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Higher Education in Function of Sustainable Development of Tourism in Serbia and Western Balkans

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## **BASALT APPLICATION PROSPECTS FOR TOURISTIC FACILITIES FURNISHING**

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**Abstract:** *This paper presents the results of the research referring to opportunities to apply basalt extracted from the "Vrelo" Kopaonik deposit in various productions and touristic facilities furnishing. Basalt is featured by a high level of aesthetic-decorative properties, it is easily machined and wear resistant. As it is also resistant to chemicals and frost, it can be widely used to furnish various touristic and traffic facilities. The properties and micro-structural characteristics of the basalt products are determined according to the conditions intended for their applications.*

**Key words:** *basalt, basalt products, touristic facilities*

### **1. INTRODUCTION**

Basalt is classified into magmatic rocks. It contains different minerals. Basalt has got good technical properties making it suitable for various commercial applications: it is used for the asphalt concrete aggregate production, as well as for production of wearing layer of the barriers for top speed railways and roads. It is suitable for any type of traffic loads. As mentioned above, it is featured by a high level of aesthetic-decorative properties, well scraping wear resistance, low water absorption and resistance to frost and to base and acid solutions. In architectural applications, it may be used as a building material for interior and exterior claddings. It can be also used for all kinds of hydro-technical works. Basalt cast is widely applied in mining, metallurgy and construction industry as a substitute for metallic materials (Simic, R., 2000., Prstic, A., 2005.).

### **2. BASALT MORPHOLOGY AND TEXTURE**

The shape, structure and texture of basalt are showing the way how basalt has reached the surface of the ground, whether by being spilled out in the sea or emerging after an explosive or volcanic eruption. The basalt formed in the open air circumstances creates three types of volcanic deposits: columns, plates and polygons. In case of submarine eruption, water cools it down creating some pillow-shaped plates and alike (Figure 1).



Basalt is created in columns when a thin lava layer is quickly cooled thus creating significant contraction forces which may lead to formation of small, variously sized columns. These may be easily treated at the same location where they were created. Once lava is erupted out of volcanic crater, it is quickly cooled and volcanic bombs are formed. Volcanic glass is made when lava is quickly cooled; due to a sudden temperature drop, the melt of lava and magma cannot crystallize so it gets solidified in a form of glass. Volcanic glasses are convenient for manufacturing different decorative products, souvenirs, etc. (Figure 2).



*a. plates*



*b. polygon structure*



*c. cut rock*



*d. "Vrelo" site*

**Figure 1.** Volcanic deposit types

Other forms of volcanic sediments – perlites, tuff, pumice – are quality building materials with significant applications. These have a small specific weight, extraordinary thermic-insulation properties, no water absorption, they are frost and chemically resistant. These sediments are used for production of coatings for inner and outer walls of facilities (as either a filter or filler), varnishes (glazes) for decorating ceramic products, sanitary cast productions and other (Simic R, 2002).



*Figure 2. Types of quickly cooled basalt- volcanic glass*

### 3. BASALT PROPERTIES AND APPLICATIONS

Basalt is used for plating roads, squares and pedestrians; for cladding facades, walls, openings; for staircases, interior floor plates; for decorative furniture (tables, pottery), Figure 3-4. It may be combined with ceramics to produce various pottery and souvenirs. Black volcanic rock is smooth; once it is heated up to 60 C, it is successfully applied in saunas and wellness centres for body treatment purposes (Prstic A, 2003, Andrić, Lj., 2012) .

As far as basalt is concerned, processing technology is an eco-friendly one, and the products obtained are not cancerous. Industrial applications include production of basalt wool, thin and super-thin basalt fibres, casted products, basalt plastics, anticorrosive materials used for traffic constructions and buildings, Figure 5. These products are used for heat insulation of pipelines, boilers, furnaces and other similar equipment ranging from extremely low to very high temperature values; they are used as fillers (for sound absorption purposes )in acoustic insulation devices; for production of thermically and acoustically insulated construction materials and for a number of refractory products. As there are some quality basalt deposits in Serbia, application prospects for basalt are interesting in terms of both economy and ecology.



*a. basalt-architectural rock*



*b. cut basalt for road applications*



*c. wall cladding with basalt*



*d. staircase erection*



*e. parking lot erection*



*f. traffic facility construction*

**Figure 3.** Construction industry applications - examples



a. basalt pottery



b. "English black basalt teapot, c.1810"



c. decorative pottery



d. sand stone souvenirs



e. basalt rock for hot massage



hot massage

**Figure 4.** Production of pottery, souvenirs, hot massage





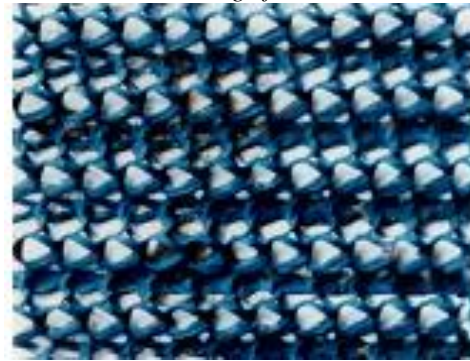
*a. concrete reinforcement*



*b. rough fibre*



*e. basalt canvas*



*f. basalt net*

**Figure 5. Basalt-based industrial products**

In quarries, basalt rock are either cut into slabs or milled. The plates can be produced by sintering or casting technologies. Due to their density and a complete lack of water absorbing ability, these plates are exceptionally wear and freeze resistant and durable; furthermore, they retain the colour infinitely. Plate surface may be treated either manually or mechanically, plates can be polished, various patterns may be applied. The edges are smooth, flat or rounded. Finally, these plates can be specially treated in order to get an ancient / aging look.

In order to discuss application prospects for the basalt extracted from the "Vrelo –Kopaonik" deposit, a seam basalt (from the deposit) and casted basalt (casted into molds at 1300 °C, thermically treated at 850 °C / 1 hour) have been analysed. The seam basalt is a compact, vital rock, dark green in colour, with no apparent fissures, the scratch is coloured grey. Mineral composition of the sample included: plagioclase, olivine, piroxene, spynele, magnetite, chromite.



Basalt cast is a compact, vital material with glassy and fluid structure; overlap is shell-like, extremely hard. Basalt cast contains transformed minerals of piroxene, spynele, glass mass and metallic minerals. A quality mineralogic sample analysis was carried out by means of a polarized microscope for permeated light, using petrographic preparations with minerals' indentification and analysis of the texture-structural relations. Mechanical and physical properties of basalt were tested according to the stones and rocks test standards pursuant to the following norms: SRPS B.B8.032, SRPS B.B8.012 i SRPS EN 1926.

#### 4. CONCLUSION

Based on the results obtained after examination of application prospects for the basalt extracted at the "Vrelo Kopaonik" deposit, it may be concluded that the basalt from this site has got the composition suitable for glass & ceramics - based basalt products.

These products are not cancerous, therefore they can be successfully introduced as a substitute for asbestos and metallic materials. Basalt processing technologies are eco-friendly ones, what is a very important fact from the aspects of economy, ecology and energy. The products made of this type of glass-ceramics can have a number of applications in construction and furnishings of both touristic and traffic facilities.

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