

***Natural Pollutants include  
Carbon Dioxide and Natural Aerosols***

***Artificial Pollutants include  
Sulphur Dioxide, Nitrogen Oxides and Artificial  
Aerosols***

It is well known that air pollutants are usually classified either into suspended particulate matters (*Dust, fumes, Mists and Smokes*), gaseous (*Gases and Vapors*) or odors, where, clean air comprises O (21%), N (78 %), a number of rare gases as Argon and CO<sub>2</sub> at a low percentage concentration (0.03 %) WHO, (2000).

Also, we can confirm that clean air contains approximately 0.03ppm of SO<sub>2</sub> 0.053ppm of NO<sub>2</sub> and 0.08ppm of O<sub>3</sub> varied with meteorological condition, in addition to chlorine compounds and other kinds of pollutants which produced by industrial activities and vehicular traffic.

## Biological effects

This factors represent one of the major of deterioration factors affecting stone and monumental buildings especially in moisten areas and they divided to *4 essential categories* as fallow:

**Botanical effects**

**Birds effects**

**Insects effects**

**Micro-organisms effects**

All of these factor have a complex deterioration mechanisms either physically or chemically.

## Human activity

There are many deterioration mechanisms resulting from different *Human activity* which we can classify it as fallow:

***Intended Damage*** as destruction, firing, thefting, etc...

***Un-Intended Damage*** as Wars

***Improper conservation works*** as unsuitable materials and methods...

## Natural Catastrophes

The most destructive factors of deterioration affected either wall paintings or all the archaeological building and its different components by mechanical movements

It can be happened by effect of :

***Fluids***

***Earthquakes***

***Firs***

***Volcanoes***

## Indogenous factors

Means poor quality of materials or/and building techniques that lead to helping the Exogenous factor to destroy all components of monumental building, from this point of view, we can classify it to:

Defects on materials composition

Error in employed techniques

# Deterioration forms

## **Heat and Moisture**

**Surface drying and Thermal expansion of stone components**

**Exfoliating of some kinds of stone layers**

**Fading of colors**

**Surface oxidation**

**Crystallization of some species of salts in several shapes such as effloresces, Sub-effloresces and Crypto- effloresces as a direct result of Sun dried**

**Diluting of different cement materials dominated in stone compositions**

**Diluting of different sources of salts either in soil, Stones, Mortars, Plasters or inside the pore structures**

**Rising damp resulted from the effect of RH**

**Gilding and Dampness of stone surfaces**

**Frost and freezing actions**

**Microbiological growth**



**Thermal effects of Air temperature**



**Surface drying effects of stone surfaces**



**Exfoliating of some kinds of stone layers**



**Fading of mineral colors**



**Surface oxidation resulted from Thermal effects**



**Salt efflorescence as result of Sun dried**



**Salt crystallization under the stone surfaces**



**Salt accumulations on the stone surfaces**



**Diluting of different cement materials**



**Diluting of different sources of salts**



**Rising damp resulted from the effect of RH**



**Gilding and Dampness of stone surfaces**



**Microbiological effect resulted from the effect of RH**



**Frost action resulted from freezing of water sources**



**Microbiological growth**

## ***Wind Erosion***

***Surface drying***

***Granular Desegregation***

***Rotate deterioration***

***Scrape & Scratch***

***Presences of some biological features***



**Surface drying**



**Granular Desegregation**



**Rotate deterioration**



**Scrape & Scratch**



Presences of some biological features

## ***Air pollution***

***Dusting and contaminated stone surfaces and covering it particles with different kind of pollutants***

***Presences some layers of salt crusts as  
 $\text{Ca CO}_3$  and  $\text{Ca SO}_4 \cdot 2\text{H}_2\text{O}$***

***Creating some of stress and strain especially inside the pore structures***

***Chemical dissolution of painting components as a direct results of acid rain***



**Falling down all components of archaeological sites as a direct result of earthquakes**





**Thank you**