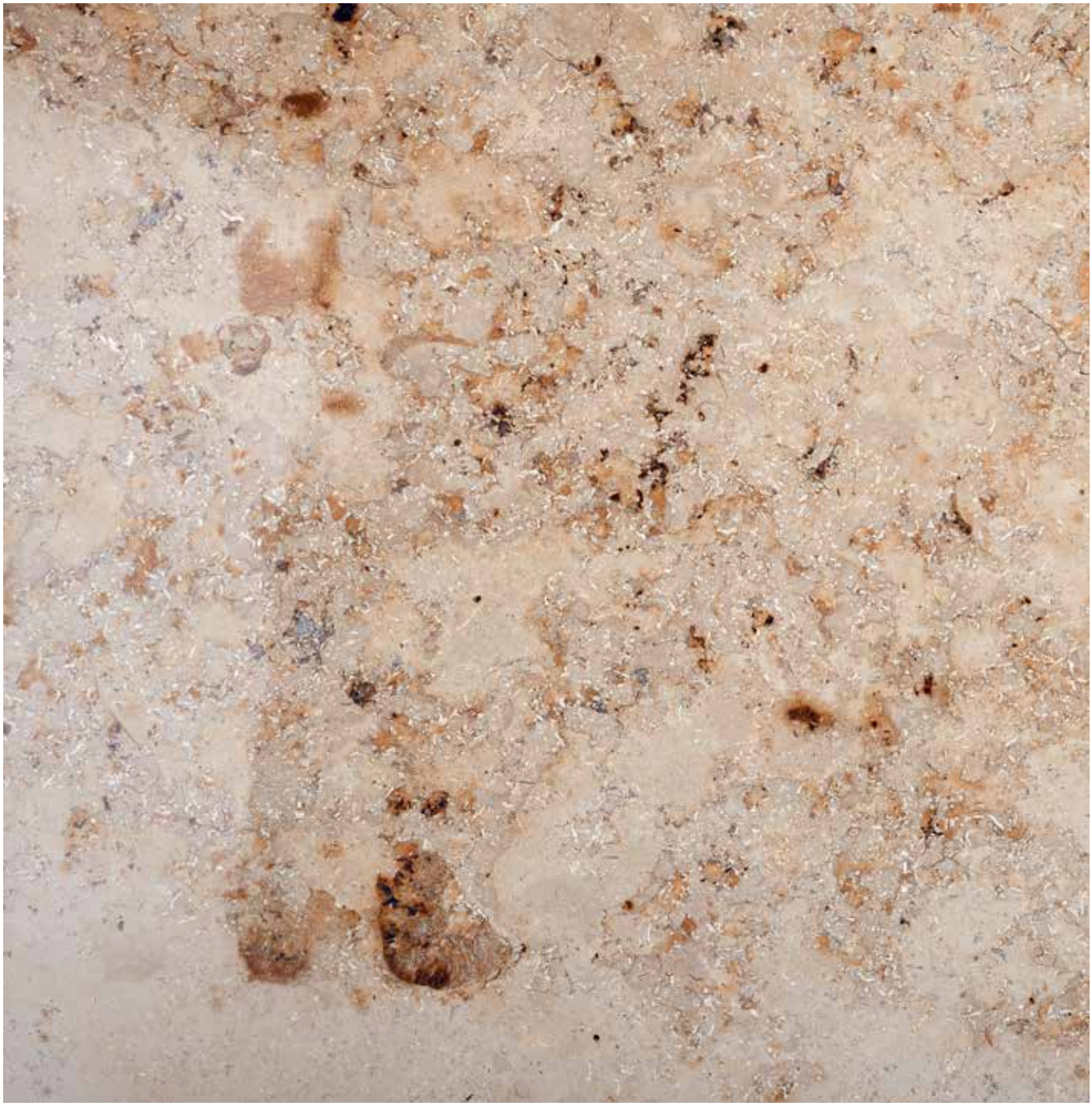
AKEMI®

Protection products for Jura limestone



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Stand V/24

1. Introduction

The protection requirements for impregnations can vary for Jura limestone depending on the layer and surface. In this series of tests, the protective effect of various AKEMI® protection products was tested on several Jura limestone layers, taking into account different surfaces. The AKEMI® protection recommendations for the respective Jura limestone layers can be taken from the results.

2. Tested stones with different surfaces

Layer	Surface	Application
1,3,5 (grey blue)	honed 220 grid sandblasted sandblasted and brushed	Indoors
10 (yellow)	honed 220 grid sandblasted sandblasted and brushed	Indoors
11 (yellow banded)	honed 220 grid sandblasted sandblasted and brushed	Indoors and outdoors
18 (yellow)	honed 220 grid sandblasted sandblasted and brushed	Indoors and outdoors
20 (grey)	honed 220 grid sandblasted sandblasted and brushed	Indoors and outdoors

3. AKEMI® Protection products

Outdoors	Indoors
Anti-Graffiti	Stain Repellent Nano-Effect
Graffiti Remover	Pearl Impregnator
Pre-Protect	Stain Repellent W
Rapid Impregnator	Duro Impregnator
Duro Impregnator	
Natura Impregnator	

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4. Areas of application

4.1 Graffiti Protection

Tests carried out

A total of six stone slabs of layer 18 with the three different surfaces (see table below) were used for this test. Of these, three slabs remained untreated and three slabs were protected with **AKEMI® Anti-Graffiti**. After two days, all panels were sprayed with spray paint in the colours red, yellow and silver. After another two days, the panels were first cleaned with steam jet only, then in combination steam jet and **AKEMI® Graffiti Remover** (see table below).

Layer	Surface	AKEMI® Protection Products	Result after cleaning
18 (yellow)	honed 220 grid	untreated	Paint residues present
18 (yellow)	honed 220 grid	Anti-Graffiti, Consumption: 45g/m²	Complete removal of the paint
18 (yellow)	sandblasted	untreated	Paint residues present
18 (yellow)	sandblasted	Anti-Graffiti, Consumption: 45g/m²	Complete removal of the paint
18 (yellow)	sandblasted and brushed	untreated	Paint residues present
18 (yellow)	sandblasted and brushed	Anti-Graffiti, Consumption: 45g/m²	Complete removal of the paint

Result

Figure 1: Slab (sandblasted) **without** AKEMI® Anti-Graffiti after cleaning with steam cleaner

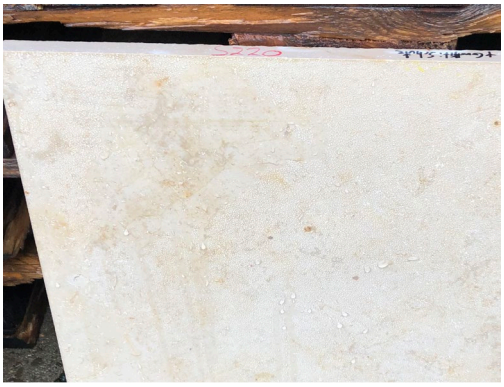

Figure 2: Slab (sandblasted) **with AKEMI® Anti-Graffiti** after cleaning with steam jet and **AKEMI® Graffiti Remover**

From the results it can be deduced that protection with **AKEMI® Anti-Graffiti** is a prerequisite for successful cleaning. Without this sacrificial layer, it is not possible to carry out a residue-free cleaning, as the paints can penetrate too deeply into the stone structure. To support the cleaning process, the use of **AKEMI® Graffiti Remover** is recommended. This allows spray paints to be removed effortlessly and in less time (see figures 1 and 2).

With the correct application of the products used, all surfaces tested could be cleaned without leaving residues.

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4.2 Protection for exterior façades

Tested protection products

The water-based products **AKEMI® Pre-Protect** and **AKEMI® Natura Impregnator** as well as the solvent-based products **AKEMI® Rapid Impregnator** and **AKEMI® Duro Impregnator** were used for the exterior. The products have a water- and dirt-repellent effect. An oil-repellent effect is usually not required in the façade area (except for 3-5 m upper edge floor height; see Test 4.3 Indoor application).

Tested stones and surfaces

Layer	Surface
11 (yellow-banded)	honed 220 grid
11 (yellow-banded)	sandblasted
11 (yellow-banded)	sandblasted and brushed
18 (yellow)	honed 220 grid
18 (yellow)	sandblasted
18 (yellow)	sandblasted and brushed
20 (grey)	honed 220 grid
20 (grey)	sandblasted
20 (grey)	sandblasted and brushed

Water penetration test

After application and a 48-hour curing period, the treated stones were subjected to a 24-hour water penetration test, using Karsten's tubes (see Figure 3).

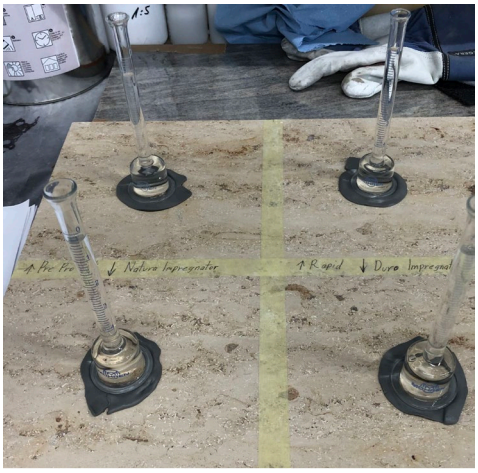

Figure 3: Karsten tube penetration test

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Result: Test winner => **AKEMI® Duro-Impregnator** and **AKEMI® Pre-Protect**

Layer	Surface	Untreated	Test winner 1 (solvent-based) Water absorption in ml with AKEMI® DURO Impregnator	Test winner 2 (water-based) Water absorption in ml with AKEMI® Pre-Protect
11 (yellow-banded)	honed 220 grid	1,5	0,2	0,1
11 (yellow-banded)	sandblasted	2,1	0,25	0,1
11 (yellow-banded)	sandblasted and brushed	1,5	0,2	0,1
18 (yellow)	honed 220 grid	0,2	0,15	0,1
18 (yellow)	sandblasted	0,7	0,3	0,1
18 (yellow)	sandblasted and brushed	0,4	0,15	0,2
20 (grey)	honed 220 grid	0,2	0,15	0,1
20 (grey)	sandblasted	0,6	0,2	0,2
20 (grey)	sandblasted and brushed	0,3	0,1	0,1

Since the façade panels are exposed to the weather and the surface can be heavily stressed as a result, additional QUV tests were carried out. The QUV test simulates exposure to sunlight, rain and dew. Water absorption was measured after various time intervals.

The following tables show the water absorption of the test winners (**AKEMI® Duro Impregnator** and **AKEMI® Pre-Pretect**) before and after weathering with a honed Jura 220 grid surface and compared with the untreated surfaces:

	Jura honed 220 grid								
Product	**AKEMI® Duro Impregnator**			**AKEMI® Pre-Protect**			**untreated**		
Layer	**L 11**	**L 18**	**L 20**	**L 11**	**L 18**	**L 20**	**L 11**	**L 18**	**L 20**
Before weathering	0,2	0,1	0,1	0,1	0,2	0,1	1,5	0,2	0,2
Water absorption after 100 h QUV in ml	0,2	0,1	0,1	0,1	0,2	0,1	-		
Water absorption after 200 h QUV in ml	0,1	0,1	0,1	n.a.*	0,2	0,1			
Water absorption after 300 h QUV in ml	0,2	0,1	0,2	0,1	0,4	0,2			

* sandy spot is weathered, value no longer determinable

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From the tests it can be deduced that the products **AKEMI® Duro Impregnator** and **AKEMI® Pre-Protect** are very well suited as impregnations for exterior façade panels. **AKEMI® Duro Impregnator** not only provides excellent hydrophobicity, but is the only product that, due to its special formulation, solidifies the limestone surface and makes it more weather-resistant, thus maintaining the protective effect for longer. As with all solvent-based products, **AKEMI® Duro Impregnator** requires an absolutely dry stone during application.

This is where the water-based **AKEMI® Pre-Protect** shows its strengths, as this product can also be applied to the substrate with residual moisture. The protective effect starts already 20 to 30 minutes after application (compare **AKEMI® Duro Impregnator**: 24 h waiting time). A disadvantage to the solvent-based **AKEMI® Duro Impregnator** is the lower penetration depth of **AKEMI® Pre-Protect** and thus a somewhat shorter lifetime of the protective effect caused by weathering.

The colour of the material is generally not changed with either product.

Conclusion:	If residual moisture is present	-> **AKEMI® Pre-Protect.**
	If top protection is necessary	-> **AKEMI® Duro Impregnator**

The two products **AKEMI® Pre-Protect** and **AKEMI® Duro Impregnator** are very well suited for the hydrophobing treatment of limestone façades. If the surfaces to be treated still have residual moisture, **AKEMI® Pre-Protect** is recommended. For excellent long-term protection, **AKEMI® Duro Impregnator** is best suited.

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4.3 Protection for indoor application

Tested protection products and rock layers / surfaces

Layer	Surfaces:	AKEMI® Protection Products
1,3,5 (grey blue)	honed 220 grid sandblasted sandblasted and brushed	Stain Repellent Nano-Effect Pearl Impregnator Stain Repellent W Duro Impregnator **+** Stain Repellent Nano-Effect*
10 (yellow)	honed 220 grid sandblasted sandblasted and brushed	Stain Repellent Nano-Effect, Pearl Impregnator Stain Repellent W Duro Impregnator **+** Stain Repellent Nano-Effect*
11 (yellow-banded)	honed 220 grid sandblasted sandblasted and brushed	Stain Repellent Nano-Effect Pearl Impregnator Stain Repellent W Duro Impregnator **+** Stain Repellent Nano-Effect*
18 (yellow)	honed 220 grid sandblasted sandblasted and brushed	Stain Repellent Nano-Effect Pearl Impregnator Stain Repellent W Duro Impregnator **+** Stain Repellent Nano-Effect*
20 (grey)	honed 220 grid sandblasted sandblasted and brushed	Stain Repellent Nano-Effect Pearl Impregnator, Stain Repellent W Duro Impregnator **+** Stain Repellent Nano-Effect*

*Combined application: First application with Duro Impregnator, after 24 hours waiting time second application with Stain Repellent Nano-Effect

Stain test

After a curing time of approx. 48 hours, a stain test was carried out with commercially available stain formers (water, coffee, cola, cooking oil). After an exposure time of 30 minutes, 2 hours and 6 hours, the protection against the substances was evaluated according to school grades.

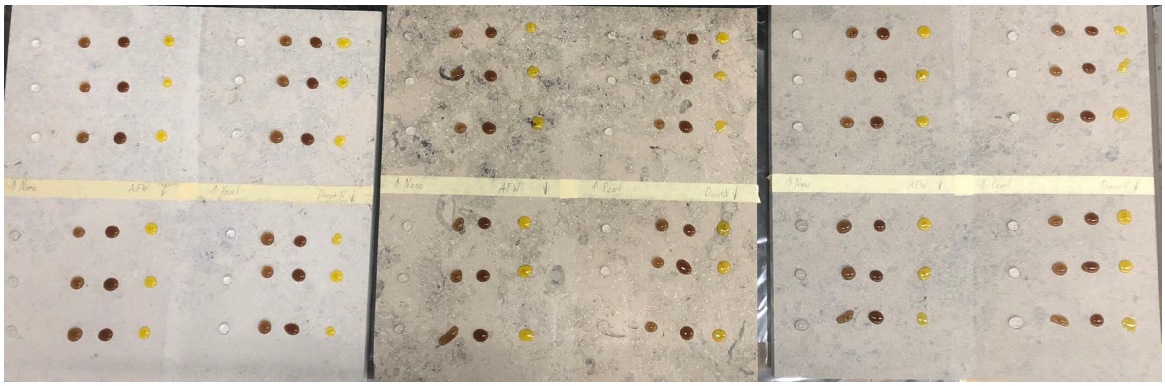

Figure 4: Stain test with different stain formers:
Top left **Stain Repellent Nano-Effect**, top right **Pearl Impregnator**; bottom left **Stain Repellent W**; bottom right **Duro Impregnator.**

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Result: Test winner => **AKEMI® Stain Repellent Nano-Effect** and **AKEMI® Stain Repellent W**

Layer	Surface	Test winner 1 (solvent-based) AKEMI® Stain Repellent Nano-Effect Test rating [1,2]	Test winner 2 (water-based) AKEMI® Stain Repellent W Test rating [1,2]
1,3,5 (grey blue)	honed 220 grid	1	2
1,3,5 (grey blue)	sandblasted	1	2
1,3,5 (grey blue)	sandblasted and brushed	1	2
10 (yellow)	honed 220 grid	1	1
10 (yellow)	sandblasted	1-2	1-2
10 (yellow)	sandblasted and brushed	1	1
11 (yellow banded)	honed 220 grid	1	1-2
11 (yellow banded)	sandblasted	1-2	1-2
11 (yellow banded)	sandblasted and brushed	1	1
18 (yellow)	honed 220 grid	1	2
18 (yellow)	sandblasted	1-2	1-2
18 (yellow)	sandblasted and brushed	1-2	2
20 (grey)	honed 220 grid	1	2
20 (grey)	sandblasted	1-2	2
20 (grey)	sandblasted and brushed	1-2	2

[1] Evaluated after 6 hours
[2] Evaluated according to school grades: 1 ≈ no stain visible, 2 ≈ stain barely visible, 3 ≈ … etc., 6 ≈ no protection

The test has shown that **AKEMI® Stain Repellent Nano-Effect** (solvent-based) is the suitable product for Jura limestone. It offers very good protection with minimal colour intensification.

As an alternative water-based product, **AKEMI® Stain Repellent W** is suitable. An advantage of **AKEMI® Stain Repellent W** is that it can also be used on substrates with residual humidity. The colour shade of the material may deepen slightly.

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5. Summary / Test winners:

Based on the results from the test series, the following AKEMI products can be recommended depending on the protection requirements:

Graffiti protection:	**AKEMI® Anti-Graffiti** A pH-neutral product with active ingredients dissolved in water.
Protection for façades:	**AKEMI® Duro Impregnator** Solvent-containing impregnation with solidifying effect for long-term hydrophobisation.
Stain protection for indoor application:	**AKEMI® Stain Repellent Nano-Effect** Solvent-based protective product with very good water-, oil- and grease-repellent properties.

6. Realisation:

The test series was carried out by Xaver Schöpfel (Application Technology) and Karl Heinz Wunsch (Research and Development).

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