

# Weathering damage on Pharaonic sandstone monuments in Upper Egypt

## Distribution and intensities of weathering forms

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Based on the classification scheme of weathering forms developed for the sandstone monuments in Upper Egypt, twenty-three investigation areas at Karnak Temple, Luxor Temple, Horus Temple and Hathor Temple were surveyed with respect to distribution and intensities of weathering forms. The investigation areas show different spectra of weathering forms and their intensities. The state of weathering was further evaluated in dependence upon age and exposure characteristics of the investigation areas, lithotypes and environmental conditions.



1. Karnak Temple, Gate of Ptolemy III Euergetes, NNE-facade, part 1



2. Karnak Temple, Gate of Ptolemy III Euergetes, NNE-facade, part 2



3. Karnak Temple, Temple of Khonsu, Hypostyle Hall, part - SSW-facade



4. Karnak Temple, Second Pylon, part - NNE-facade



5. Karnak Temple, Temple of Ramesses II, part - SSW-facade



6. Karnak Temple, Temple of Ramesses II, part - WNW-facade



23. Hathor Temple, Dendera, part - WNW-facade



22. Hathor Temple, Dendera, part - NNE-facade

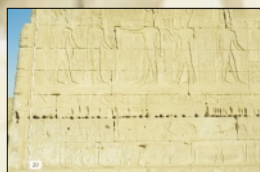
GROUP	MAIN WEATHERING FORMS	INDIVIDUAL WEATHERING FORMS	INVESTIGATION AREAS																										
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23				
1	Relief (R)	Back weathering due to loss of scales (WR)																											
		Alveolar weathering (Ra)																											
2	Break out (B)	Weathering out dependent on stone structure (BR)																											
		Weathering out of stone components (BRc)																											
3	Discoloration (D)	Crust (C)																											
		Granular disintegration (Da)																											
4	Soiling (S)	Flaking (F)																											
		Crumbly disintegration to contour scaling (F-C)																											
5	Loose salt deposits (E)	Flaking to contour scaling (F-S)																											
		Fixtures (L)																											

### Weathering forms and their frequency

Investigation areas 1-23 / Karnak Temple, Luxor Temple, Horus Temple/Edfu and Hathor Temple/Dendera



21. Hathor Temple, Dendera, part - ESE-facade



20. Hathor Temple, Dendera, part - ESE-facade

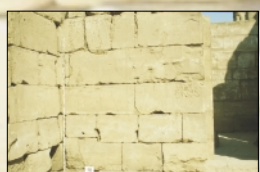


19. Horus Temple, Edfu, Mammisi, part - W-facade

INDIVIDUAL WEATHERING FORMS	INTENSITIES	INVESTIGATION AREAS																													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23							
Back weathering due to loss of scales (WR)	Depth of back weathering (mm)																														
	Intensity 1: <math>0-0.5</math>																														
Rounding / notching (Rn)	Depth of rounding / notching (mm)																														
	Intensity 1: <math>0-0.5</math>																														
Alveolar weathering (Ra)	Depth of alveolar weathering (mm)																														
	Intensity 1: <math>0-0.5</math>																														
Weathering out dependent on stone structure (BR)	Depth of weathering out (mm)																														
	Intensity 1: <math>0-0.5</math>																														
Break out (B)	Volume of break out (mm <sup>3</sup> )																														
	Intensity 1: <math>10-100</math>																														
Soiling by particles from the atmosphere (Sp)	Mass of particles (mg)																														
	Intensity 1: low																														
Efflorescences (Ea)	Mass of deposits (mg)																														
	Intensity 1: low																														
Light-colored crust tracing the surface (RaC)	Mass of deposits (mg)																														
	Intensity 1: high																														
Granular disintegration into sand (Da)	Mass of detaching stone material (mm <sup>3</sup> )																														
	Intensity 1: low																														
Single scale (Sa)	Thickness of the scales (mm)																														
	Intensity 1: <math>0.5-1</math>																														
Granular disintegration into sand to crumbling (Da-Pu)	Mass of detaching stone material (mm <sup>3</sup> )																														
	Intensity 1: medium																														
Fixtures independent of stone structure (La)	Number of fixtures																														
	Intensity 1: high																														
Fixtures dependent on stone structure (Ls)	Number of fixtures																														
	Intensity 1: high																														

### Intensities of characteristic weathering forms

Investigation areas 1-23 / Karnak Temple, Luxor Temple, Horus Temple/Edfu and Hathor Temple/Dendera



18. Luxor Temple, Naos, part - ESE-facade



12. Luxor Temple, Hypostyle Hall, part - ESE-facade



11. Luxor Temple, Court of Ramesses II, part - SE-facade



17. Karnak Temple, Chapel of the 26th Dynasty, NW-facade



16. Karnak Temple, Chapel of the 26th Dynasty, NW-facade, part 1



14. Karnak Temple, North gate, SSW-facade, part 1



15. Karnak Temple, North gate, SSW-facade, part 2