

MUL CHOWK GATEKEEPER LIONESSE

Report of the Institute of Conservation (IoC), University of Applied Arts Vienna



Fig. 1: Overview of Mul Chowk Gatekeeper Lions, 2008 (© Stanislaw Klimek)

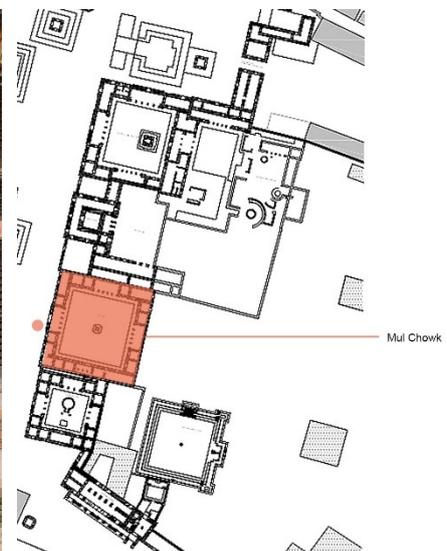


Fig. 2: Location within the Palace Complex

Data Sheet

Description

Mul Chowk is the main courtyard of the Royal Palace in Patan. Built in 1668 by King Sri Niwas Malla, it is the palace's heart as well as hub of its ritual activities. Its entrance is guarded by two stone lions, a male to the north and a female to the south. With a height of more than three metres, each of them is of imposing presence and underpins the importance of Mul Chowk. Similar to other stone sculptures in and around the palace, they consist of several small sandstone blocks.

Both lion sculptures are dated 1666, but were repaired multiple times. During one of these interventions, the lioness was dismantled and rebuilt using a cement-based mortar. Several stone blocks were replaced and a brick core was introduced.

The main problem prior to the conservation was the inadequate joint mortar. It was too dense for the surrounding stone and also partly missing, which caused increased water penetration. The high water retention ability of the brick core further impaired the situation and caused long-lasting wetness of the stone blocks. All these factors favoured biological growth and accelerated deterioration.

In addition to a faithful conservation carried out by stone conservators of the Institute of Conservation together with Nepali craftsmen, the overall structure of the lions was reinforced by inserting pins and clamps, primarily to increase their stability against earthquakes.

The conservation of the Gatekeeper Lion was undertaken by the KVPT similar to the Lioness.

Names	Mula Coka - / Mucuka - / Mul Chok – Lioness; Gatekeeper Lioness	
Dated	1666	
Measurements (H x W x D)	Height approx. 3 m	
Materials/Technology	Stone, mortar, brick	
Interventions (IoC)	Survey	2010-2011
	Mapping	2013
	Sampling	2013-2014
	Analyses	-
	Conservation	2011
	Maintenance	2014
Team (IoC)	Gabriela Krist, Manfred Trummer, Marija Milchin, Lisa Gräber, Martina Haselberger, Katharina Fuchs	
Academic Research (IoC)	Thesis by Katharina Fuchs	2014

Survey: Materials and Technology

- Lioness situated right when entering the Mul Chowk from the Darbar Square through the main gate
- Multi-part stone sculpture made of sandstone [1] blocks
- Built on top of brick steps, which are surrounding the Royal Palace
- Processing marks and carving visible on stone blocks



Fig. 3: Detail of ornamental carved stone, 2011



Fig. 4: Detail of formal and fine carvings, 2011



Fig. 5: Stone intrinsic layering, some carving detail, 2011



Fig. 6: Fine processing marks at the surface, 2011



Fig. 7: Rough processing marks within the structure, 2011

Previous (Conservation) Intervention

After 1950 (?)	Dismantling of sculpture (introducing a brick core and porous cement-lime mortar at the upper part and cement mortar for pointing joints)
Unknown	Repairs done (at least three) with cement-based mortars: pointing of joints with mortar and mortar applied on stone surfaces next to joints
Unknown	Revised stone carving without respecting the original carvings (probably due to the fact of having thicker joints after introduction of joint mortar, where former copal glue had been)
Unknown	Replacement of stone blocks by local stonemason

Survey: Condition and Causes of Decay (2011)

- Damaged and open joints
- Microbiological growth and growth of higher plants within damaged areas (cracked joints) and uncovered areas (overhanging roof only partly protects monument from rain water)
- Loose stone blocks
- High water retention of brick core keeps stones wet longer which favours microbiological growth



Fig. 8: Damaged and open joints, 2011



Fig. 10: Broken edge and biological colonization, 2011



Fig. 9: Damaged / open joints biological colonization, 2011



Fig. 11: Inappropriate application of joint mortar, 2011

Conservation (IoC)

- Dismantling of upper part, removing of the brick core
- Mechanical removing of joint mortar and mortar residues on dismantled blocks with glass fibre pencils, scalpel, hammer and chisel
- Opening of joints in remaining structure to a depth that allows a proper repointing
- Cleaning of all parts with (rain) water and brushes
- Biocide treatment (2% in water), three-time application
- Reassembling of dismantled parts and introducing inox clamps to create a kind of ring bracing in two different levels (earthquake reinforcement); in between vertically inserted inox needles interconnect stone block layers
- Exchange of highly damaged stones (new stone blocks were carved by KVPT)
- Former brick-filled core was left hollow (improved stability was provided by clamps)
- Repointing of joints by using a mortar based on lime and white cement as binding media (cement was necessary due to the continuous rain load on the front parts of the monument); scratching off the joints to surface level of the stone

Conservation Materials* and Recipes used:

- Alkylbenzyltrimethylammoniumchlorid Merck® (Sigma-Aldrich)
 - Inox clamps and needles
- Joint mortar:** 1 vol. part cement : 2 vol. parts lime : 6 vol. parts sand : 3 vol. parts brick dust
- white cement
 - slaked lime (pigmented)
 - pigments black (local) and green ('oxide pigments' - NCS S 7010-G10Y)
 - sand
 - brick dust

* Product / technical data sheets can be found in the supplement [A]



Fig. 12: During dismantling, brick core, 2011



Fig. 13: Upper part dismantled, 2011

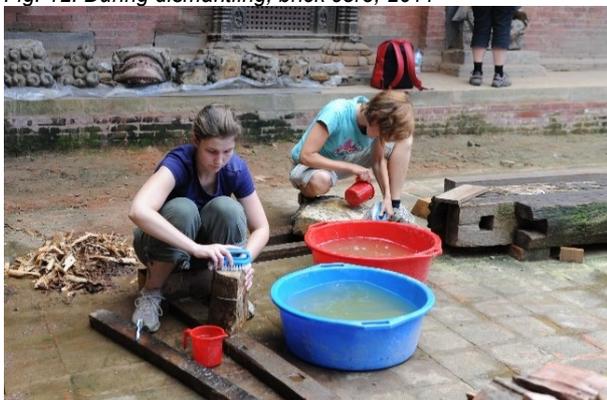


Fig. 14: Cleaning of stone parts, 2011



Fig. 15: Repointing joints, 2011



Fig. 16, Fig. 17, Fig. 18: Repointed joints, 2011



Fig. 19: Drilling holes for the inox needles, 2011



Fig. 20: Introduced inox clamps, 2011

Before and after Conservation



Fig. 21: Condition before conservation, 2010

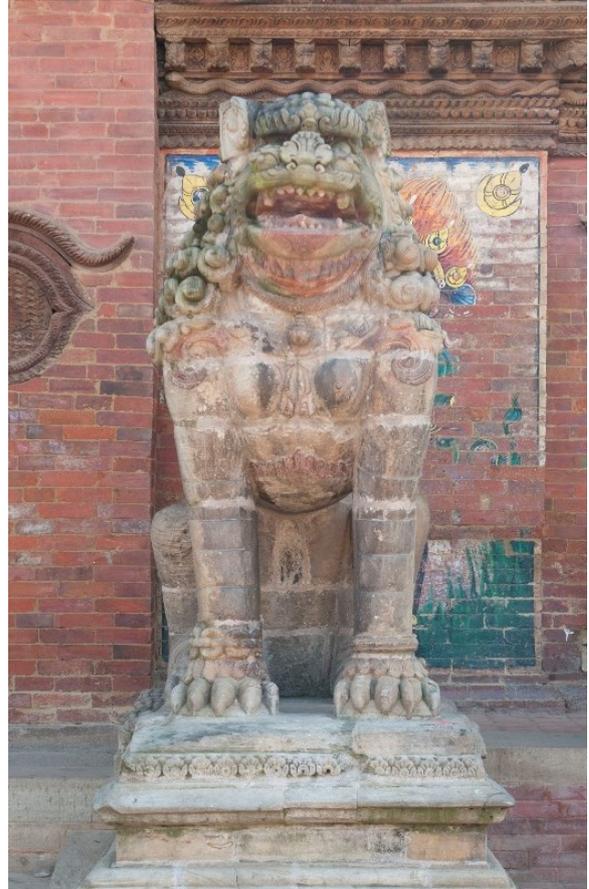


Fig. 22: Condition after conservation, 2013



Fig. 23: Condition before conservation, 2011

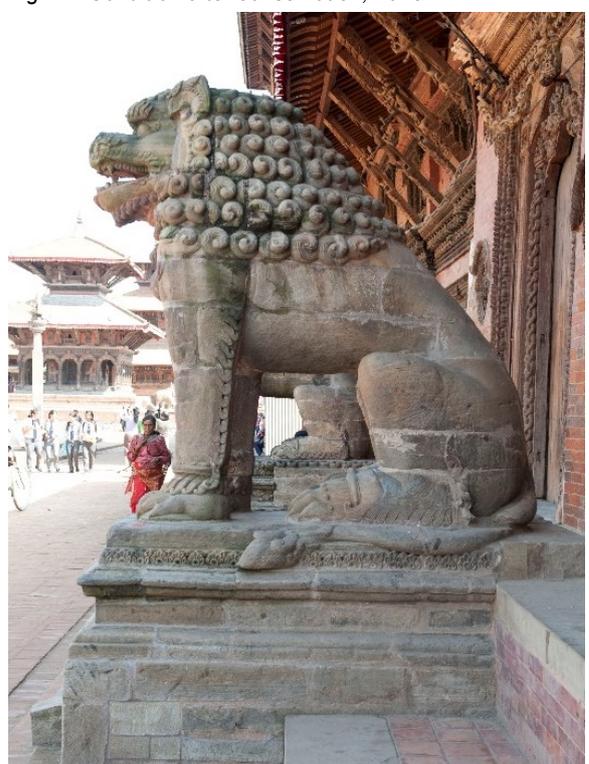


Fig. 24: Condition after conservation, 2013

List of Publications / Reports (IoC)

Fuchs, Katharina. 2014. "The Royal Palace in Patan, Nepal. Evaluation of the Conservation Treatments and Recommendation for a Maintenance Program." Unpublished Diploma Thesis, University of Applied Arts Vienna.

Supplements

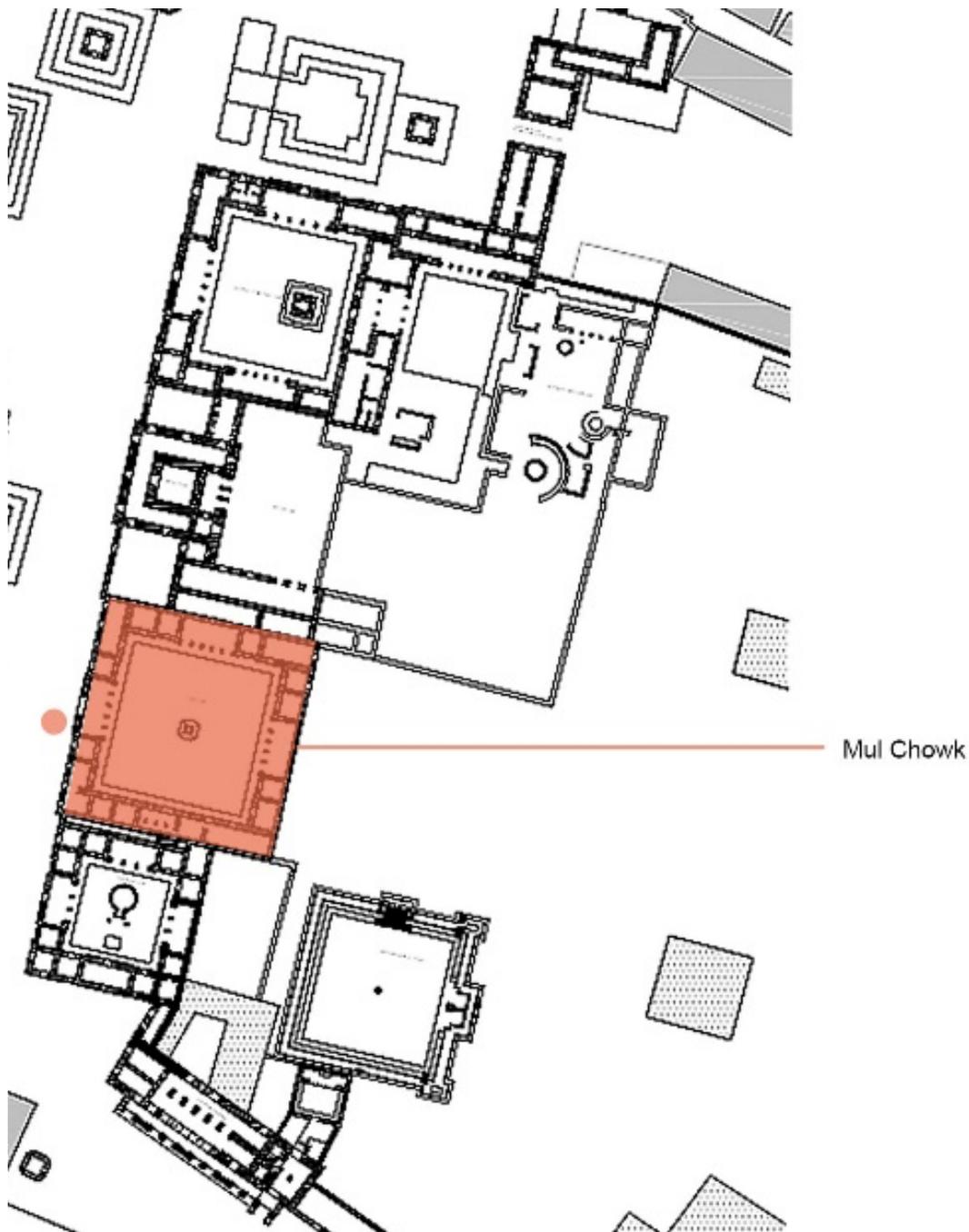
[A] List of all product / technical data sheets

[1] Detailed material characterisation - sandstone

Photo Credits

Unless otherwise stated, all photographs © Institute of Conservation, University of Applied Arts Vienna

GENERAL INFORMATION		
Monument Mul Chowk Lioness	Orientation -	Size (H x L x W) 300 cm (height)
Date of Production 1666	Location In front of Mul Chowk on Darbar Square	
Date of the last Treatment Conservation 2011; Maintenance 2014	Institutions of the last Treatment IoC	



Condition Assessment

Date of Evaluation

May 2024

Evaluation done by

Martina Haselberger

Fabian Sever

Sarah Moyschewitz

Recent Damages:

Stability Problems

Not detected

Major

Medium

Minor

Comment:

Broken / - into several Pieces

Not detected

Many

Some

Few

Comment:

Lose / Missing Parts

Not detected

Many

Some

Few

Comment:

Joints

Not detected

Open

Cracked

Many

Some

Few

Very few

Many

Some

Few

Very few

Comment:

Scaling, Sanding or Powdering

Not detected

Major

Medium

Minor

Thin scales on the right side and front foot with no salts visible.

Scaling may be caused by material-immanent problems.

Comment:

<input checked="" type="checkbox"/> Biological Colonization <input type="checkbox"/> Not detected	<input checked="" type="checkbox"/> Microbiological Growth	<input type="checkbox"/> Major	
		<input type="checkbox"/> Medium	
		<input checked="" type="checkbox"/> Minor	Only partially, mostly in the curls of the mane
	<input checked="" type="checkbox"/> Mosses	<input type="checkbox"/> Major	
		<input type="checkbox"/> Medium	
		<input checked="" type="checkbox"/> Minor	In the curls of the mane
<input type="checkbox"/> Higher Plants	<input type="checkbox"/> Major		
	<input type="checkbox"/> Medium		
	<input type="checkbox"/> Minor		

Comment:

<input checked="" type="checkbox"/> Mechanical Damage <input type="checkbox"/> Not detected	<input type="checkbox"/> Abrasion	<input type="checkbox"/> Major	
		<input type="checkbox"/> Medium	
		<input type="checkbox"/> Minor	
	<input checked="" type="checkbox"/> Other	<input type="checkbox"/> Major	
		<input type="checkbox"/> Medium	
		<input checked="" type="checkbox"/> Minor	Scratches are probably due to harsh cleaning with stiff brushes

Comment:

<input type="checkbox"/> Salt Deterioration <input checked="" type="checkbox"/> Not detected	<input type="checkbox"/> Efflorescence	<input type="checkbox"/> Major	
		<input type="checkbox"/> Medium	
		<input type="checkbox"/> Minor	
	<input type="checkbox"/> Subflorescence	<input type="checkbox"/> Major	
		<input type="checkbox"/> Medium	
		<input type="checkbox"/> Minor	

Comment:

<input checked="" type="checkbox"/> Soiling <input type="checkbox"/> Not detected	<input type="checkbox"/> Heavy	
	<input type="checkbox"/> Medium	

	<input checked="" type="checkbox"/> Light	The object seems to have been maintained/cleaned recently.
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Comment:

<input type="checkbox"/> Other	Comment:
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Evaluation of the Condition

good (no need for treatment)

satisfactory (some minor treatments necessary)

unsatisfactory (major conservation measures necessary)

Conclusion

PHOTO DOCUMENTATION

Condition at Evaluation Date



Fig. 1-4: Condition in 2024.



Fig. 5: Cracked and open joint.



Fig. 6: Darkened crust and scaling on stone surface.

[A] Product Data Sheets – Links¹ to Suppliers/Manufacturers

AEROSIL® 200

https://products.evonik.com/assets/or/ld/AEROSIL_200_TDS_DE_DE_TDS_PV_52043839_de_DE_WORLD.pdf

Aviva Silikat Grundierung

https://www.adler-lacke.com/Canto/tmb/aviva-silikat-grundierung_tmb_4079_de.pdf

Alkylbenzyltrimethylammonium chloride

<https://www.sigmaaldrich.com/AT/en/sds/mm/8.14858?userType=anonymous>

KluceI™ EF

<https://www.kremer-pigmente.com/elements/resources/products/files/63701-63713.pdf>

Aviva Tirokat-Color, Adler

https://www.adler-lacke.com/Canto/tmb/aviva-tirokat-color_tmb_4087_de.pdf

Mixtion Le Franc, Kremer

<https://shop.kremerpigments.com/elements/resources/products/files/98000e.pdf>

Waxes, Deffner und Johann

https://deffner-johann.de/media/datasheets/4186000/EN/Zusatzinformation_Wachse_DE_DJ.PDF

Injection mortar HFX

https://productdata.hilti.com/APQ_HC_RAW/ASSET_DOC_7567931.pdf

Kölner Classic Ölmixtion 3h; 12h; 24h

<https://www.kolner-vergolderprodukte.de/produkte/koelner-oelmixtion/>

KSE 500 E

https://media.remmers.com/celum/export/documents/Remmers_0715_KSE-500-E-_Technisches-Merkblatt_de_DE_26355.pdf

Lascaux 498 20 X acrylic adhesive

[https://deffner-](https://deffner-johann.de/media/datasheets/2051100/DE/2051100_Technisches%20Datenblatt_Lascaux%20Acrylkleber%20498%2020%20X_DE_DJ.pdf)

[johann.de/media/datasheets/2051100/DE/2051100_Technisches%20Datenblatt_Lascaux%20Acrylkleber%20498%2020%20X_DE_DJ.pdf](https://deffner-johann.de/media/datasheets/2051100/DE/2051100_Technisches%20Datenblatt_Lascaux%20Acrylkleber%20498%2020%20X_DE_DJ.pdf)

Marble dust

https://www.kremer-pigmente.com/elements/resources/products/files/58500-58580_59001-59690.pdf

Natural hydraulic lime

<https://www.preservationworks.us/wp-content/uploads/2019/10/NHL-Datasheet-Lafarge-23.5.pdf>

Plextol B-500 (acrylic dispersion)

[https://deffner-](https://deffner-johann.de/media/datasheets/2556500/DE/2556500_Technical%20Data%20Sheet_Acrylic%20Dispersion%20B%20500_EN_DJ.pdf)

[johann.de/media/datasheets/2556500/DE/2556500_Technical%20Data%20Sheet_Acrylic%20Dispersion%20B%20500_EN_DJ.pdf](https://deffner-johann.de/media/datasheets/2556500/DE/2556500_Technical%20Data%20Sheet_Acrylic%20Dispersion%20B%20500_EN_DJ.pdf)

Primal® SF 016

[https://deffner-](https://deffner-johann.de/media/datasheets/2543001/DE/2543001_Technical_Data_Sheet_Primal_SF_016_DJ_EN.pdf)

[johann.de/media/datasheets/2543001/DE/2543001_Technical_Data_Sheet_Primal_SF_016_DJ_EN.pdf](https://deffner-johann.de/media/datasheets/2543001/DE/2543001_Technical_Data_Sheet_Primal_SF_016_DJ_EN.pdf)

AKEPOX® 2010

https://data.akemi.de/fileadmin/user_upload/products/productdocuments/TMB/Akepox_2010_TMB_D.pdf

¹ All links were last accessed on 13 May 2025.

EPO-TEK® 301-1

<https://www.epotek.com/docs/en/Datasheet/301-1.pdf>

Titebond Wood Glue

<http://sds.franklini.com/msds/1411.042k0nmo0020.pdf>

Paraloid™ B-72, Kremer

<https://www.kremer-pigmente.com/elements/resources/products/files/67400-67409.pdf>

Keim Granital®

https://www.keim.com/documents/de-AT/723/TM_Granital_DE-AT.pdf

[1]“Sandstone”	
Visual characteristics	<ul style="list-style-type: none"> - Fine and homogenous grain structure - Whitish to ochre colour
Samples taken (sample names and origin)	<ul style="list-style-type: none"> - KAT2, (Leiner 2010) Bhandarkhal Tank Pavilion Base (Fig. 3, 4) - KRP Original (Fuchs 2013), Stone Gate, Patan Darbar Square (Fig. 5–9) <p>Cross and thin sections of the samples were prepared and examined with light microscopy and SEM.</p> <p>Sources: Leiner, Susanne. 2010. "Der Pavillon am Bhandarkhal-Tank. Palastkomplex Patan, Nepal." Pre-thesis, University of Applied Arts Vienna. Fuchs, Katharina. 2013. "Bitumen Coating on Stone, a Nepalese Problem? The Conservation of Two Stone Relief Gates at the Nasal Chowk, Patan Royal Palace." Pre-thesis, University of Applied Arts Vienna.</p>
Petrographic/geological characterization	<ul style="list-style-type: none"> - quartz sandstone ("arkose" sandstone) - rich in feldspar - silica grains angular, interlocked and covered by layers of iron oxides/hydroxides and clay - clayey binder (contains mostly sheet silicates) - different amounts of iron-compounds with sheet structure - fine grained with average grain size of 50 µm, coarse grain fraction with 250 µm
Physical properties	<ul style="list-style-type: none"> - varying porosity but in general highly porous, 20–25% porosity (Leiner 2010, S. 62), intergranular porosity - capillary active - varying colours and weathering behaviour due to different clay and iron content - homogenous structure with some bedding - relatively soft
Use at Patan Darbar Square	<p>Scientifically confirmed:</p> <ul style="list-style-type: none"> - Stone Gates - Bhandarkhal Tank <p>By visual inspection only:</p> <ul style="list-style-type: none"> - Harishankara temple base - Vishveshvara temple base and elephants - Krishna Mandir - Tusha Hiti - Mul Chowk Lions
Origin of material	<ul style="list-style-type: none"> - unknown



Fig. 1: Visual inspection of the sandstone from Bhandarkhal Tank Pavilion Base, © IoC 2010.



Fig. 2: Visual inspection of the sandstone from Bhandarkhal Tank Pavilion Base, © IoC 2010.

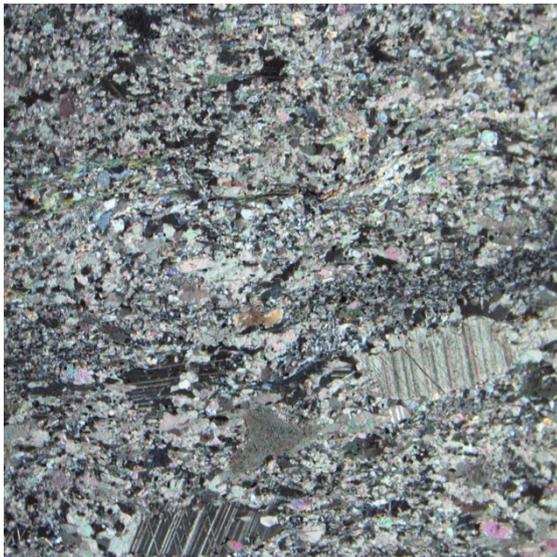


Fig. 3: Sample KAT2, thin section, optical microscopy, polarized light, x24.



Fig. 4: Sample KAT2, thin section, optical microscopy, transmitted light, x24.

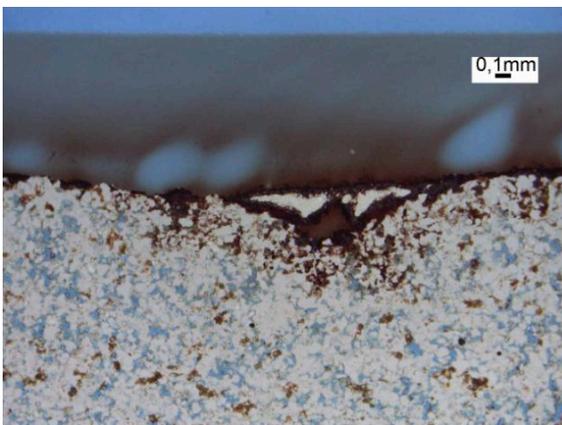


Fig. 5: Sample KRP Original, polished thin section, stereo microscope (Nikon SMZ 1500), reflected light, polarized light. The sample shows stone with bitumen coating.

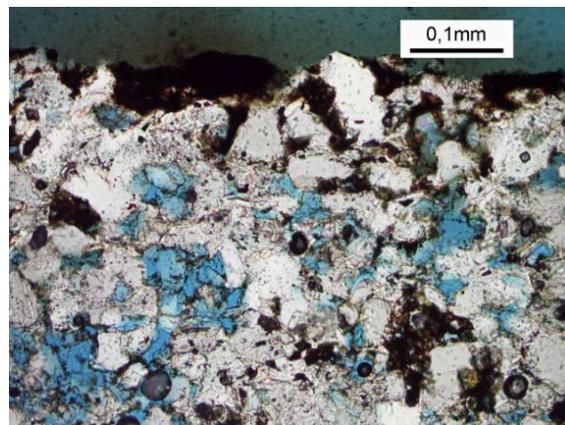


Fig. 6: Sample KRP Original, polished thin section, stereo microscope (Nikon SMZ 1500), reflected light, polarized light. The sample shows stone with bitumen coating.

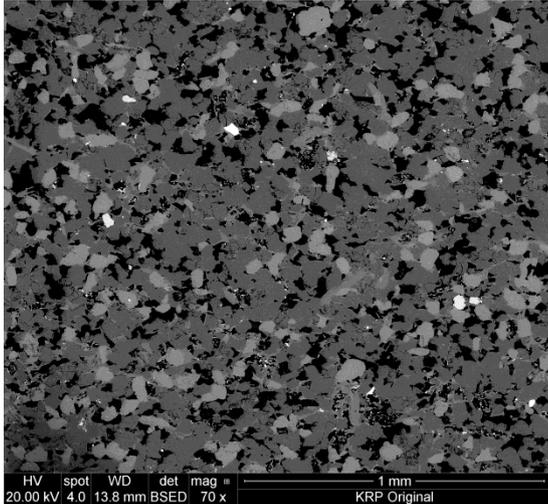


Fig. 7: Sample KRP Original, SEM; description: black = pores, dark grey = quartz, light grey = feldspar, white spots= Fe-(hydr)oxides.

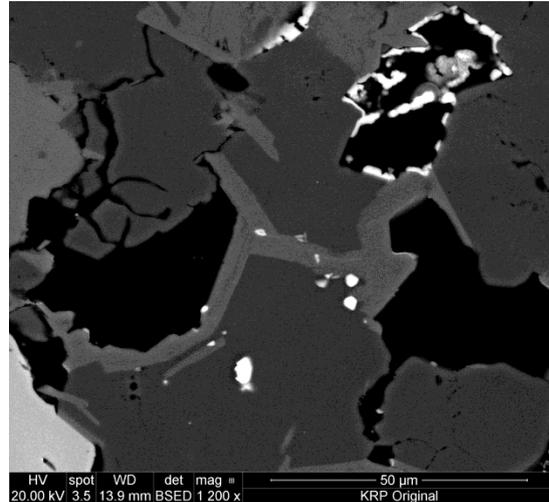


Fig. 8: Sample KRP Original, SEM; description: black = pores, dark grey = quartz, light grey = feldspar, white spots= Fe-(hydr)oxides.

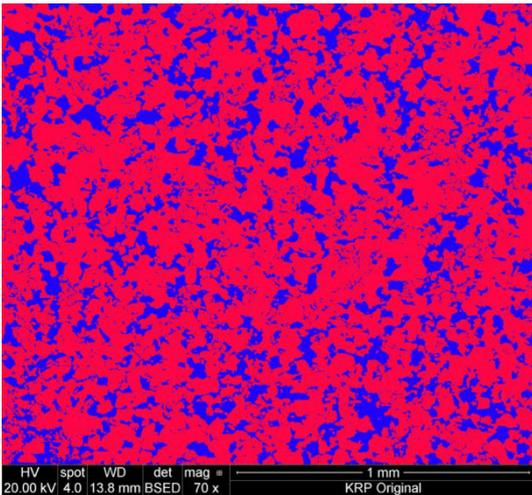


Fig. 9: Sample KRP Original, SEM photo of thin section in false colours (red = grains, blue = pores).