

GARUDA PILLAR

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



Fig. 1: Detail of Garuda with part of column, 2018

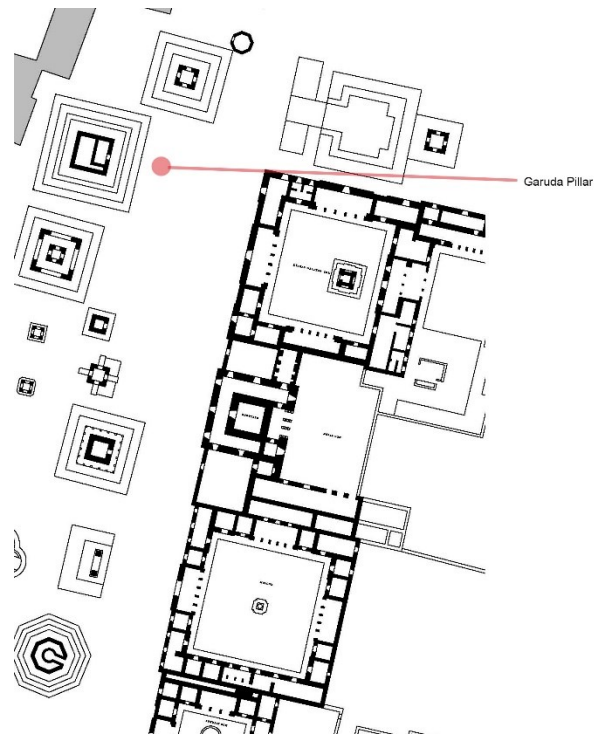


Fig. 2: Location within the Darbar Square

Data Sheet

Description

The pillar of Garuda on the Patan Durbar Square comprises not only an important element of Patan's architectural ensemble. Beside its cultural importance, it also represents an important living heritage. Garuda pillars are usually positioned in front of Vishnu temples as Garuda is the mount of god Vishnu. In addition, Garuda is considered the king of birds and Garuda together with lord Vishnu legitimize kingship. Therefore, Garuda pillars are mostly located not only in front of the entrance of the Vishnu temple but also in front of the entrance of Royal Palaces, as it is the case at the Patan Durbar Square. Garuda is depicted as a humanoid bird in an almost kneeling position, a depiction common in Nepal although differing to Indian Garudas.

Names	-
Dated	1637
Measurements (H x W x D)	Height without plinth and sculpture: approx. 6 m Stone pillar without plinth: 600 x 56,5 x 53,5 cm Plinth (made out of 4 stone blocks): 17 x 133 x 127 cm
Materials/Technology	Stone pillar, fire gilded copper sculpture
Interventions (IoC)	Survey 2018 Mapping - Sampling - Analyses - Conservation 2018 Maintenance -
Team (IoC)	Gabriela Krist, Marija Milchin, Katharina Fuchs, Martina Haselberger, Marina Paric
Academic Research (IoC)	-

Survey: Materials and Technology

Stone:

- Stone pillar consists of four parts (excluding the segmented square base): column shaft, two further elements forming a lotus flower, and the top part as a plinth for the Garuda sculpture
- All of these are made of calcite schist [2], except the plinth, which is made of fine-grained silicate sandstone [1]
- Parts of the pillar show carved ornaments
- Later introduced metal rings (at the top of the column shaft and at the stone plinth of Garuda

Sculpture:

- Multiple parts of fire-gilded metal form the Garuda sculpture



Fig. 3: Painted area at the shaft (all sides)



Fig. 4: Detail of tool marks and later introduced ring



Fig. 5: Metal ring at the column shaft



Fig. 6: Detail of carved ornaments



Fig. 7: Details of the feathers of Garuda

Previous (Conservation) Interventions

Unkown Application of thin metal ring around the plinth in order to stabilize the already weathered stone plinth

Survey: Condition and Causes of Decay (2018)

Stone:

- Soiling (loose deposits of dust and dirt, pigeons' droppings), particularly at the lower area of the pillar also wax stains, Tikka paste, and different kind of paper labels
- Graffiti and scratches in the lower areas
- Partial thin black crust on stone surface
- Open joints
- Small cracks
- Biological colonization at joints (moss)

Fire gilded metal elements:

- Soiling (loose deposits of dust and dirt, pigeons' droppings)
- Corrosion of iron rings, partial corrosion on fire-gilded metal sculpture
- Few cracks and holes within the metal parts
- Few scratches
- Few deformed elements
- Partly reduced gilding



Fig. 8: Applied labels at the lower area of column



Fig. 9: Moss growth within joint



Fig. 10: Small crack



Fig. 11: Crack at the plinth



Fig. 12: Partial black crust on stone



Fig. 13: Detail of metal part with hole



Fig. 14: Partly lost gilding



Fig. 15: Soiling on the head of Garuda

Conservation (IoC)

Stone:

- Dry cleaning (mechanical removal of loose deposits with brushes and spatulas)
- Combination of chemical-mechanical cleaning with detergent-solution in water by using brushes and non-woven web
- Filling of cracks with mortar based on natural hydraulic lime and sand
- Pointing of joints with a mortar based on natural hydraulic lime and different sands, mortar was applied above level and scratched off to the stone level after pre-curing
- Retouching of joint mortar in aqua sporca technique using dust particles and fine sand grains in water with 5% acrylic resin (Primal)

Fire gilded copper:

- Dry cleaned
- Wet cleaning by using detergent solution and brushes
- Mechanical removal of corrosion products on metal ring and sculpture
- Closing of cracks and holes in metal surface with epoxy resin (Akepox)
- Tightening and fixing the existing metal ring

Conservation Materials* and Recipes used:

- Akepox 2010 (Akemi)

- Primal® SF 016, Deffner&Johann

Pointing mortar: 1 vol. part lime : 2 vol. parts bore dust : 1 vol. part sand

- natural hydraulic lime NHL 3.5 LaFarge

- yellowish bore dust of local stone

- black marble sand (Schwarzes Marmormehl) 0-0.6 mm, Kremer Pigmente

Mortar for cracks: 1 vol. part lime : 1 vol. parts bore dust : 1 vol. part sand

- natural hydraulic lime NHL 3.5 LaFarge

- bore dust of local stone

- black marble sand (Schwarzes Marmormehl), Kremer Pigmente: 1 vol. part 0-0.6 mm and 1 vol. part 0.7-1.2 mm

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



Fig. 16: Mechanical cleaning of stone



Fig. 17: Mechanical cleaning with non-woven web



Fig. 18: Pointing joints



Fig. 19: Derusted metal ring, pointed joint



Fig. 20: Fixing and tightening the thin metal ring



Fig. 21: Wet cleaning of metal elements with brushes



Fig. 22: Filling of crack in plinth with mortar

Before and after Conservation



Fig. 23: Overview before conservation, 2018



Fig. 24: Overview after conservation, 2018



Fig. 25: Detail before conservation, 2018



Fig. 26: Detail after conservation, 2018

Supplements

[A] All product / technical data sheets can be found in this additional document.

[1] Detailed material characterisation - sandstone

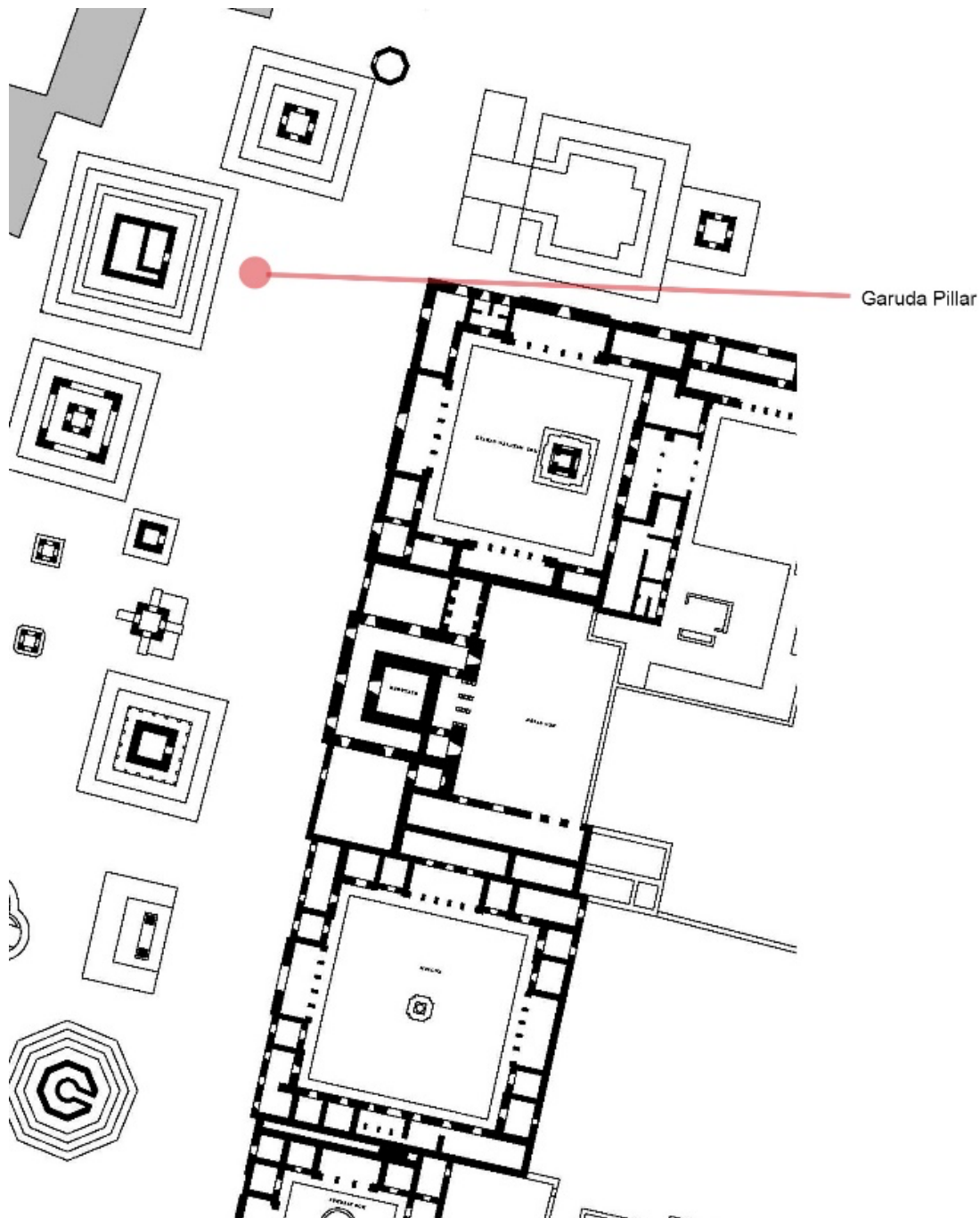
[2] Detailed material characterisation - calcitic schist

Photo Credits

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GENERAL INFORMATION

Monument Garuda Pillar	Orientation Sculpture facing Krishna Mandir	Size (H x L x W) 600 x 56,5 x 53,5 cm
Date of Production 1637	Location Between Krishna Mandir and Patan Museum	
Date of the last Treatment Conservation 2018	Institutions of the last Treatment IoC	



Condition Assessment

Date of Evaluation

May 2024

Evaluation done by

Martina Haselberger

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

Many

Some

Few

Cracked

Many

Some

Few

Comment: Retouching of joint mortar in *aqua sporca* technique using dust particles and fine sand grains in water with 5% acrylic resin (Primal), carried out in 2018.

Scaling, Sanding or Powdering

Not detected

Major

Medium

Minor

Scaling found at the corner of the lower shaft, also on the upper section on the south-east side.

Comment:

<input type="checkbox"/> Biological Colonization <input checked="" type="checkbox"/> Not detected	<input type="checkbox"/> Microbiological Growth	<input type="checkbox"/> Major	_____
		<input type="checkbox"/> Medium	_____
		<input type="checkbox"/> Minor	_____
	<input type="checkbox"/> Mosses	<input type="checkbox"/> Major	_____
		<input type="checkbox"/> Medium	_____
		<input type="checkbox"/> Minor	_____
	<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 checked="" type="checkbox"/> Medium	Fine scratches were found on all sides of the shaft of the pillar, from bottom to top (Fig. 1)
		<input type="checkbox"/> Minor	_____

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	Mostly in lower areas of the pillar, particularly human-caused soiling such as oil and greasy substances (Fig. 2)
Comment:		
<input checked="" type="checkbox"/> Other	Comment: Vertical crack running through the lower shaft on the south side	

Evaluation of the Condition

- good (no need for treatment)
- satisfactory (some minor treatments necessary)
- unsatisfactory (major conservation measures necessary)

Conclusion

Dark crusts on the stone, specifically under the lotus seat in the shape of drips (“Rinnsuren”) (Fig. 3).
Iron belt shows corrosion, but no rust stains are visible on the floor (Fig. 3)
Fine scratchings on the surface due to abrasive cleaning?
Pillar acts as perch for pigeons



Fig. 1: Scratches on the stone surface.

PHOTO DOCUMENTATION

Condition at evaluation date



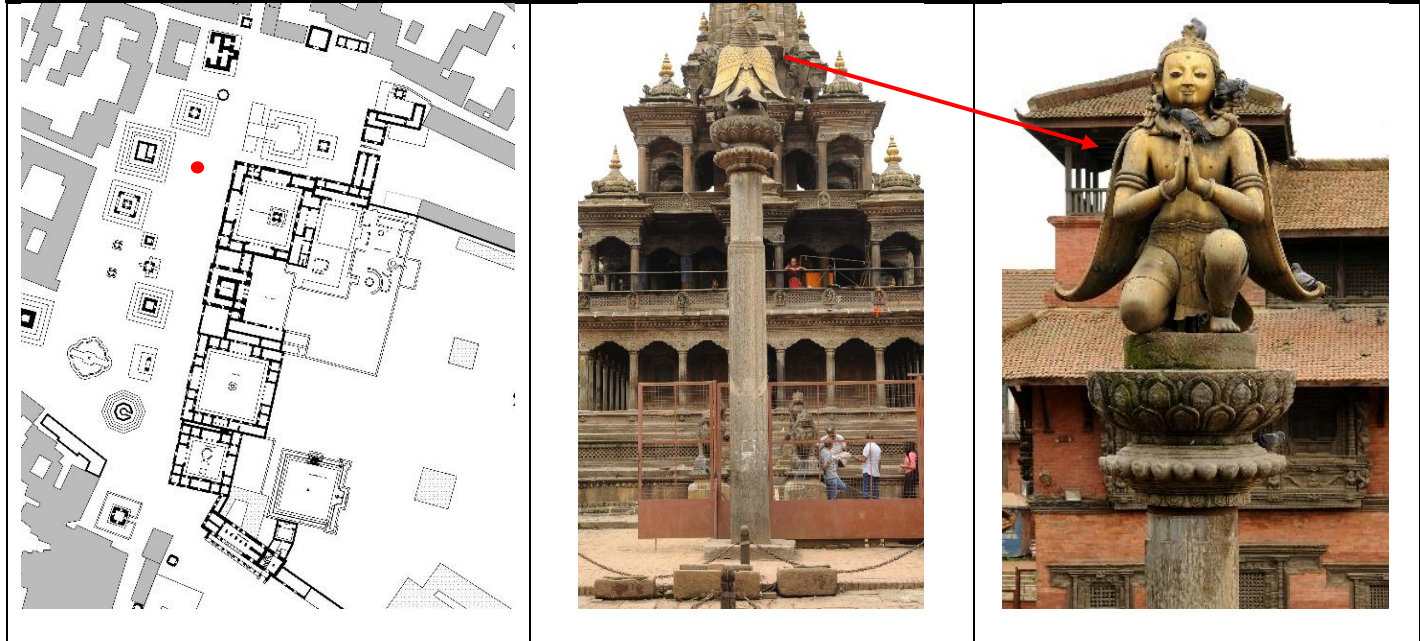
Fig. 2: Darkened area due to oil and other greasy substances.



Fig. 3: Dark grey drips under the lotus seat, and rusted iron rim.

GENERAL INFORMATION

Object / Monument Garuda sculpture	Orientation In front of Krishna Mandir	Size (H x L x W) -
Date of Production 1637	Location Patan Durbar Square	
Material and Technology - copper repoussé, fire-gilded - internal wrought iron substructure		
Date of the last Treatment Conservation 2018: see short report	Institutions of the last Treatment IoC	



EVALUATION

Date of Evaluation May 2024	Evaluation done by Meral Hietz, Katharina Mendl
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All descriptions from Garuda's perspective

Recent Damages:

<input type="checkbox"/> Stability Problems	<input type="checkbox"/> Major
	<input type="checkbox"/> Medium
	<input type="checkbox"/> Minor

Comment:

<input type="checkbox"/> Broken / - into several Pieces	<input type="checkbox"/> Many
---------------------------------------------------------	-------------------------------

	<input type="checkbox"/> Some <input type="checkbox"/> Few		
Comment:			
<input type="checkbox"/> Lose / Missing Parts	<input type="checkbox"/> Many <input type="checkbox"/> Some <input type="checkbox"/> Few		
Comment:			
<input type="checkbox"/> Cracks / Holes	<input type="checkbox"/> Many <input type="checkbox"/> Some <input type="checkbox"/> Few		
Comment:			
<input type="checkbox"/> Deformation / Dents	<input type="checkbox"/> Major <input type="checkbox"/> Medium <input type="checkbox"/> Minor		
Comment:			
<input checked="" type="checkbox"/> Abrasion / Worn out Gilding	<input type="checkbox"/> Major <input type="checkbox"/> Medium <input checked="" type="checkbox"/> Minor	- Especially on upper thighs and left knee - Also on lower arms, lower thighs, jewellery, crown decoration, hind end of the three wings (especially on tail feather), middle fingertips (black copper visible)	
Comment:			
<input checked="" type="checkbox"/> Corrosion	<input type="checkbox"/> Major <input type="checkbox"/> Medium <input checked="" type="checkbox"/> Minor	- Darkening especially on tail feather and legs - Also on chest, arms, shoulders (gutter-shaped) and jewellery - Green corrosion not visible from afar	
Comment:			
<input checked="" type="checkbox"/> Soiling	<input checked="" type="checkbox"/> Dust	<input checked="" type="checkbox"/> Heavy <input type="checkbox"/> Medium <input type="checkbox"/> Light	- Matt appearance of the whole surface due to dust layers
	<input checked="" type="checkbox"/> Dirt	<input checked="" type="checkbox"/> Heavy <input type="checkbox"/> Medium <input type="checkbox"/> Light	- Heavy soiling due to numerous bird droppings (especially on upper thighs, but also on arms, right bangle, chest, snake, head and wings)

Blood

Heavy

Medium

Light

Comment:

Evaluation of the Condition

- good
- satisfactory
- unsatisfactory

Conclusion

In general, the condition of the object was judged to be satisfactory. Due to inaccessibility, details of conservation work could only be assessed using binoculars. Unfortunately, due to the lack of direct access, it has not been possible to assess the adhesive securing (e.g. closing cracks and holes) with epoxy resin.

The surface treatments have proven to be stable over time. The appearance of the sculpture is very matt due to heavy dirt deposits. Countless birds sit on the object every day. As a result, the surface also shows worn gilding and therefore extensive darkening in exposed areas (e.g. upper thighs, hind end of the wings). Deposits (soiling and especially bird droppings) are also a major cause of corrosive reactions. In this respect, maintenance is the key to the long-term preservation of the sculpture. Regular cleaning and removal of bird droppings must be considered by the local community as the most important factor in long-term conservation. Where citric acid is used to chemically reduce corrosion, it is essential that the surface is thoroughly rinsed after cleaning, as acidic residues accelerate corrosive reactions.

PHOTO DOCUMENTATION



Fig. 1: Garuda sculpture after conservation, 2018

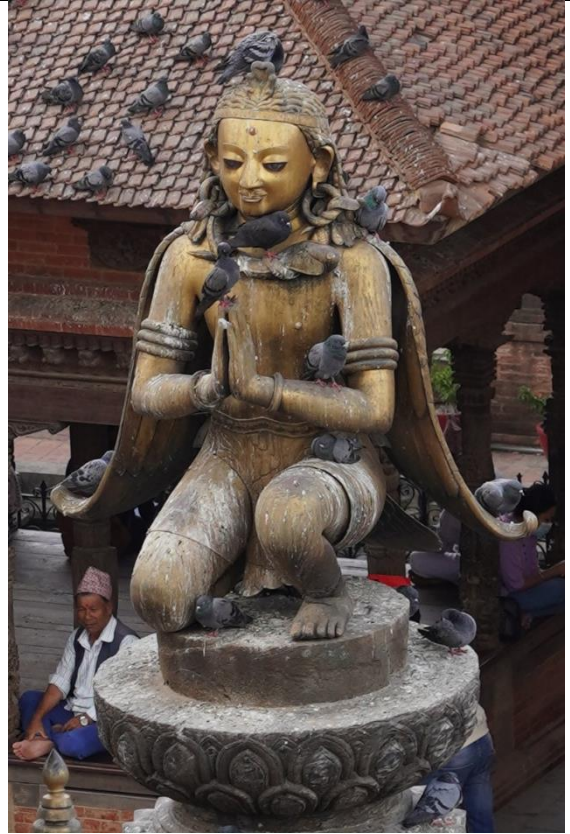


Fig. 2: Garuda sculpture, front, in May 2024



Fig. 3: Garuda sculpture, side view, in May 2024



Fig. 4: Garuda sculpture, back, in May 2024

[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

Köln 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

[2]“Calcitic schist”

Description of visual characteristics	<ul style="list-style-type: none"> - light grey to almost black colour - occasional white inclusions with reddish center - characteristic schist surface with homogeneous foliation and inclusions
Samples taken (sample name and origin)	<ul style="list-style-type: none"> - KAT1 (Leiner 2010), Bhandarkhal Tank Pavilion Base (upper covering) (Fig. 3, 4) - P06, P07 (Kaipf 2017), Yoganarendra Pillar (Fig. 5–16) - NEP_ST_1 (Haselberger/Fuchs 2023), loose material around Royal Garden workshop (Fig. 17–22) <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. Kaipf, Luis. 2017. “The Pillar of Yoganarendra Malla. Condition Survey, Conservation Treatment and Re-erection.” Pre-thesis, University of Applied Arts Vienna. Johannes Weber, Katharina Fuchs, Martina Haselberger. 2023. Scientific investigation of the stone sample NEP_ST_1 from Patan Royal Garden Workshop. Unpublished report, Institute of Conservation, University of Applied Arts Vienna.</p>
Petrographic/geological characterization	<ul style="list-style-type: none"> - weakly metamorphic schist, predominantly calcareous - high concentration of silicates arranged in foliations, surrounded by a very fine-grained siliceous marble - homogenous matrix and slight banding - average grain size of major calcite crystals between 0.03–0.05 mm; 0.05–0.25mm for silicate crystals - minor components of Phlogopite mica (grain size 0.1–0.2mm) - grain borders linear or curved - analyzed sample displays shear zone of ore minerals or graphite
Pyhsical properties	<ul style="list-style-type: none"> - relatively dense and heavy material - almost no water absorption
Damage patterns	<ul style="list-style-type: none"> - (hair) cracks and loss of material due to mechanical stress – probably stone intrinsic due to metamorphosis - almost no water related damage
	<p>Scientifically confirmed:</p> <ul style="list-style-type: none"> - Pillar Yoganarendra Malla - Bhandarkhal Tank Pavilion Base (upper covering)

<p>Use at Patan Darbar Square:</p>	<p>By visual inspection only:</p> <ul style="list-style-type: none"> - Lion Pillar - Garuda Pillar - Harishankara Temple Base (cornerstones with lion protomes, inner threshold) - Kings Throne - Stone Gates (inner profile) - Tusha Hiti - Visveshvara Temple Base (cornerstones with lion protomes, inner threshold)
<p>Probable origin of material:</p>	<ul style="list-style-type: none"> - Probably mined in the Kathmandu Valley – the alluvium filled Kathmandu Valley is bordered by a sequence of unmetamorphosed to slightly metamorphosed sedimentary rock in the east, south and west - Most probably from the southern part of the Kathmandu Valley, according to the geological map (Himalayan Maphouse [Ed.] Comprehensive Geological Map, GL701), possibly associated with the Chandragiri Formation. - According to the map, the stone from the Chandragiri Formation is defined as following: <i>“light fine grained crystalline limestones partly siliceous thick to massively bedded white quartzites in upper parts. Wavy limestones contain late ordovician schinoderms.”</i>



Fig. 1: Upper stone covering of Bhandarkhal Tank Pavilion Base, © IoC, 2010.

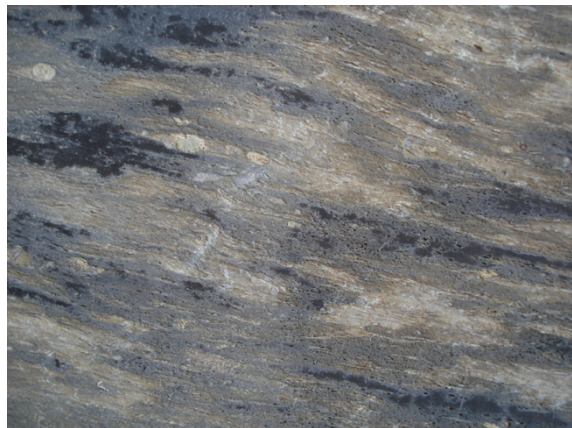


Fig. 2: Visual inspection of stone from Yoganarendra Malla Pillar, © IoC, Kaipf, 2017.

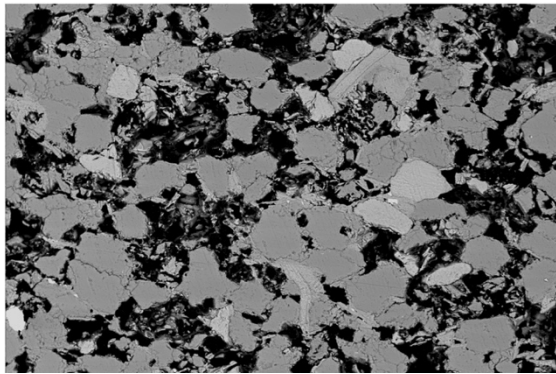


Fig. 3: Sample KAT1BS1, thin Section, SEM BSE.

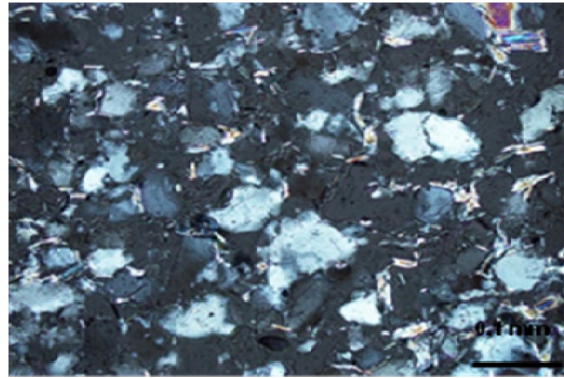


Fig. 4: Sample KAT1, thin section, optical microscopy, x200.

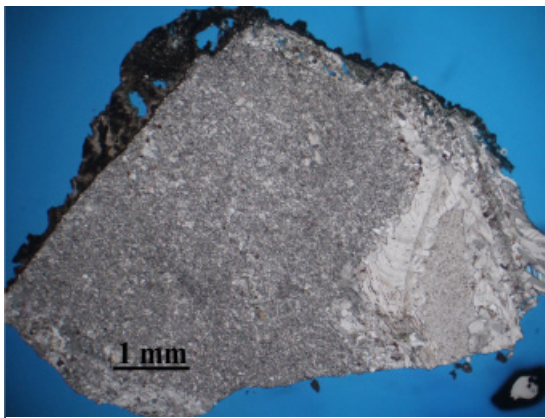


Fig. 5: Sample P06, thin section, optical microscopy, x24.

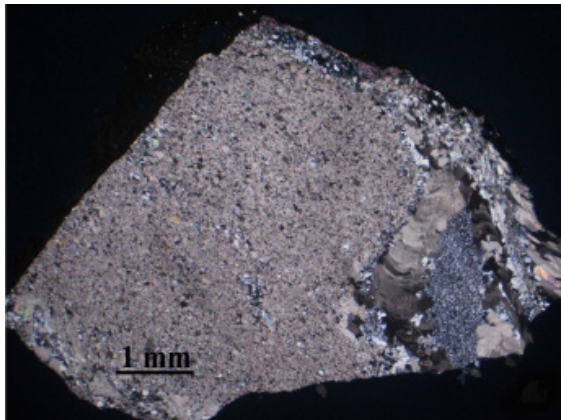


Fig. 6: Sample P06, thin section, optical microscopy, x24.

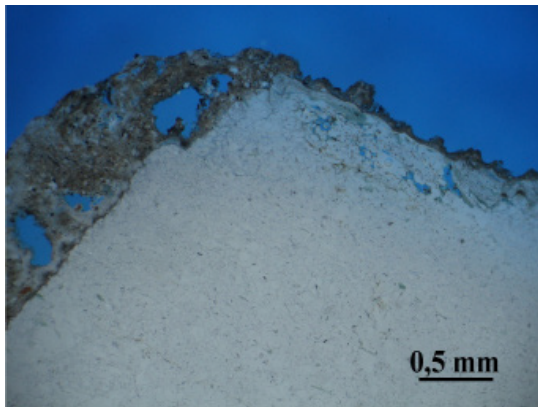


Fig. 7: Sample P06, thin section, optical microscopy, x48.

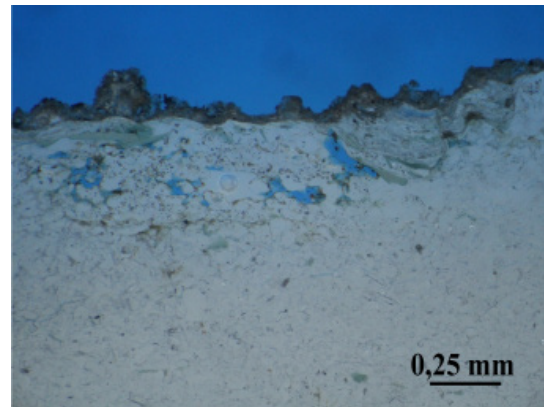


Fig. 8: Sample P06, thin section, optical microscopy, x48.



Fig. 9: Sample P07 taken in 2016, Lotus ring, Pillar of Yoganarendra Malla, Kaipf 2017.

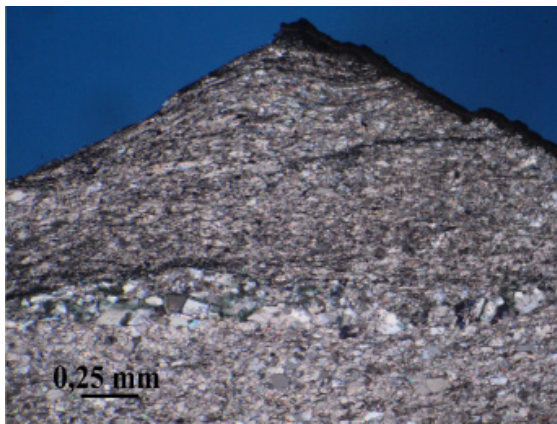


Fig. 10: Sample P07, thin section, x72. Fabric with relatively homogenous matrix and slightly developed banding.

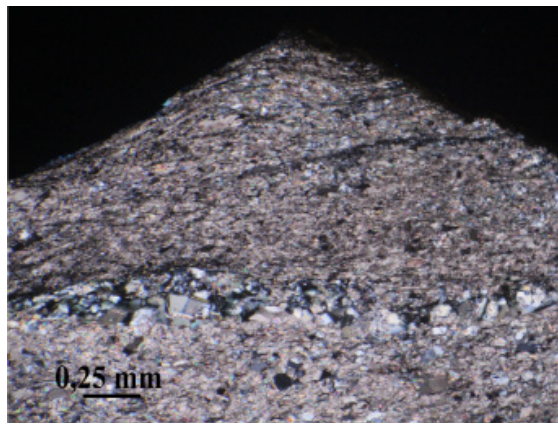


Fig. 11: Sample P07, thin section, x72.

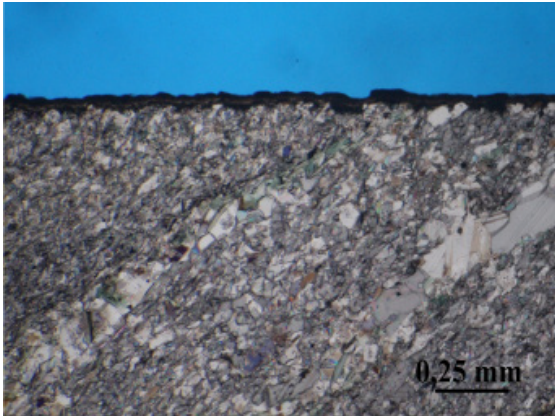


Fig. 12: Sample P07, thin section, x90.

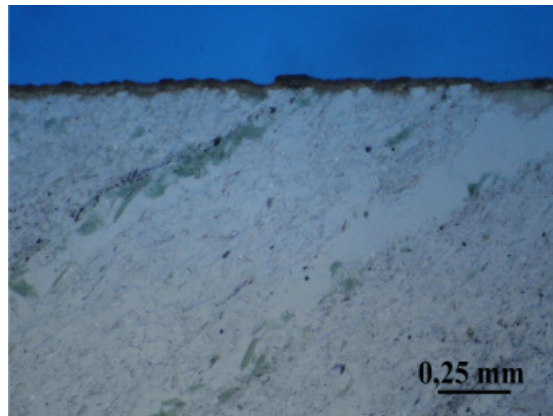


Fig. 13: Sample P07. thin section, x90.



Fig. 14: Sample P07, thin section, x100; Phlogopite.

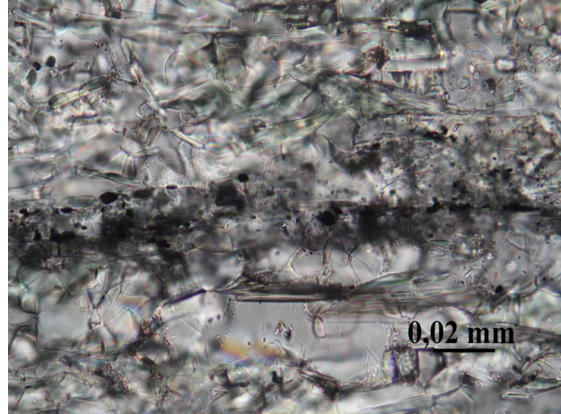


Fig. 15: Sample P07, thin section, x1000; Shear zone.

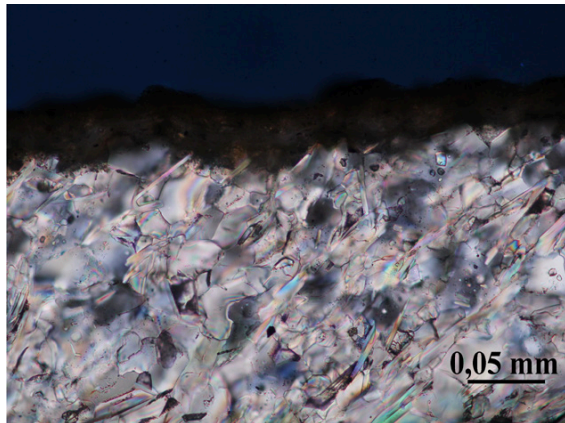


Fig. 16: Sample P07, thin section, x500. Equigranular grain aggregate with mainly polygonal grain forms.



Fig. 17: Sample NEP_ST_1.



Fig. 18: Sample NEP_ST_1.



Fig. 19: Sample NEP_ST_1, Nikon SMZ 500, transmitted light, crossed polarizers. Overview of the rock matrix with coarser and finer layers.



Fig. 20: Sample NEP_ST_1, Nikon SMZ 500, transmitted light, parallel polarizers. Detailed view of the matrix.



Fig. 21: Sample NEP_ST_1, Olympus BX40, incident light, bright field. Overview of mica inclusions (whitish spots).

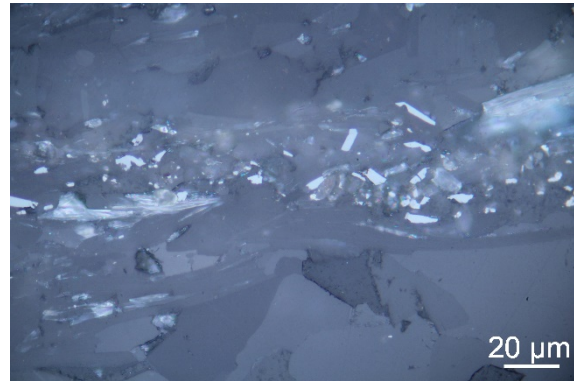


Fig. 22: Sample NEP_ST_1, Olympus BX40, incident light, bright field. Detail of a fine layer with mica flakes.