

Pyrolave Technical Information Sheet 09

Environmental Message

Volvic lava is considered extremely rare because the lava flows are located within the NATIONAL PARK of the AUVERGNE VOLCANOS with the extraction sites upon the flow being very small.

The lava in the Nugere crater is unique across the world & being of such quality & size that it permits enamelling & firing. All aspects of extraction are carefully monitored by Pyrolave as well as the French administrative departments.

Environmental limitations are stringently followed; - each extraction area is subjected to an << administrative authorization for extraction within a classified zone>> following a 2 year study of the zone. Respecting the rules of extraction is rigorously enforced. Environmental controls & inspections are frequent. Studies that record the impact upon the environment are carried out & restoration of the sites after extraction is compulsory.

The authorisation file includes the analysis & control of direct & indirect, temporary & permanent effects upon the environment & specifically a landscape study, a study on noise, dust & vibrations, hydro-geologic & hydrologic studies. The "developer" must prove that there is no risk of pollution due to hydrocarbon, organic or mineral waste.

These documents are not considered confidential & can be viewed upon request.

The annual extraction for a company like Pyrolave is the equivalent to an area of 50 mtrs x 10 mtrs high. We can guarantee a yearly yield of 10-20,000 m2 continually over a 20 year period in strict respect of the environmental rules.

The lava "quarries" are situated over the flow zone of Volvic mineral waters owned by Danone (1st European food industry group) who are equally stringent about the environmental risks.

Historic Perspective

The Volvic lava has been an important historic architectural stone in France for many hundreds of years. In the large cities close to Volvic (Riom, Clermont Ferrand, Lyon) you can witness many cathedrals, municipality buildings, schools, shops & public places constructed of natural lava building blocks, carvings & statutory through to simple walling.

The Michelin company based locally to the quarry were the first to identify & use Volvic lava for glazing having secured the contract to map France. These orientation maps can still be seen on the roadside after 150 years. The original art nouveau world famous "Metro" signs were also made of glazed lava as was the facade of the equally famous Samaritaine building in Paris which is still in place today.

The ancient lava quarries were a way of life & vital to the local economies. The stone being extremely heavy was very difficult to move long distances but such was the importance of the stone that Volvic railway station was built by the quarry owner to link into the national network & expand the market across France.

Pyrolave have built upon this early pioneering work & the enthusiasm & creativity of artisans in establishing a new & varied direction for the future of the stone in exporting glazed & natural lava to all of Europe, The USA, Australia and The Middle east.

The natural Volvic lava continues to be used as a flooring & paving stone, a material for construction (building blocks, lintels etc.) for carvings, staircases & fireplaces, industrial acid burning chimneys & as an open jointed rain-screen facade cladding.

The glazed lava is easily recognised as a design tool for kitchens & bathrooms, hotel & restaurant surfaces, public places, swimming pools & as a decorative external cladding (rain-screen or jointed).

The benefits of Pyrolave Volvic lava include;

Colour	Any colours can be achieved matching to RAL, PANTONE scales etc.
Size	From mosaics up to 3000 mtrs slabs.
Properties	Benefits of stone with the resistance of an enamel coating.
insulation	Excellent sound & heat insulation properties.
Applications	Interior & exterior, wet or dry, hot or cold - inert.
Chemical resistance	Stain & chemical resistant
Versatility	Product can be produced as a one off or production run.
Unique signature	Every order is unique in terms of colour, size & appearance.
Visually	Its used in areas where a high visual impact is required.
Crazing	Fine surface crazing being an inherent feature.
Aesthetics	Pleasing to the eye, cool to the touch.
Care & Maintenance	Easy to clean using household cleaners.
Fire	Class 0 fire rating (cannot burn nor omit toxic fumes).



Physical Properties

Volvic lava is resistant to all climatic conditions.
It is frost resistant.
No expansion from 0-100 degrees.
Average conductivity λ K cal (over) h.m. $^{\circ}$ C = 0.42
Average density 2.2
Average porosity (un-glazed) 22.4%
Compression resistance; 63 MPA
Flex resistance 19 MPA
Resistant to all acids except fluorhydric
Enamels are all colour fast - UV stable.
Surface crazing (enamelled lava)
Will not rot, crumble or delaminate.

Chemical Analysis	%
Silica (SiO ₂)	57.5
Alumina (Al ₂ O ₃)	17.4
Titanium (Ti)	1.5
Iron (Fe)	6.7
Manganese (Mo)	0.3
Calcium (Ca O)	4.2
(Mg O)	2.5
Sodium (Na ₂ O)	5.2
Potassium (K ₂ O)	3
Sulphur Dioxide (S O ₃)	0.4
Phosphorus (P ₂ O ₅)	0.4
Loss of weight if fired @ 1050 $^{\circ}$	0
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Total 99.3	

Production process

The randomly sized boulders of lava are lifted by crane from the flow in accordance with the natural shrinkage cracks. The block is then sliced into scants of varying thickness by diamond tipped saws. These scants are then cut to shape by either CNC or water jet cutting technology. All stone working tasks are then completed by a combination of CNC & by hand. The surface is refined by filling all of the microscopic holes & the stone with filler (with-out enamel) are bonded together during its first kiln firing cycle. This 8 hour firing creates enormous stress upon the stone after which it either continues to be glazed or discarded after inspection in the event of failure. Each piece is then rigorously sanded & polished as smooth as glass to remove all surface imperfections. An glaze undercoat (engobe) is then applied to the entire surface to neutralise the colour. This is left to dry naturally after which the second coating of coloured enamels are applied over the undercoat by hand. The pieces then re-enter the computer controlled kilns for a second & final firing cycle after which the pieces are grouped together for quality control purposes before being packed into rigid wooden crates with card & foam separators.

Testing Data

Due to the many varied applications for our product the following test procedures have been carried out as a direct result of client or project requirements. The testing centres are recognised testing centres or national laboratories & copies of the full test data certificates are available upon request or viewed on our website. In summary the results show that the lava either passes the tests outright or reveals excellent results generally exceeding the highest test standard.

Test	Standard	Applicable	Testing Centre
Modulus of rupture	ISO-10545-4	lava	Bologna- Italy
Determination of colour to light	DIN 51094	enamel	Bologna- Italy
Determination of chemical resistance	ISO-10545-13 § 8	enamel	Bologna- Italy
Determination of stain resistance (to white)	ISO -1045-14	enamel	Bologna- Italy
Determination of scratch hardness according to MOHs	EN101	enamel	Bologna- Italy
Determination of chemical resistance (glazed tile)	EN122	enamel	Bologna- Italy
Flex resistance	NF EN12372	lava	CEBTP- Paris France
Thermal conductivity	139-829	lava	National Lab. Paris, Fr.
Freeze resistance (upon 9 typical colours)	NF EN ISO 545-12	lava & enamel	SFDPParis, France
Light (impact) shock resistance (upon 9 typical colours)	An. 7 notes 3515 CSTB	enamel	SFDPParis, France
Stain resistance (upon 9 typical colours)	NF EN ISO 10545-14	enamel	SFDPParis, France
Thermal shock resistance (immersion on 9 typical colours)	NF EN ISO 10545-9	lava & enamel	SFDPParis, France
Thermal shock resistance (surface contact upon 9 typical colours)	NF EN 1183 method B	enamel	SFDPParis, France
UV light & colour fast test	DIN 51024	enamel	SFDPParis, France
Abrasion & anti-slip resistance testing	BSEN 1341 2000 Ann.D	enamel	Sandberg London UK
Impact - hard & soft body test	BS 8200:1985 Sct.7 Ap.G	lava	Taylor Woodrow UK
Cooking directly upon surface via induction	practical testing	lava & enamel	Induced Energy UK

Typical applications include

Glazed Lava

Rain Screen cladding
 Wall panels for extreme sites
 Capping pieces
 Faience cladding
 Stall risers
 Steam rooms
 Swimming pools
 Commercial counters
 Bar tops
 Served counters
 Laboratory counters
 Vanity tops
 Bath surrounds
 Shower trays
 Kitchen worktops
 Decoration
 Tables

Natural Lava (polished, honed, tumbled or bush hammered)

Rain Screen cladding
 Wall panels for extreme sites
 Capping pieces
 Faience cladding
 Stall risers
 Paving
 Flooring
 Chimneys
 Walling
 Construction
 Urban furniture

The glazed & natural lava is extracted & processed in France by the Pyrolave Group incorporating Pyrolave SA & Mallet SA.