

Comité scientifique international pour la pierre  
International Scientific Committee for Stone

**Minutes of the 6<sup>th</sup> meeting held in Stockholm, Sweden**  
**on June 28<sup>th</sup>, July 2<sup>nd</sup> and 3<sup>rd</sup>**  
**Organised by Marie Klingspor Rotstein and Skanska SE**

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**Report**

Next ISCS meeting: **Lisbon, Portugal**  
Dates: **February 2005 (first or second week)**  
Our host: **Jose Delgado Rodriguez, ICOMOS Portugal**

**Participants:**

Name	Acronym	Organisation	State	28/06	02/07	03/07
Andrew <b>McMillan</b>	AMM	British Geological Survey	UK	Exc	*	Exc
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David <b>Young</b>	DYG	Heritage Cons., Campbell	AUS	*	*	*
Elisa <b>Heikkila</b>	EHA	National Board of Antiquities, Helsinki	FIN	Exc	*	*
Elsa <b>Bourguignon</b>	EBN	GCI, Los Angeles	USA		*	Exc
Erwan <b>Hyslop</b>	EHP	British Geological Survey	UK	Exc	Exc	*
Esther <b>Von Plehwe-Leisen</b>	EPL	Lab. For Stone Conservation, Cologne	GER	*	Exc	Exc
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Ingval <b>Maxwell</b>	IML	OBE, DA(DUN) RIBA FRIAS FSA Scot	UK	Exc	*	*
Isabelle <b>Pallot-Frossard</b>	IPF	LRMH, Champs-sur-Marne	FR	Exc	*	*
Jean-Marc <b>Vallet</b>	JMV	CICRP, Marseille	FR	Exc	*	*
JoAnn <b>Cassar</b>	JCR	Institute for Masonry and Construction Research, Malta	MT	Exc	*	*

José <b>Delgado-Rodríguez</b>	JDR	LNEC, Portugal	PT	*	Exc	Exc
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Marie <b>Klingspor-Rotstein</b>	MKR	SKANSKA	SE	Exc	*	*
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Philippe <b>Bromblet</b>	PBT	CICRP, Marseille	FR	*	*	*
Rolf <b>Snehlage</b>	RSE	BLFD, Munich	GE	*	Exc	Exc
Stefan <b>Simon</b>	SSN	GCI, Los Angeles	USA	Exc	*	Exc
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Takeshi <b>Ishizaki</b>	TII	National Research Institute of Cultural Properties, Tokyo	JP	Exc	*	Exc
Véronique <b>Vergès-Belmin</b>	VVB	LRMH, Champs-sur-Marne	FR	*	*	*

**Excused persons:** Elena Charola, Rob Van Hees, Roger Lefevre, Joann.Cassar, Myrsini Varti-Matarangas, David Young, George W. Scherer, Chiraporn Aranyanark, Tamara Anson-Cartwright, Vasco Fassina, Bern Fitzner, Marisa Laurenzi-Tabasso, Thomas Warsheid,

## 1. GENERAL INFO

Two very interesting websites addresses in relationship with our work are now available: <http://www.stone.rwth-aachen.de/> website of the working group “stone” of the Aachen University, where the so-called “Fitzner” system of classification and mapping on stone weathering is available. <http://www.compass-salt.org/> website of the EC program COMPASS, where definitions and illustrations of the Masonry Damage Diagnostic System (MDDS), are provided.

## 2. MONDAY JUNE 28, 18.00 - 20.00

After a short presentation of the ICOMOS-ISC web site, the discussion was focused on the following topics:

**Suggestion for Tutorials:** Ok, but who will it be for? Students, pHds, architects?, which language? A project has to be raised, and presented at the next meeting.

### Discussion on groups of terms

- Some terms still to be eliminated (find a way to provide info on the place to find them, nevertheless...)
- terms related to **masonry** deterioration
  - terms related to **bricks** and to **terracotta** deterioration
  - terms related to **mortars** deterioration

Some groups to be changed

- terms to be put into other groups, and some groups to be cancelled
- title of some groups to be changed

see the proposal in Annex 2

### Discussion on terms

- 50 terms sufficient (RSE)
- delamination/exfoliation : thickness: millimetric, splitting: thickness: centimetric
- remove notching, replace by coving (close to taffoni)
- alveolar erosion better than alveolization?
- erosion/ back erosion / differential erosion

Suggestion JDR: add to the glossary adjectives which qualify the terms, as « **differential** », « **homogeneous** », etc

### 3. FRIDAY JULY 02, 14.00-17.00

**AIX ARKITEKTER**, Hudiksvallsgatan 8, Stockholm

After a short self-presentation of delegates, IML contribution (a CD-ROM including ca. **200 photos**) is acknowledged, Ingvall Maxwell being warmly thanked for his efforts to enrich the panel of illustrations of the ISCS glossary

VVB introduces the colleagues to the state of advancement of the glossary. The web site is copied from VVB lab top into the available personal lab tops : IPF, JMV, CFN, IML, TII, then the group is split into three working groups (WGs) for further work on definitions

- WG1 (**MMN, AMN, PBT**) works on a selection from the group of terms “detachment”
- WG2 (**TII, CFN, IML, MKR**) works on a selection from the group of terms “detachment”
- WG3 (**IPF, JMV, DYG, JGM**) works on the group of terms “discoloration & deposit”

### 4. FRIDAY JULY 02, 18.00 - 21.30

**AIX ARKITEKTER**, Hudiksvallsgatan 8, Stockholm

#### 4.1 Administrative points

- **Location of the next meeting**

Three proposals: Los Angeles (proposed by Stefan Simon), Lisbon (proposed by Jose Delgado Rodriguez), and Edinburgh (proposed by Ingvall Maxwell)

The delegates propose the next (February 2005) meeting to be held in Lisbon, the second one in Edinburgh, probably in September 2005, in connection with a workshop organised by Historic Scotland, and the next other one in Los Angeles, if it is possible for the GCI to support travel expenses for some members who would have difficulties to find funding for that.

We are waiting for a confirmation from Jose Delgado Rodriguez. The members are kindly invited to provide quickly to the board the dates at which they are not free in February 2005.

- **Preparation of the election of a new board**

According to the statutes, the committee has to organise the elections for the board at the beginning of 2005. After discussion, the members decided to organise the vote in the following manner:

At **the end of 2004** (December), a mail will be sent to all the voting members asking them to give their **application for the positions of president and general secretary** in the new board. The list of candidates will be sent to the members before the next meeting.

The vote will be organised during the meeting itself. As the quorum of 51% of present voting members is required, it will **be necessary for the non attending members to give their proxy to one of the voting members** that will be present at the February meeting. If the quorum is not reached, a vote by e-mail will be set up after the February meeting.

- **Opening of an information on ISCS activities on the ICOMOS web site**

The question, raised by CFN, has already been discussed several times during preceding meetings. Up to now, the glossaries were not considered as sufficiently achieved for being accessible to a large public. Furthermore, the pages that can be seen on the ICOMOS web site cannot be updated very easily, they are more or less “crystallised “ until a new version is sent by the ISCS secretary on a CD to the colleagues at ICOMOS headquarters

It is thus proposed and accepted to provide on the ICOMOS web site only the general pages on ISCS activities.

- **Concerns related to the disappearing of the Venice ICCROM course**

DYG informs the colleagues about a concern related to the ICCROM course on stone deterioration and conservation, held every two years in Venice for years. This course would not be renewed, following an evaluation made by an independent company one or two years ago. If the information reveals itself to be true, it is proposed to inform the ICCROM board about our concern. This course has been and until the very last one, has been considered apparently as very useful by students.

IPF will check the information, send it around, and if it is right that the course is to be cancelled, will make a proposal for a letter.

- **Other topics**

MKR suggests to the group to work in parallel with the glossaries on some of the other topics included in the working program, such as:

- promoting the introduction of specific training on stone conservation in schools of architecture,
- increasing the reliability and reproducibility of measurements,
- encouraging institutions and governments to create periodic and systematic condition surveys of monuments,
- developing simple systems for recording the application of treatments and regular follow-up evaluations.

As the program was really very ambitious, and the work on glossary a long-term job, IPF proposes as a first step to the members to make a short state-of-the-art on stone conservation in their country. During the next meetings, it will be possible for 2 or 3 interested members to present the situation in their country to the group. In order to try to propose later on a kind of general report on stone conservation to the ICOMOS advisory committee.

## 4.2. Work on the glossary

The group is split into several working groups (WGs)

WGs 1, 2 and 3 have the same composition as during the 2-4 PM meeting, and continue the work they have begun.

- **WG4 meeting**

WG4 is constituted by the newly arrived persons: **EHA, SSN, JCR, MVM**

VVB introduces the colleagues to the glossary.

MVM proposes to add to the glossary new terms related to **Causes of deterioration, i.e.:**

**Terms related to endogenic causes, such as:**

mineral composition, texture, structure (grain size, bonding of grains, etc.), homogeneity or not in mineral composition and/or in texture – structure, porosity, stylolites, veins, fractures, clay minerals

**Terms related to exogenic causes, such as:**

moisture, wet-dry cycling, thermal cycling, biological activity, anthropogenic causes (air pollution, soluble salts, fire hazard, war), natural hazards (seismic...)

The group discusses on the suggestion. It is finally proposed to focus on the terms describing degradation patterns i.e. on the work in progress), and in parallel, to check on the web for any glossary already existing on causes of deterioration. Next step will be to link the eventual web sites to the ICOMOS-ISCS web site.

It is also suggested and accepted to add the term “patterns” to the title of the glossary, in order to make it clearer: “**ISCS illustrated glossary on stone deterioration patterns**” instead of “ISCS glossary on stone deterioration”

## 5. SATURDAY JULY 03, 10.00-14.30

**AIX ARKITEKTER**, Hudiksvallsgatan 8, Stockholm

The attending persons split into working groups, having approximately the same composition as the preceding day: WG1: **MMN, PBT, EHP**; WG2: **NTU, CFN, IML, MKR**; WG3: **IPF, JMV, DYG, JGM**; WG4: **EHA, JCR, MVM, DKI, VVB**

Overview of Wgs work:

- WG1 (**MMN, AMN, PBT, EHP**) has worked on the following terms :  
alveolization, crumbling, disintegration, flaking, loss of components, blistering, differential erosion, erosion, granular disintegration, splitting
- WG2 (**TII, CFN, IML, MKR**) has worked on the following terms :  
Chipping, Fragmentation, Contour Scale, Delamination, Exfoliation, peeling, spalling, abrasion, cut, perforation, scratch, surface retreat, rounding, roughening, surface retreat, relief formation, pitting, microkarst, loss of matrix

- WG3 (**IPF, JMV, DYG, JGM**) has worked on the following terms: bleaching, crust, discolouration, encrustation, moist area, concretion, deposit, efflorescence, graffiti, subflorescence
- WG4 (**EHA, JCR, MVM, DKI, VVB**) has worked on the following terms: cavity, gap, lacuna, missing part, loss of material, void

IPF suggests to make all the synonyms available in the alphabetic list of the glossary. Only main terms would stay in the list of "Classified terms".

For instance, "bleaching" will appear in the alphabetic list (to be called "Index"?), and it will be linked to the definition of the term "discolouration", where it appears as a subtype, together with "colouration".

The suggestion is accepted by the group... VVB will try to manage it so that things remain clear...

## **6. CONCLUSIONS**

The output of the work performed may be found in annexes 2 and 3. VVB shall make an overview the definitions and will present comments and suggestion at the next meeting.

**ANNEX 1  
ICOMOS –ISCS  
MEMBERS LISTS**

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ANNEX 2

**ISCS glossary**

Elaboration of definitions  
State of the art Stockholm/July 2004

Terms / groups of terms	WG	Comments Stockholm	Remarks post Stockholm
<b>General terms</b>			
Alteration			
Decay			
Degradation			
Weathering			
Deterioration			This term is lacking in the glossary
<b>Biological colonization</b>		no microbiologist	Wait for contribution
Alga		no microbiologist	Wait for contribution
Biofilm		To fall under « film » ?	To be discussed
Biological colonization		no microbiologist	Wait for contribution
Lichen		no microbiologist	Wait for contribution
Mould		no microbiologist	Wait for contribution
Moss		no microbiologist	Wait for contribution
Plant		no microbiologist	Wait for contribution
<b>Detachment</b>			
Chipping	WG2		This term is re-introduced after having been suppressed, due to discrepancy between the term and its definition in various background glossaries
Contour scale	WG2	WG2 defines « contour scale », not « contour scaling », which was selected previously.	to be discussed
Crumbling	WG1		
Delamination	WG2		
Disintegration	WG1		
Exfoliation	WG2		
Flaking	WG1		
Fragmentation	WG2	This term is introduced (suggestion JDR) in order to replace « chipping »	To be discussed
Granular disintegration	WG1		
Peeling	WG2		
Scaling			
Spalling	WG2		
Splitting	WG1		
Splintering			
<b>Discoloration &amp; deposit</b>			
Bleaching	WG3	To be put under « discolouration »	
Concretion	WG3		
Crust	WG3		
Deposit	WG3		
Discolouration	WG3	To be spelt « discolouration » instead of « discoloration » as previously written	
Efflorescence	WG3		
Encrustation	WG3		
Film			
Gloss			
Graffiti	WG3		
Damp area	WG3	The group prefers « damp area » to « moist area »	To be discussed
Patina			
Soiling			
Staining			
Subflorescence	WG3		
<b>Crack &amp; deformation</b>			
Crack			
Deformation			

<b>Missing part</b>			
Cavity	WG4	Should fall under alveolization	
Gap	WG4	This term should be moved to the group « fissure and deformation »	
Lacuna	WG4	WG4 suggests to re-introduce this term, which is appropriate for stone in English language	
Loss of material	WG4		
Void	WG4	Not to be used, refer to it under « gap »	
Missing part	WG4		
<b>Mechanical damage</b>		Discrepancy here, to be dealt with : this refers to the origin of the damage, not only to its pattern.	To be clarified
Abrasion	WG2		
Bursting			
Cut	WG2		
Perforation	WG2		
Scratch	WG2		
<b>Change in surface morphology</b>		« change in surface morphology » is not appropriate because it may apply for the morphological changes due to crusts, concretions, encrustations etc.. which are not concerned by in this group of terms.	New heading to be found
Alveolization	WG1		
Blistering	WG1		
Coving		WG1 suggests to suppress this term	To be discussed
Differential Erosion	WG1		
Erosion	WG1		
Loss of components	WG1		
Loss of matrix			
Microkarst	WG2		
Pitting	WG2		
Relief			To fall under « relief formation »
Relief formation	WG2		
Roughening	WG2		
Rounding	WG2		
Surface retreat	WG2		

## ANNEX 3

Definitions elaborated by WGs in Stockholm

Crumblingwg1.doc

# Crumbling

**Translations:**

<b>Definition</b>	detachment of aggregates of grains from the substrate. These aggregates generally have a limited size (less 2 cm ) depending on the nature of the stone and its environment  <i>requires pictures</i>
<b>Relationship with the substrate</b>	<i>Crumbling can start from the surface of the material or can be found in depth.</i>
<b>Synonym(s) associated terms</b>	
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	Sub-type of disintegration
<b>Not to be confused with</b>	flaking.
<b>Other remarks</b>	.often associated with granular desintegration
<b>References</b>	



# Disintegration

**Translations:** désaggrégation

<b>Definition</b>	<p>Disintegration corresponds to the detachment of single grains or aggregates of grains into its component parts. The particles of the material are no longer bound</p> <p>This kind of detachment corresponds to the loss of crystals or stone grains or aggregates of stone grains without defined form. The size of the detached material does usually not exceed few centimeters in its upper extension.</p> <p>Systematic loss of the grains in sedimentary rocks, or crystals in crystalline rocks.</p> <p><i>(Normal under « disaggregation ») Decohesion or disintegration characterized by the surface friability, i.e., loss of crystal or stone grains through minimal mechanical action. It is sometimes referred to as sugaring.</i></p>
<b>Relationship with the substrate</b>	It may affect the surface of the substrate or can occur in depth.
<b>associated terms</b>	<p>Powdering, chalking, sugaring (for marbles), sanding (for sandstones),</p> <p>"Disintegration" is to be preferred to "loss of cohesion", "incoherence" decohesion, <i>friability</i> and "disaggregation"</p> <p><i>To replace the following terms: disaggregation, , sugaring, powdering, chalking, loss of cohesion, intergranular incoherence, powdering, pulverization, sand, sanding</i></p>
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	Crumbling , granular disintegration, Disintegration along bedding are sub-types of disintegration.
<b>Not to be confused with</b>	
<b>Other remarks</b>	<p><i>(QUB) This occurs in granular (e.g. sandstone) and crystalline (e.g. granite) stones where, for example, the cement holding the grains together is weakened by solution or where salts crystallise in pores to force individual grains apart. In crystalline stones this may need an earlier, preparatory stage of weathering – perhaps limited chemical alteration or a series of severe frosts – which opens up a network of micro-fractures that the salts can enter and exploit. Typically granular disintegration produces debris that is a mixture of salt and individual grains that is referred to as a 'rock meal' and can often be seen accumulating beneath stones that are actively decaying</i></p>
<b>References</b>	

Flakingwg1.doc

# Flaking

**Translations:**

<b>Definition</b>	Detachment process in thin flat or curved pieces linked to the local deformation on the surface of the stone. The detachment follows the stone surface. The thickness of a flake is negligible compared to its area (which does not exceed few square centimeters ).
<b>Relationship with the substrate</b>	It affects the superficial part of the substrate.
<b>associated terms</b>	microscaling
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	Sub-type of exfoliation.
<b>Not to be confused with</b>	
<b>Other remarks</b>	Flaking can be due to salts crystallization and rusting of metal, expansion and contraction linked to trapped moisture,. . The application of a water-repellent coating may result in flaking of the masonry when trapped moisture is forced to the surface. Flaking also commonly occurs in masonry coatings, such as paint, or stucco, and results from a loss of adhesion between the coating and the masonry substrate. Flaking may be associated with sub-surface penetration and surface parallel expansion of biofilms. The micro-organisms seek protection and thus create sub-surface damage resulting in flaking, scaling etc.
<b>References</b>	

# Granular disintegration

Translations:	
<b>Definition</b>	<p>Detachment of individual grains The grain size and colour of the stone determines the size and colour of the resulting detached material</p> <p>picture 1 possibly removed because no so clear</p>
<b>Relationship with the substrate</b>	<p>Damage starts from the surface of the material. Granular disintegration generally occurs just below the stone surface, except on crystalline marble where it may occur deeply into the stone (several centimeters, sometimes more).</p>
<b>associated terms</b>	<p>"Granular disintegration" should be preferred to the following synonyms : intergranular incoherence, loss of cohesion, pulverization</p>
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	<p>"sugaring" : often used to describe the intergranular decohesion of crystalline marbles- powdering,  " pulverization" &amp; "chalking" : sometimes used for fine grained stones or bricks- "  sanding" : used for granular stones like granite or sandstone, or for mortars  "Granular disintegration along bedding" refers to the development of this degradation pattern according to specific stone layers .  alveolisation is a irregulous granular desintegration occurring on limestones and sandstones</p>
<b>Not to be confused with</b>	<p>Sometimes lichens or any granular deposit having the same aspect as the stone may be confused with granular disintegration phenomena.</p>
<b>Other remarks</b>	<p>sometimes associated with granular desintegration  In the case of crystalline marbles, thermal stresses are known to be one of the main causes of granular disintegration  Granular disintegration may show transitional forms to crumbling, scaling, exfoliation.  Alveolization, rounding, notching are surface morphologies often associated with granular disintegration  May be due to salt crystallization just below the stone surface ; growth of microorganisms.  If the surface topography is appropriate, for instance if the stone surface forms a cavity (notching), the resulting detached material may accumulate through gravity.</p>
<b>References</b>	<p>Winkler, Fitzner, ...</p>

Splitting wg1.doc

## Splitting

Translations:	
<b>Definition</b>	Fracture of a stone along a plane of weakness such as microcracks, cracks and fissures,
<b>Relationship with the substrate</b>	<i>In case that structural elements are orientated almost perpendicular to the stone surface the detachment is called splitting.</i>
<b>Synonym(s)</b>	cracking
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	
<b>Not to be confused with</b>	delamination
<b>Other remarks</b>	<i>concerning splitting, the frequency of the splits and the width of the splits are considered as intensity criteria. May be induced by frost action, fire, or the presence of nails or through vibration for example during earth tremors</i>
<b>References</b>	

Alveolizationwg1.doc

## Alveolization

Translations:	
<b>Definition</b>	formation of cavities (alveoles) on the stone surface, of variable shapes and sizes which are, in many instances, interconnected.  picture 2 requires a better description : example of irregular alveolization picture 3 : an example of honeycomb alveolization
<b>Relationship with the substrate</b>	
<b>Synonym(s) associated terms</b>	Relief weathering, honeycombs
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	
<b>Not to be confused with</b>	pitting
<b>Other remarks</b>	In those particular cases in which it develops mainly in depth in a diverticular manner, it can be referred to as vermicular alveolization It occurs mainly in calcareous rocks (and also mortars). It is a differential weathering possibly due to inhomogeneity of the stone material.
<b>References</b>	

Blisteringwg12.doc

# Blistering

## Translations:

<b>Definition</b>	<p>Swelling /raised skin (hemispherical elevations) of uniform thickness leading to the detachment from the underlying substrate, either across or parallel to the bedding plane.</p> <p><b>OK 1.</b> France, Laon (Aisne, 02). Cathédrale Notre-Dame, façade ouest, Vierge à l'Enfant, 1983 . The left cheek of the limestone figure shows <b>blistering</b> . DIA00010119 lrmh</p>
<b>Relationship with the substrate</b>	outer surface
<b>Synonym(s) associated terms</b>	bulging, swelling, bubbling
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	
<b>Not to be confused with</b>	
<b>Other remarks</b>	<p>i</p> <p>The most obvious explanation for the blister is that salt has gradually accumulated and crystallised at a shallow depth within the stone. Expansion and contraction due to repeated wetting and drying could then have lifted the surface layer away from the underlying stone. There may, however, be other explanations. For example, the formation of a case hardened outer layer to the limestone could cause the surface layer to expand and contract at a different rate to the underlying stone when heated and cooled. Eventually this may lead to the outer layer becoming detached. Each example should therefore be examined and interpreted individually</p>
<b>References</b>	

Differential erosionwg1.doc

# Differential erosion

Translations:

<b>Definition</b>	erosion leading to surface relief, possibly resulting from a primary heterogeneity picture 1 remove « Alveolization resulting from » from the caption
<b>Relationship with the substrate</b>	
<b>Synonym(s)</b>	
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	alveolization, honeycomb, loss of components
<b>Not to be confused with</b>	pitting
<b>Other remarks</b>	.
<b>References</b>	

Erosionwg1.doc

# Erosion

Translations:

<b>Definition</b>	General term for loss of surface due to various causes It can be due to chemical or/and physical processes  Pictures are OK
<b>Relationship with the substrate</b>	
<b>Synonym(s)</b>	
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	differential erosion
<b>Not to be confused with</b>	
<b>Other remarks</b>	.natural and/or anthropogenic causes
<b>References</b>	

Loss of componentswg1.doc

# Loss of components

**Translations:**

<b>Definition</b>	loss of specific constituents of the stone due to various processes  requires pictures
<b>Relationship with the substrate</b>	
<b>Synonym(s)</b>	
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	
<b>Not to be confused with</b>	
<b>Other remarks</b>	.examples : dissolution of soluble grains
<b>References</b>	

## Chipping WG2

The result of an accidental or man-made action. The physical breaking off of pieces of sound material to produce chips that disfigures an original surface. The chips, or splinters, are irregular in form and thickness and vary in size.

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## Fragmentation WG2

The complete disintegration or partial breaking up, into smaller portions or chips of variable dimensions that are irregular in form, thickness and volume.

*Synonym - Destruction*

---

## Contour Scale WG2

A physical separation of a veneer, or planes of common thickness, parallel to the worked outer surface of a stone that is independent of the stone's natural structure. Different stones can produce veneers of different thickness (from 1mm up to 25mm).

*It mainly appears on worked stones.*

---

## Delamination WG2

A physical separation of a veneer, or planes of common thickness that correspond to a layer, or part of layers, that follow the natural bedding planes (usually of sedimentary stones). Different stones can produce laminates of different thickness, and be composed of a number of strata.

---

## Exfoliation WG2

The physical separation of a detached outer stone surface.

*Not to be confused with delamination, contour scaling, scaling, or disaggregation.*

---

## Peeling

The shedding, coming off, or partial detachment of an applied surface film, layer or coating.

---

## Spalling WG2

A partial progressive sudden fracturing and detachment of fragments from the exposed stone surface (e.g. as a result of thermal shock or internal pressures from iron rust expansion).

---



## Abrasion WG2

The physical process of wearing down or rubbing away by means of friction using a tool or another material. It may be induced manually or environmentally.

---

## Cut WG2

A mechanical separation of a surface or volume of material by physical means.

---

## Perforation WG2

A single or series of surface punctures, holes, rips or gaps that penetrate into the body of the stone. Normally induced manually.

---

## Scratch WG2

An accidental or intentional manually induced superficial surface scrape, graze, cut or score.

---

## Surface Retreat WG2

A with-drawl or departure from the original exposed stone surface due to a variety of decay mechanisms, resulting in a loss of stone material.

---

## Rounding WG2

The transformation of originally angular stones as a result of preferential erosion at the block edges to result in a distinctly spherical or globular profile.

---

## Roughening WG2

Surface changes of the exposed stone primarily due to partial or selective weathering resulting in alteration to the original stone surfaces due to the loss of small particles. It can be progressive with continuing exposure and induced because of inappropriate actions, such as aggressive cleaning.

---

## Relief Formation WG2

The creation and development of surface undulations on outer stone faces due to partial or selective weathering. It can result in the selective and differential loss of stone material in a large variety of forms. It can vary dependant upon stone type, character and mineralogy and the methods of working.

Should this term be used??

---

## Pitting WG2

A formation of small depressions on a stone surface because of partial or selective weathering and localised deterioration. The pits generally have a cylindrical or conical shape, with a diameter of a few millimetres. They can be biogenically induced, especially on carbonate rocks.

---

## Microkarst WG2

Morphological changes due to the local dissolution of carbonate stone surface because of partial or selective surface water run-off. The effect creates a zone of numerous small concave irregularities in the form of watercourse runs.

---

## Loss of Matrix WG2

The dissolution, reduction in strength, and loss of binding material in sedimentary and volcanic rocks due to weathering, pollution or man-made actions resulting in physical disaggregation.

# Bleaching

## WG3

<b>Translations:</b> décoloration	
<b>Definition</b>	<p>Should be put under "discoloration"          Type of discoloration due to chemical weathering of minerals or extraction of colouring matter. Bleaching by iron and manganese reducing micro-organisms is very frequent in wet rock</p> <p>Type of discoloration (i.e. alteration of the original stone color). Bleaching is a chromatic alteration /decolorization due to chemical weathering of minerals (e.g. reduction of iron and manganese compounds) or extraction of coloring matter (leaching, washing out)</p>
<b>Relationship with the substrate</b>	generally very superficial
<b>Synonym(s)</b>	fading
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	
<b>Other patterns which should not be confused</b>	calcite encrustation, lichen,
<b>Other remarks</b>	Dark color marble often show bleaching as a result of exposure to rain.
<b>References</b>	(Fitzner)

# Concretion

## WG3

<b>Translations:</b>	
<b>Definition</b>	A compact deposit, in general of limited extent. Concretions may have nodular, botryoidal (grape-like) or framboïdal forms growing on the substrate.
<b>Relationship with the substrate</b>	Surface deposit.
<b>Synonym(s)</b>	
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	
<b>Other patterns which should not be confused</b>	Crust, encrustation (covering larger areas).
<b>Other remarks</b>	Stalagmites and stalactites are concretions.
<b>References</b>	

# Crust

## WG3

Translations:	
<b>Definition</b>	Accumulation of generally coherent materials on the surface which may include exogenic deposits in combination with materials derived from the stone. They are frequently dark coloured ("black crusts") but light colours are also found.
<b>Relationship with the substrate</b>	The crust may be weakly or strongly bound to the substrate. Detachment of crusts and loss of some of the stone material is often observed.
<b>Synonym(s)</b>	
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	Black crust.
<b>Other patterns which should not be confused</b>	Biological growth that may have a dark colour during the dry season, may be confused with black crusts. Black iron rich patina developing as a thin layer (frequent on sandstones) may also be confused with black crusts.
<b>Other remarks</b>	Crusts have variable compositions. Black crusts often contain soot (carbon particles) and other solid pollutants, bound with gypsum. They are generally located in areas protected against the direct impact of the rain.
<b>References</b>	FITZNER

There is no photograph on other crusts than black ones.

Suggest remove photo 2 as it contains examples of other deteriorations.

- |   |
|---|
| 1. France, AMIENS (Somme, 60). Cathédrale Notre-Dame. Façade occidentale, 1991 : A black <b>crust</b> has developed on the areas protected against direct rain strike. Large side : 0.6m DIA00091436 lrmh |
| 2. Germany, Halberstadt, Cathedral, 1993, Limestone, gypsum crust, partly detaching ; image width: ca. 1 m ;Geol. Inst./ Aachen Univ., B. Fitzner   |
| 3. Germany, Naumburg, Cathedral, 1990, Limestone Sculpture, black crust. Head height: ca. 30 cm ;Geol. Inst./ Aachen Univ., B. Fitzner  |

# Deposit

## WG3

Translations: Dépôt	
<b>Definition</b>	Accumulation of exogenic material, such as dust, mold, droppings, etc. It is usually of variable thickness and poor cohesion.
<b>Relationship with the substrate</b>	It may lack adhesion to the underlying stone.
<b>Synonym(s)</b>	Surface deposit.
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	Animal deposits (such as bird nests, spider webs, guano), splashes of paint or mortar, salt or dust...
<b>Not to be confused with</b>	
<b>Other remarks</b>	General expression of any exogenic matter laying on the surface. The deposit should be described for colour, morphology, size and if possible its nature or origin.
<b>References</b>	

1. Prague, 2002, these spider webs constitute a discontinuous **deposit** on the protected part of a rendered facade. [reference????](#)
2. France , Thouars (Deux-Sèvres, 79). Église Saint-Médard 1993 : This pigeon nest, on a carved limestone element, constitutes an example of biological **deposit**..DIA00941391 lrmh [Scale ?](#)
3. France, Paris, Cathédrale Notre-Dame, façade occidentale, 1998 : limestone figure partially covered with **deposits** of pigeon droppings and dust. LRMH [Scale ?](#)

# Discolouration

## WG3

Translations:	
Illustrations	
<b>Definition</b>	Change of the original stone colour in one or more colour parameters: hue, value and chroma. A discolouration of the stone not caused by something that covers it (e.g. deposited matter, paint, salt or dirt).
<b>Relationship with the substrate</b>	It may affect only the surface or more deeply.
<b>Synonym(s)</b>	Discolouration should be preferred to "chromatic alteration" or "decolourization".
<b>Other orthograph</b>	Discoloration (US)
<b>Sub-type(s)</b>	Colouration, bleaching, fading are subtypes of discolouration. Colouration (to be preferred to colouring) is a gain in colour. Bleaching and fading are losses of colour.
<b>Other patterns which should not be confused</b>	Staining: a stain can also be due to a deposit or covering matter.
<b>Other remarks</b>	Discolourations are frequently produced by salts, by the oxidation of metals (e.g. iron, manganese) or by other chemical changes such as those caused by micro organisms. Some typical yellow, orange, brown and black pigments are carotenoids and melanins produced by fungi and cyanobacteria.
<b>References</b>	Fitzner MDDS, NORMAL

1. Belgium, Brussels, 1995: **Discolouration** due to selective colonization of the stone by algae. The pattern is due to the presence of tool marks on the stone surface. LRMH **scale?**
2. Russia, Suzdal historical site, church, 1995 : **Discolouration** due to copper salts. LRMH **scale ?**
3. France, Dieuze (Moselle, 57), Salines Royales, bâtiment de la délivrance, 2002: limestone ashlar showing an area of **discolouration** due to local oxidation of iron minerals at the stone surface. Large side: 1,5m. Lrmh
4. Italy, Pavia, Certosa, 1989: marble relief showing **discolouration** due to surface accumulation of lead oxides. GCI. **Scale ?**
5. France, Thouars ( Deux-Sèvres, 79 ), Eglise Saint-Médard: soft siliceous limestone, showing **discolouration** due to green algae colonization. lower small side: ca. 1m. Lrmh **Date ?**

# Efflorescence

## WG3

<b>Translations:</b> efflorescence	
<b>Definition</b>	Usually whitish, powdery or whisker-like crystals on the surface. They are generally poorly cohesive and commonly consist of soluble salts.
<b>Relationship with the substrate</b>	Efflorescences are crystalline growths developing from the substrate and generally not adhering to the surface.
<b>Synonym(s)</b>	Should be preferred to the expression "loose salt deposits".
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	
<b>Other patterns which should not be confused</b>	
<b>Other remarks</b>	Efflorescence is commonly the result of evaporation of saline water from the porous structure of the stone. In the case where crystallization occurs in the interior of the material it is referred to as "subflorescence".  Efflorescence may also consist of stable minerals such as calcite, barite, silica.
<b>References</b>	Normal, Fitzner

Replace photograph 1 with an example of efflorescence on stone.

- |   |
|---|
| <ol style="list-style-type: none"> <li>Italy, Venice, 1995 : Halite (NaCl) <del>efflorescences</del> <b>efflorescences</b> at the surface of a brick</li> <li>Egypt, Cairo, Mosque, 1999, <b>efflorescence</b> of halite (NaCl) on porous limestone, image height: ca. 60 cm ; Geol. Inst./ Aachen Univ., B. Fitzner</li> </ol> |
|---|

# Encrustation

## WG3

Translations Other patterns which should not be confused:

### Illustrations

<b>Definition</b>	Visible compact and adherent outer layer of endogenic or exogenic matter. Surface morphology and colour are usually different from that of the stone.
<b>Relationship with the substrate</b>	Encrustations generally adhere firmly to the stone surface. Stone material may be detached by removal of the encrustation.
<b>Synonym(s)</b>	Should be preferred to "incrustation".
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	
<b>Other patterns which should not be confused</b>	It should be stressed that an encrustation is different from a crust, which may be only weakly adherent. With time, an encrustation may develop into a crust. Some lichens (the so-called "endolithic" ones) can be confused with encrustations. Lichens are usually not hard. When scratched, one can see blackish or green traces resulting from algae or cyanobacteria hosted by the lichen.
<b>Other remarks</b>	Encrustations on monuments are frequently deposits of remobilized and possibly altered endogenic materials. Carbonates, sulphates, oxides and silica are frequently found.
<b>References</b>	MDDS NORMAL

1. France, ARLES (Bouches-du-Rhône, 13). Eglise Saint-Trophime, cloître , 1993: Marble column which has had long term water flow. Its surface is partially covered with a calcite **encrustation**. Large side : 0,4m DIA00093495 Irmh
2. Egypt, Cairo, Mosque, 2000, Porous limestone, salt **encrustation** (halite) ; stone width: ca. 30 cm ;Geol. Inst./ Aachen Univ., B. Fitzner
3. France, Finistère, Eglise de Plougastel Daoulas, 1993. Calcite **encrustation** developing on granite as a result of dissolution and reprecipitation of carbonate material from the mortar. scale: each block is 0.3 m high **reference ??**



# Graffiti

## WG3

Translations:	
<b>Definition</b>	Engraving, scratch or deposit of paint, ink or similar matter on the stone surface.
<b>Relationship with the substrate</b>	
<b>Synonym(s)</b>	
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	
<b>Other patterns which should not be confused</b>	
<b>Other remarks</b>	Graffiti are generally the result of an act of vandalism. However, some graffiti may be part of the cultural heritage and should be conserved.
<b>References</b>	

1. France, Versailles, statue du groupe de Latone, 1981: White marble sculpture, partially covered with **graffiti** of black and red stripes of paint. DIA00009278 Irmh **scale ?**
2. France, Cambrai (Nord, 59). Château de Selles, 1997 : **graffiti** made by a prisoner on a limestone block during medieval times. In this case, the graffiti has an historical value and should be conserved. DIA971238 Irmh **scale ?**
3. France, Amiens (Somme, 60). Cathédrale Notre-Dame, West front, 1991 : This **graffiti**, dated from 1877, has indented the stone surface Large side : 0.6m; DIA 00091447 Irmh

There should be examples of artistic painting graffiti and scratch graffiti.

# Moist area (Damp area preferred)

## WG3

Translations:	
Definition	Darkening of the surface due to dampness.
Relationship with the substrate	
Synonym(s)	"moist area (damp area?)" should be preferred to "moist spot", "moist zone" or "visible damp area"
Sub-type(s)	
Other patterns which should not be confused	Dark coloured stain.
Other remarks	The cause of this pattern can be, for example, water penetration (e.g. rising damp), hygroscopic behaviour of salts, condensation.
References	(MDDS)

### We prefer stones examples

1. Italy, Florence, 1999. This brick building suffers both from capillary rise and water infiltration from a broken pipe. This results in a complex degradation pattern, showing among others algae (along and under the pipe), salt efflorescences and **moist areas**. Large side: 4 m. Irmh
2. France, BELPECH (Aude, 11). Église Saint Saturnin, portail, 1994 This limestone and marble portal is set into a brick masonry. **A moist area** is mainly observable on the brickwork, on each side of the portal. Large side : 6 m, DIA00941084 Irmh

# Subflorescence

## WG3

Translations: subflorescence	
<b>Definition</b>	Usually whitish, powdery crystals (commonly soluble salts) beneath the surface of the stone.
<b>Relationship with the substrate</b>	Subflorescences are crystalline growths developing within the porous structure and often result in scaling of the surface.
<b>Synonym(s)</b>	The term "subflorescence" is to be preferred to "Cryptoflorescence".
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	
<b>Other patterns which should not be confused</b>	
<b>Other remarks</b>	<p>Subflorescence is commonly the result of evaporation of saline water from the porous structure of the stone. In the case where crystallization occurs on the surface of the stone it is referred to as "efflorescence".</p> <p>Subflorescences are generally hidden, until the scale over it detaches, resulting in loss of the surface.</p>
<b>References</b>	

# Missing part

## WG4

<b>Translations:</b> partie manquante	
<b>Definition</b>	a blank gap or space (webster 1913) 1. A small opening ; a small pit or depression ; a small blank space ; a gap or vacancy ; a hiatus.
<b>Relationship with the substrate</b>	
<b>Synonym(s)</b>	gap is a synonym, that should not be employed for describing missing parts on stone, but rather on renders, plasters, mural paintings.
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	
<b>Not to be confused with</b>	
<b>Other remarks</b>	.
<b>References</b>	webster 1913 www.hyperdictionary.com

Suggestion : Missing part to stay in the title only

# Gap

## WG4

<b>Translations:</b>	
<b>Definition</b>	An opening made by breaking or parting which implies a breach or defect
<b>Relationship with the substrate</b>	
<b>Synonym(s)</b>	Crack (Large crack)
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	
<b>Not to be confused with</b>	The term « void », according to MDDS, relates to empty spaces in pointing mortar (between the horizontal joint and the brick, or between vertical and horizontal joint or all around the brick).
<b>Other remarks</b>	
<b>References</b>	(webster 1913) MDDS

**Gap** should be moved to the group « fissure and deformation »

# Loss of material

## WG3

<b>Translations:</b>	
<b>Definition</b>	Very general term, that refers to a gradual loss of original surface, which could be due to a variety of reasons such as granular disintegration, scaling ...
<b>Relationship with the substrate</b>	
<b>Synonym(s)</b>	
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	
<b>Not to be confused with</b>	Lacuna, which refers Gap Void cavity
<b>Other remarks</b>	
<b>References</b>	

# Lacuna

## WG3

<b>Translations:</b>	
<b>Definition</b>	A lacuna (lacunae as a plural form ) is a loss of layer(s) from the stone surface either exposing the underlying substrate, or going through the entire depth of the stone
<b>Relationship with the substrate</b>	A lacuna may be the result of separation and loss of layers which are intrinsic to the stone, due to delamination, scaling, splitting....
<b>Synonym(s)</b>	
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	
<b>Not to be confused with</b>	Gap cavity
<b>Other remarks</b>	
<b>References</b>	

Lacuna back in the glossary, survey of english native speakers to be organized

# Cavity

## WG4

Translations: Cavité

<b>Definition</b>	hollow remark : This term should fall under alveolization
<b>Relationship with the substrate</b>	
<b>Synonym(s)</b>	« Alveolus » is a synonym
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	
<b>Not to be confused with</b>	gap
<b>Other remarks</b>	.
<b>References</b>	webster 1913

# Void

## WG4

Translations: Cavité

<b>Definition</b>	Suggestion : not to use it... To be referred to in « gap »
<b>Relationship with the substrate</b>	
<b>Synonym(s)</b>	
<b>Other orthograph</b>	
<b>Sub-type(s)</b>	
<b>Not to be confused with</b>	
<b>Other remarks</b>	
<b>References</b>	