 11th century, the builders of castles and cathedrals in Normandy often used Cannes stone. It is a light creamy yellow limestone mined in the countryside around the city of Cannes. Cannes Stone is a fine-grained oolitic limestone formed in shallow lagoons during the Bathonian Age, about 167 million years ago. The stone is uniform and therefore particularly suitable for threading. It was mined in numerous quarries in the 11th and 12th centuries.



Fantini vehicle near the mine entrance.

According to the good recommendations of the architects and builders of Normandy, the Cannes stone began to be exported to England. As part of its consolidation in 1070, Wilhelm appointed Lanfranc the first Norman archbishop of Canterbury Cathedral. The cathedral was destroyed by fire in 1067. Lanfranc cleared the ruins and began the reconstruction of the cathedral using Cannes stone. The project was based on the drawings of the abbey of Saint-Etienne in Cannes, where he had previously been abbot.

In 1075, at the insistence of

Lanfranc, King William appointed Gandulf the bishop of neighbouring Rochester. Gandulf was a disciple of Lanfranc and was recommended as an excellent specialist in the field of stone construction. In 1078, Wilhelm used the construction experience of Gandulf of the White Tower of London. And because Gandulf was familiar with the Cannes stone, he was often used to build cathedrals in England. This stone was universal, for example, the Winchester Cathedral was built using limestone mined on the nearby Isle of Wight, and the Ely, Lincoln and Peterborough cathedrals - with a stone from nearby quarries. The list of English cathedrals that were built using Cannes stone includes Canterbury, Rochester, Norwich, Durham and Chichester.

Other famous historic buildings in England that were built using Cannes limestone: Westminster, Tewkesbury and Glastonberry Abbey, Eaton College, the Hatfields House and perhaps the most famous are Buckingham Palace.

History of Cannes stone

In a book written approximately in 1825, entitled "Architectural Antiquities of Normandy," author August Charles Pugin writes: "One mile west of Cannes is the village of Saint-Germain-de-Blancher. In the immediate vicinity of this village, on the opposite side of the river, there are glorified quarries, of which Cannes stone has been extracted for many centuries to this day. This stone, like the bat in England, is soft and easy to handle, but has more dense and pleasant structure, the quarries worked on the principle of caves ... Most of the stone is extracted from the layer between 6 and 11 meters below the surface. Stone blocks were lifted by shafts, on top of which were large wheels. " At one time there were about 100 quarries of Cannes stone, mostly cuts. According to historians, in addition to France and England, Cannes stone was

used in the construction of St. Patrick's Cathedral in New York, the Royal Castle in Brussels, Belgium, Germany, Bermuda and Saudi Arabia.

As in other parts of Europe, the Cannes stone trade stopped in the 1960s. In France, the restoration of ancient buildings was continued in the sixties using limestone from the Oise region, but the coarse stone was not very resistant to wear and contamination.



Block cutting on Gilbert machine.

According to Jacques Millet of the MCA Arquitects, the mining of Cannes stone was resumed in 1986-1987 years for the Cannes Memorial construction. It is a museum and a memorial in the northern suburb of Cannes. The memorial is dedicated to the history of the Second World War, 800 m³ of Cannes stone was used in its construction. It was officially opened on June 6, 1988, on the day of a memorable military date.

Santa Dungeons

After the construction of the Cannes Memorial, there was a need for a stone for the restoration work of other local buildings. Coordinated efforts, several local government organizations decided to open a mine near Saitou, 15 km southeast of Cannes, on the way to Brattleville-sur-Laye. It was necessary to carry out extensive geological prospecting to ensure the continuity of supply. The extraction on the site began in March 2004 by an underground method. The

basic principle was to determine whether the stone had the necessary quality for extraction from the surface. A place was fixed where access to the rock mass could be organized by the horizontal method of drilling. As a rule, this place was on the side of the hill (see picture). Under the ground, the classic method of columns and chambers was used to separate stone blocks from rock mass. The main unit was then divided into blocks in size, convenient for transportation from the working chamber. In February 2007, the British magazine "National Stone Specialist" wrote: "Cannes stone has an excellent structure and extensive use for complex carving, beginning from the end of the Victorian era, and should return to the sphere of reconstruction, where it was originally used." As M. Sylvain Laval, owner of the Société de Carrier de la Plaine de Cannes, explained: "The main reason for choosing underground mining was the cost - there is no covering layer that should have been removed first. We worked closely with Mr. Fantini, from a well-known Italian company to develop the optimal application of machines and equipment in this situation. Using caterpillar Fantini vehicles, we can extract about 3000 m³ of stone per year. Unfortunately, this figure includes about 1000 m³ or more waste. " Most of the production goes to various restoration works near Cannes in France. M. Laval reminded that the commercial results of the stone trade were significant, and exports to England reached 50%. However, the last 2 years have been very difficult financially, and M. Laval and his team hope for an increase in demand in 2014 and subsequent years. Mine Site is one part of four quarries of private company "Carriersdu Basin Parizen".

Some experts note that a stone of the required quality from Santo can be obtained only in layers up to 300 mm. Heights greater than 1m are needed to

make some parts for the current restoration project of the Great Southern Window at Canterbury Cathedral. Thus, the granular limestone Lava, from the same quarry as the limestone Lepine (near Poitiers), is used instead of the stone from Cannes.

Properties of Cannes stone

Two types of quality stone are currently offered by the manufacturer:

- "Caen 1/2 Ferme", density 2050 kg / m³, porosity 24.4%, sound speed 2970 m / s, compressive strength 25.9 MPa. The thickness of this layer is in the range from 80 cm to 110 cm.
- "Caen Ferme", density 2280 kg / m³, porosity 16.1%, speed of sound 3612 m / s, compressive strength 40.1 MPa. The thickness of this layer is from 25 to 30 cm maximum.

As Lamb & Sons, a trading company from Billingshurst, West Sussex, observes: "For centuries, the stone from Cannes has been used to create many famous manors and cathedrals in England. The stone displays a subtle range of colours and textures and is one of the most beautiful of the available limestones. It can be carved by incredibly sharp edges and formed by thin stonework.



Cannes stone.

As the representative of Canterbury Cathedral noted, the compatibility of the replaced stone with the original was a priority, and that is why the stone from

Santo is most often used. Some of the best projects are listed below.

Canterbury Cathedral

Augustine of Canterbury was sent by Pope Gregory as a missionary to the Anglo-Saxons. Augustine founded the cathedral in 597, which is now the oldest in England. It was completely rebuilt in 1070 -1077, after the Norman invasion, using Cannes stone. A large part of it was rebuilt after the fire in 1174. Stone from Cannes were not always used during the last centuries, many changes, additions, and restorations. As the operating manager of the Canterbury Cathedral Christian Pascal said: "The compatibility of the stone is necessary for a correct restoration. The inability to solve this problem in the past has aggravated some of the weak points of the building."



Canterbury Cathedral.

In April 2011, the local news agency reported that "About 750 kg of Cannes stone was sent by ferry along the Stour River from the Sandwich to Fordwich, the old port of Canterbury. Then it was transported on a cart with a horse to the city. Two blocks of stone were donated by a quarry in France. " In late 2013, another major project was initiated: the restoration of the Great South Window. Cannes stone was used to perform the ornamentation,

and from the Agrain stone from Poitiers (from the same quarry as Lepin's stone) made racks and transverse beams.



Canterbury Cathedral corridors.

Agrain stone was thoroughly tested for compatibility. It is planned that the new veneer will remain in commercial form for 120 years. To give some idea of the importance attached to the restoration of the Canterbury Cathedral, we note that 17 masons were employed for the restoration. It is expected that the new project will be completed in about 2 years.

The White Tower of London

The White Tower is the first built (approximately was laid in 1078) and is part of the Tower of London. It was designed by Bishop Gandulf and was built mainly with the use of a stone from Cannes. For centuries the construction has been changing, supplemented and restored. The 2 millionth restoration project "GBP" of the White Tower won the main awards in 2012.



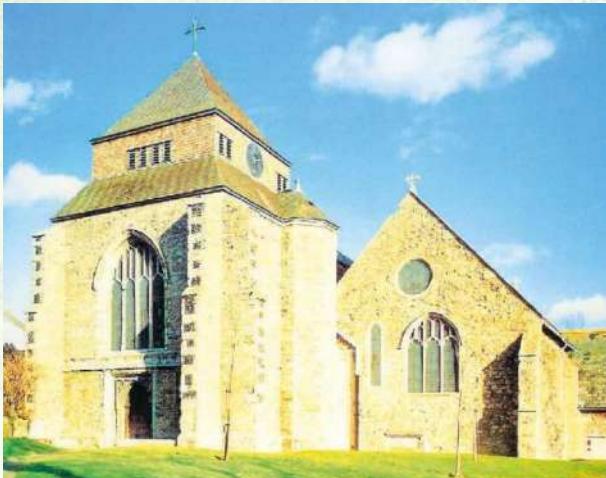
The White Tower of London.



The White Tower of London.

Minster Abbey

This is perhaps the smallest abbey in England, located in Minster on the island of Sheppey, Kent. Archbishop de Corbiul rebuilt the church and monastery in 1123-1139, using the Cannes stone for the Norman part of the structure.



Minster Abbey, Isle of Sheppey, Kent.

Westminster Abbey

Westminster Abbey in London was the church for coronation since 1066. The church, as it is, was laid by Henry III in 1245, and, according to Christian Reynolds, the Cannes stone was used in the library for the original design along with the Reigate stone from Surrey. The stone from Cannes was involved in restoration work in 1840-44. Later, the

restoration was carried out using the stone Portland or as it is called - the stone "Saint Maxim".



Westminster Abbey.



Westminster Abbey.

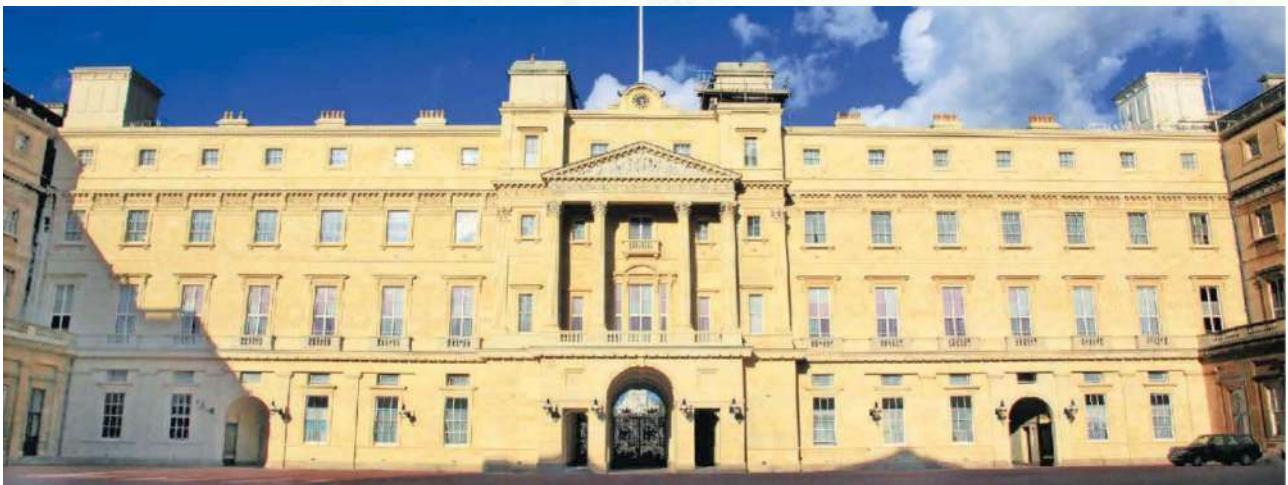
Buckingham Palace

To underscore the continued interest in the stone from Cannes in England, in 2010 the project of the company "GBB-Pi" was awarded for the restoration of the quadrangle of the Eastern Rise of Buckingham Palace, the main residence of Her Majesty Queen Elizabeth II in the centre of London. The Eastern Rise was built in the 1830s using Cannes stone, while the earlier facades are a mix of Butt and Portland stones. LFS (Organization for Works in the Councils) awarded the

project of cleaning and removing 17 layers of oil-based paint from the Elevation, allowing to restore the stone. Stone replacement was carried out on cornices of storey attics, decorative-facing elements of medium cornices, rain cornices of lower levels and on carved modules and ornaments. Another section of the project was the preservation and restoration of the pediment "Nine Muses", the central landmark of the facade of the Palace.



Buckingham Palace before restoration.



Buckingham Palace after restoration.

Kylo is a manual percussion instrument used in underdeveloped countries and intended for stone work, rocky soil, very dense soil, for destruction of old masonry, and so on

MINING INDUSTRY

Australia

Australia is the only state that occupies the whole continent. Australia occupies a special place in the mining industry. It is one of the main exporters of iron ore, coal and stone. Export is carried out in many countries of the world. The Australian continent occupies a leading position in the extraction and processing of all kinds of rocks.

What is mined and processed in Australia?

In Australia, large deposits of various rock are concentrated. Some of them are described below.

1. Granite. On the mainland, about twenty varieties of gray and pink granite are mined. Especially popular around the world is the blue granite, Labrador Blue. Among the demanded grades of granite stone for export are Harlequin, Kangaroo, Tasmanian Green, Verde Fuocco.

Each of these granite varieties has its own unique coloration, and characteristics such as density, moisture absorption, compressive strength and bending strength. Granite, mined on the mainland, is used as a finishing and building material. It is used in decoration due to its unique properties. In addition, granite is used to make decorative items for the interior.



Granite mining, Queensland.

2. Marble. Marble in Australia is mined mostly for internal purposes. Penrice in South Australia operates the largest marble mine state. Cairns Marble Australia Pty Ltd mines and sells various marble products such as blocks, polished and unpolished slabs, tiles etc. Marble is used as a building and finishing material, as well as for the manufacture of interior products.



Bianca Mist, Cairn's Marble Australia.

3. Coal - used in the manufacture of fuel, in medicine, as a source of energy, in the metallurgical, electrical and chemical industries. The scope of this material is extensive.

The main mining varieties of coal raw materials on the territory of the Australia are coking and energy species.



Coal mining, Queensland.

4. Bauxite. This rock is used in ferrous metallurgy for extraction of non-ferrous metals - mainly aluminium. Also, alumina obtained from stone raw materials is used as a flux. The mineral acts as a filler of paint and varnish and sorbents.

The natural material contains several chemical elements: silicon, alumina, iron, aluminium. During the smelting of bauxite, it is possible to produce alumina cement or electro corundum (refractory and chemical resistant material). It depends on the melting method.



Bauxite mining, Australia.

5. Ilmenite. The mineral is used for the extraction of titanium, the stone itself is used in the paper-cellulose, jewellery and ceramics industries. Its distinctive feature is that it is not able to dissolve in acid.



The Goondiculum ilmenite mine near Monto (Queensland).

6. Iron ore. This rock is necessary for obtaining cast iron. In addition, it is used as a natural paint and acts as a weighting agent for drilling fluids. Iron ore material has excellent strength and anti-corrosion properties.

7. Precious and semiprecious stones - sapphires, opals, diamonds, rubies, emeralds,

tourmaline, aquamarine. A special place among the mining industry is the extraction of precious and semiprecious stones.



Diamonds mining, North Australia.

Australia is the world leader in the extraction of coloured stones and is one of the first places in their exports. Basically, such jewellery is needed when creating jewellery.

Enterprises in Australia engaged in mining. The most famous mining and processing companies:

BHP Billiton - the company is in the city of Melbourne. A mining company was founded in 2001 due to the merger of two large companies Billiton (The Netherlands) and Broken Hill Proprietary Company (Australia). It specializes in the extraction of iron ore and coal. The place of extraction of iron ore is in Perth, coal - Brisbane.

Turnover of iron ore is more than 10 million dollars per year. More than 200 million tons of this breed are produced annually. Turnover for coal is more than 4.5 billion dollars. The production is more than 40 million tons of metallurgical angle and more than 30 million tons of steam coal. Also, the company is engaged in diamond mining in Australia.

Slab is a semi-finished product, which is the result of cutting stone blocks into large and flat slabs with untreated edges. Before cutting them into finished products (facing tiles, kitchen countertops, wall panes or facade panels), slabs can be exposed to various surface treatments of large faces.



Iron ore mining, BHP Billiton.

Fortescue Metals Group - the company is the fourth largest producer of iron ore in the world. Annually, the company produces more than 165 million tons of iron ore. The main mining areas are Chichester Hub and Solomon Hub (Pilbara region). The company is involved in several iron ore mining projects. Each project is implemented in various areas of the mining town of Pilbara.

Rio Tinto Group - the company's date of foundation is 1873 through the merger of two companies - Rio Tinto (Australia) and Alcan (London). The company specializes in the extraction of coal, diamonds and iron ore. In terms of the number of diamonds, sapphires and opals produced, the company ranks third in the world. The company is the only diamond miner in the entire territory of the state. Every year about 30 million carats of precious stone are mined. The company's capitalization is about 80 billion dollars annually.



Coal mining, Rio Tinto Group.

Vale Australia - the company specializes in the extraction of iron ore and coal. Obtained

by the company mainly coking and energy coal. An annual average of 22 million tons of this material is obtained. Coal is exported to East Asian countries. The company is a major exporter of iron ore.

Export

One of Australia's leading export industries is coal, which accounts for 10 percent of all foreign trade. More than half of all Australian fuel is sent to Japan. Also, coal is exported to the United States, Western Europe, the Republic of Korea and the island of Taiwan. More than 200 million tons are exported. A large amount of coal is also supplied to Israel - about \$ 113 million.

Iron ore is exported to Japan, China, East Asia and Western Europe. In a year the total amount of exported iron ore is more than 250 million tons.

Bauxite does not bring so high income to the state, unlike other rocks. But at the same time, more than 18 million tons of this breed are exported every year. The stone is exported to Japan, China, countries of South-East Asia and Western Europe. The state takes the third place in the world market for the export of this breed.

A special place is occupied by mining diamonds, opals, sapphires, rubies, emeralds, tourmaline, aquamarine. These precious stones are annually supplied to the world market. The total annual export of precious stones is more than 7,000 kilograms. The main countries to which sapphires are supplied are Thailand, Russia, Hong Kong and European countries. Noble opal is mainly bought by the USA, the countries of Europe and South-East Asia. Israel annually buys precious stones for more than 12 million dollars.

In total, the Australian state exports more than a quarter of all mined rock. Exports depend on the country's economy. Japan ranks first in exports of goods from Australia.

With regard to granite and marble, on the mainland these rocks are mined in small quantities and practically do not export.

Import

The main imported partner of the Australian state is the United States of America - 14% of the extracted stone raw materials are imported

to Australia. Among the imported to the country stone raw materials can be identified tourmaline, pomegranate, purple apatite, topaz, quartz, turquoise.

Also, the partner of the Australian state is Japan, which annually delivers 13% of the mined rock. These rocks include non-metallic building materials - gravel, sand, soil, building stones (garnet), limestone, dolomite, pyrite.

China in the last place - 11% of the goods imported into the country. Basically, it is building and finishing granite, marble, onyx and others. Also, some types of stones are supplied to Australia from Japan: semiprecious - jade and precious - rock crystal. In addition, they supply turquoise.

India is also a major importer. It imports marble, granite, quartzite, onyx, sandstone and other finishing and building materials into the Australian state.

China and India occupy the leading positions in the extraction of building and facing raw materials. In total, about 72 million dollars are imported annually to Australia of natural raw materials. Chinese and Indian granite, marble used in construction, decoration, landscape

design and so on.

Also, China and India import to the mainland quartzite, which is used in decoration, landscape design, in the manufacture of decorative items. He also goes on making jewellery. Each year, it imports a little more than 9 tons, which in total is more than 700 thousand dollars. Imported onyx and sandstone also serves as decorative and finishing material.

Porphyry, basalt, sandstone and other stone for construction and cladding works are annually supplied to the Australia about \$ 2.5 million, which is more than 8,000 tons. Travertine, or calcareous tuff, and other limestones are also supplied for the construction of about 8 tons each year, which is slightly less than a quarter of a million dollars.

Thus, Australia appears to be one of the leading powers in extraction and processing of various rocks. The main part of the extracted natural rocks is exported to other countries. Imported stones occupy a small percentage. These are the goods that are mined in the state in small quantities.



Marble mining, Australia.

NATURAL STONE IN CONSTRUCTION

External application

The decoration of buildings with natural stone is considered prestigious. The material is durable, and is often used repeatedly. The stone cover looks attractive, reliably protects the walls from damage.

Basalt and granite

During the crystallization of magma at depths under high pressure, basalts and granites are formed. The basalt layer, characterized by an alkaline reaction, is deeper in the earth's crust. But individual deposits come to the surface on almost all continents. The largest quantities of basalt are mined in Canada, Ethiopia, Eastern Siberia, Armenia. Its density is the maximum among natural building materials - 2600-3100 kg / m³. In the composition of 47-52% of silicon oxide, and about 15% of aluminium oxide.

The colour spectrum of basalt is limited. Gray, black and green shades predominate. Green varieties are formed with prolonged exposure to geothermal water, and are valued above gray-black. Basalt tiles are characterized by maximum resistance to wear. It is used to cover the floor in public places, also on the walls of metro stations and train stations.



Basalt facing.

Sour granite is more diverse. The silica content is higher, usually within 68-73%. Density reaches 2600 kg / m³. Granite deposits are widespread in the world. In construction, a stone is mined nearby, given the considerable costs of transportation.



Granite colour varieties.

In fact, granite is an eye-visible mixture of individual minerals: white quartz, gray or reddish feldspar, almost transparent mica. Less common is a precious stone of black colour, with a little expressed granular structure.



Granular structure of granite.

The most beautiful varieties are used for facing of elite buildings and monuments. The main application is the external lining of public places, monuments, architectural compositions. From the sawn stone make a durable stone blocks and slabs for stairs. Roughly processed is used in the masonry of decorative and retaining walls.



Granite slabs.

Granite and basalt of finishing quality are relatively expensive materials, they are difficult to work with. But their advantages outweigh:

- hardness and strength;
- low porosity;
- moisture resistance and frost resistance;
- chemical resistance, in particular to acid rains.

It is not recommended to coat residential buildings with granite or basalt, since they

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It is not recommended to coat residential buildings with granite or basalt, since they

have natural radioactivity, radon gas is gradually released.



Granite facing.

Limestone (shell rock)

Limestone is a sedimentary rock that was formed during caking and partial recrystallization of chalk. Under the microscope, the elements of the shells of marine organisms are still partially distinguishable. Shell rock is found almost everywhere, under layers of sand and clay at a depth of tens of meters. On the surface comes out in the mountain peaks of the Alps and the Crimea.



Texas limestone structure.

The density of limestone is not more than 2500 kg / m³. Stone is characterized by high porosity - up to 25%. Moisture resistance and frost resistance is low, the durability of the open masonry does not exceed 150 years. The soft enough loose material is easily handled. Near the mining sites affordable and cheap limestone is widely used in the form of building blocks, but with additional cladding with more resistant building materials.



White limestone veneer house.

Sandstone

Sandstone is a cindery sand, the grains of which are bound by mineral cement. The density of the mineral is between 2200-2700 kg / m³, the porosity reaches 0.7%. Absorption of water varies from 0.6% to 6%, depending on the variety. The best physical and chemical properties show quartz sandstone, with a silica content of more than 90%. Aluminum oxide deteriorates the building characteristics. Carbonate limestone sandstone still withstands loads.



Sandstone structure.



Sandstone house.

Internal application

For interior finishing, rocks that are unstable outdoors, or of great value, are used. But granite and basalt tiles are used both for exterior and internal cladding.

Porous volcanic tuff

It is formed during eruptions of volcanoes on the surface of the earth. Density of the mineral from 800 to 2000 kg / m³, the structure is heterogeneous. Large quantities are mined in Italy, Armenia, Iceland, Cape Verde.



Volcanic tuff structure.

Volcanic tuff is almost any colour due to impurities. A natural white, grey or brown stone saturated with pores is a pumice stone. Dense low porosity grades are better suited for facing rooms. Among them there are red, green, blue and variegated.

Even dense tuff is relatively soft, it is easy to saw. Due to the simplicity of the processing it is widely used on the Apennine peninsula for the construction of low-rise buildings. In some countries the stone is imported, so it is used in elite finishing.

Quartzite

Quartzite refers to metamorphic rocks. It is formed from quartz sandstone under the influence of high pressures and temperatures. The average specific gravity is 2600 kg / m³. The main deposits are in the United States, Africa, Russia, and Eastern Europe. The extraction is conducted in an open way, which makes the cost of production cheaper. But quartzite of building quality is rare.

A set of small colours are: light gray tones, sometimes with yellow-brown impregnations

of iron oxides. Due to the high content of quartz (up to 90%), the mineral is chemically resistant, withstands heating up to 1770°C and constant exposure to moisture. Stone devoid of natural radioactivity has a wide range of applications in residential buildings. The durability of the quartz finish reaches 150-300 years. Baths, saunas, swimming pools are trimmed with treated slabs



Quartzite pool tile.

The gabbro stone is an intrusive crystalline rock. This material is based on plagioclase and gabbro rocks containing olivine and quartz, as well as apatite, magnetite, ilmenite and sphene in the form of accessory impurities. In addition, there are rocks that include nepheline, biotite and titanium magnet, the share of which is not more than 5%. Gabbro contains non-ferrous metals, sometimes their quantity reaches 40-50%. Gray-black, dark green, sometimes spotted, the gabbro has a texture of banded or porphyry-like arrangement of minerals. This is a material with parallelepipedal or stratum separate. The name of the natural stone came from the lat. "Glaber", which means "smooth".

Marble

Marble is formed by metamorphism of limestone. There are two varieties - almost pure calcite, and dolomite with a high content of magnesium. Specific gravity is 2300-2600 kg / m³. Stone is distributed in the Mediterranean, the Urals, China and Brazil. Up to 70% of world production falls on three countries: Spain, Italy and Greece.



Marble.

The colour is diverse due to the impregnation of oxides of transition metals. There are blue and green shades, which is not characteristic for other breeds. Black marble is considered the most rare and valuable. It is not difficult to choose colour to make a multicoloured mosaic.

Small elements of marble of regular shape are made inexpensively. Soft stone is easily processed. The production of large flat plates is limited only by the size of the blocks that occur in nature. With all the advantages, marble has serious drawbacks.



Marble mosaic.

These include:

- sensitivity to acids;
- poor moisture resistance and frost resistance;
- brittleness, dents and scratches form on the surface.

Traditionally, marble is used in the construction of massive structures, columns, for exterior decoration. This application is not justified even in a warm dry climate given the increased weathering. Inside, the marble finish is much more durable. Marble walls, floors, and bathrooms are made. But precautions are required: use only soft tools and non-aggressive detergents for cleaning. At the same time, marble can be easily restored when polished.



Marble fireplace.

Malachite

It is a beautiful green mineral. A characteristic colour is given to it by a high copper content. Due to the metal, the copper carbonate is heavy - the specific gravity is in the range 3700-4100 kg / m³. The main prey is concentrated in the African mountains (Congo). Small amounts of high quality stone remained in the Urals and Altai.

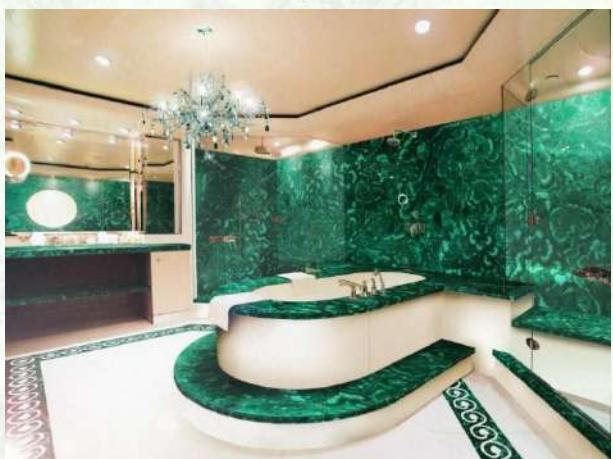


Malachite structure.

After the separation of semiprecious ornamental malachite remains a material with a fibrous structure, suitable for interior decoration of premises including wet, like bathrooms, except areas with regular direct water access (swimming pools, showers) places.

The surface of malachite is characterized by patterns in the form of undulating lines and closed circles. The colour of the different sections varies from light green to almost black.

Varieties of rich colour malachite with a beautiful pattern are highly valued in the stone market. Malachite is used for wall cladding, for the manufacture of countertops, as well as for manufacturing of various objects such vases, bowls, caskets and so on.



Bathroom decoration with malachite.



Interior decoration with malachite.

CHINESE STONE OF LIFE

Jade

History, characteristics and structure

Semiprecious Chinese stone of life jade is known since ancient times. Although it was confused for a long time with its mineralogical fellow - jadeite. The civilizations of ancient America valued this stone more than gold, and even earlier, it was used to make axes. Later, during the outbreak of the Middle Ages, another property of jade began to be valued: its supposed effectiveness in the treatment of renal diseases.

The aesthetic merits of the mineral, the play of light attracted attention as well. In Sumer and Akkad, jade was considered a magical source of happiness and tranquility. Ancient Chinese treatises indicate that he was associated with a prolonged or even unlimited time in life. And in the 13th century a special treatise was published - as many as 100 volumes and hundreds of colour images.

Jade is coloured in various colours - from white to green in the main, although occasionally there is also a yellow, and even a gray, almost black stone. If you hit the jade plate, you will get a nice and musical sound. This characteristic is almost uncharacteristic of minerals. The stone easily heals.



Various jade colours

Its brilliance does not weaken over time. Of course, the popularity of jade caused the influx of a large number of fakes. That is why many centuries ago the authors of publications about him noted that the main identification feature is the translucency. This jade must allow you to see through the flame of the fire.

Another significant difference of the stone is the phenomenal fortress compared to externally similar stones. The finger ring can only be made of jade. The loads experienced by jade product roughly correspond to the standard requirements for the strength of alloyed steel. High strength and viscosity of jade is due to its structure, but it is not capable of providing high hardness.



Jade structure

Application

In countries of southeast Asia, this mineral is used in the production of figurines, bas-reliefs, vessels for liquids and incense. There is a great demand for jade in the jewellery industry, where not only rings, but also pendants and bracelets learned from it. A promising although not yet developed the direction of the use of stone is the decoration of the elite buildings interiors and exteriors. Decorative products will fit in any interior,

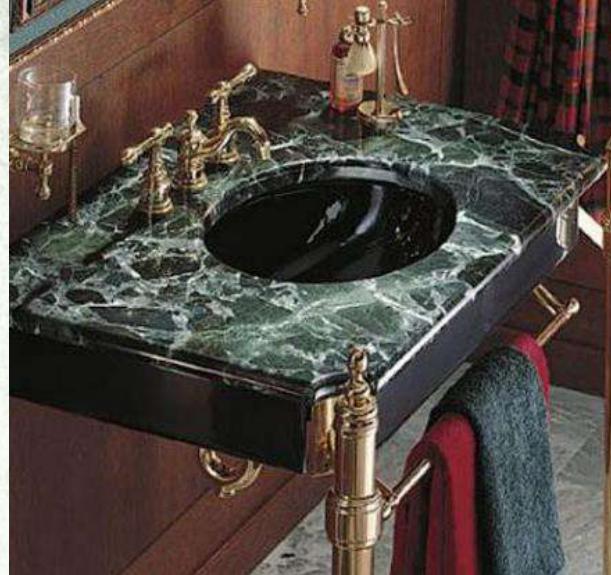


Picture from jade

Interior either in imitation of a rural house or in a state-of-the-art environment.

Mining

Already in the 17-18 centuries, nephrite was mined in significant quantities. Only from Myanmar to China 250 tons of stone were delivered every year. Gradually, its deposits were discovered in New Zealand and Switzerland, Central Asia and India, Italy and the Pamirs, Canada and the Southern Urals. These sources are unequal, and not only by the amount of mined raw materials, but also by its quality. The best jade is mined from the bowels of New Zealand, China and Canada. Since the 1970s, however, in terms of absolute figures for the production of high-quality jade, Australia ranks first. It should be



Bench top from jade

noted that the largest trading platform is in Burma, in the city of Mandalay.

It operates in the format of a conventional market, plus a very strong and illegal or semi-legal turnover in the adjacent territory.

Therefore, even approximately to estimate the amount of stone sold there is impossible. But it is known that at least 100,000 buyers come to the market daily, and over 99% of them are Chinese citizens.

Bucharda is a rough terrain, covered with tiny depressions, called so by the French name of a tool for such processing. The instruction is a needle hammer fastened to a circle, with high speed performing shock-rotational movements.



Dragon from jade



Jade block

Large reserves of jade are concentrated in the territory of the Canadian province of British Columbia. From this province $\frac{3}{4}$ of the total volume of the world market of this stone is supplied annually (in physical terms - 300 tons). The vast majority of supplies are shipped to Taiwan and China. There already tens of thousands of workers will convert the supplied mineral into various decorative products. According to the Canadian laws in the area of the Fraser River, in the territory designated by special government regulations, it is possible to engage in the jade mining without a license, but only with the use of hand tools. Industrial production is led by Jade West, one of the four largest companies in the world in this industry. The main mining of jade is carried out from 4 mines located 100 miles east of the border with Alaska.

Every year 120 tons of mineral mined.

The second most important jade mining centre is Myanmar. From the depths for up to \$ 15 billion of stone is mined. In this industry employs up to 30 companies, but the tax statistics outside the country are available only for Myanmar Gems Emporium. The total revenue of the state from the jade industry is approximately 400 million USD. The reasons for this discouraging situation are associated with the colossal preponderance of the illegal and semi-legal sector. Even according to the minimum estimates, the Myanmar official economy has recently received less than 1% of the total turnover of jade. In South Africa in the 1990s, 600 tons of jade were mined, but now, although there are a dozen companies in this industry, their total result does not exceed 100 tons.



Jade



A panel from jade

Rope saw - having the same function as disc bridge saw, rope saw is more versatile, feature-rich and efficient. Thus, the number of ropes (with a sufficient width of the drum) is practically unlimited, and the amount of tension and the individual arrangement of each of them can be regulated.

The advantages of rope-type sawing machines include:

- about 2 times higher the sawing speed than of a circular saw made of the same material and with the same abrasive used;
- almost 5 times lower energy consumption level (for a sufficiently long period of operation levelling the initial difference in cost with the disk);
- 2 times narrower strip of cut;
- the possibility of cutting stones in a wide range of strength, from marbles to gabbro-diabase;
- 3 times more economical water consumption;
- 20-30% less noise;
- the ability to process blocks in a larger range of linear dimensions;
- no need to spend on the most expensive part - the disk enclosure, as well as the periodic care of tapping new tooth segments in place of wear.

STONE CHARACTERISTICS

Granite, Marble and Engineered Stone

Parameter	Granite	Marble	Engineered Stone
Density (specific gravity)	2600 – 3000 kg/m3	1900 - 2800 kg/m3	2400 – 2500 kg/m3
Compressive strength	250 – 300 MPa	100 – 250 MPa	≈ 160 – 200 MPa
Moisture absorption	0.1 - 0,2%	0.3 – 1,0%	≈ 0.1%
Frost resistance (cycles)	50-200	25-100	≈ 50
Hardness (Mohs Scale)	6,5-7,0	3,5 – 4,0	6
Heating resistance	>400°C	<600°C	>400°C



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