The conservation project of the Temple of Quetzalcoatl

The Temple of Quetzalcoatl is one of the most representative buildings of the pre-Columbian past of Teotihuacán, due to its monumental size and its architectural elements consisting of the undulating body of the feathered serpent on the panels and the large statues of Quetzalcoatl and Chalchiuhtlicue. Furthermore, the figure decoration is composed of representations of aquatic beings, such as whales, and elements that refer to the sea.

The recent history of this monumental building began with its excavation in 1905. At this moment, the disjointed pieces were placed in its original position and the complex restoration was conceived with cement mortar, according to the style of the age. Since then, it has been exposed to weathering and rain, which has caused decay and subsequent disintegration. These damages were more noticeable at the beginning of this millennium. Therefore, in 2003, Rogelio Rivero Ortega, director and Chief of the Department of Catalogation and Description of the Anthropological Site of Teotihuacán, decided to carry out an integral conservation project of the monument to stop the problems. The intention was to create a field laboratory for the analysis and monitoring of the building.

In 2004 Rogelio Rivero made an application to the World Monuments Fund (WMF) to request financial support for the project, which was aimed at collaborating with the National Coordination for Conservation of Cultural Heritage (CONACULTA) of the National Commission of Anthropology and History (CNAH). Three stages were included in the project:
- Emergency interventions
- Restoration of the façade
- Monitoring, evaluation, and maintenance plan

The first contribution from the World Monuments Fund arrived in 2006. This financial support, in addition to WMF's assistance, allowed for the conservation and documentation process. Conservation treatments were discussed, and an agreement was reached with the professional from various fields. These interventions led by Rogelio Rivero Ortega were aimed at reversing the effects of decay, using compatible and reversible materials.

The project of the Temple of Quetzalcoatl allowed us to learn more about the constructive system of Teotihuacán, its materials, and technology. Furthermore, the support from WMF allowed the opportunity to carry out an intervention that would involve the recovery of the destroyed mantles of the feathered serpent, preserving the monument and its correct conservation.

In this small gesture, we have tried to acknowledge how it was constructed, how it deteriorates, and how a particle like the one of Quetzalcoatl was recovered.
How was a pyramid such as Quetzalcoatl built?

1. The pyramid was covered with stone blocks called xicalco which were extracted from the quarry.
   a. The first step was to open a groove on the stone. Mortars, wooden wedges were hammered into the groove.
   b. The wooden wedges were then wet with water to make the wood expand, thus exerting pressure on the stone.
   c. Finally, the wedges were hit to break the stone and split the block.
   d. Once split, the block was fitted to remove broken areas.

2. Sculpting stone decoration
   The stone figures were sculpted with tools made from harder stones.
   a. At first, the surface was sanded, then it was smoothed with sand.
   b. The heads were shaped using pieces to simulate the eyes. They were hallowed until a mouse-like brightness was attained. What made them sparkle is the sunlight.

3. Mortar preparation
   Mortar is a mixture of lime, water and sand that was used for the construction of floors and horizontal surfaces of the temple.
   a. Sand or other aggregates are collected with lime, sand is added to the mix.
   b. Lime chemically reacts with water.
   c. After mixing and prior to setting, lime reacts again with carbon dioxide from the air to create harder material.

4. Pigments gathering
   Pigments were prepared by grinding rocks in a mortar stone bowl in order to obtain a fine powder.
   a. Colors were applied with different types of brushes or mixing pigments with vegetable oils.

5. Plaster
   Buildings at the top were plastered. First, they were covered with a layer of the mortar to protect them.
   The plaster is a mortar made with sand or other aggregates, which were applied with a trowel to produce a flat surface.

6. Wall paintings
   Architectural surfaces were painted in a pyramidal fashion.colors were applied with brushes to create distinct horizontal and vertical lines.
The pyramid of Quetzalcoatl has been exposed to weathering factors from the environment since the moment of the excavation, due to the loss of its original protection (coating) throughout time.

- **Sun**
  - Heat produces thermal tensions.
- **Dew**
  - Forms dew moisture and weakens stones.
- **Animals and Plants**
  - Animals and plants inside the structure consume building materials and allow water penetration.
- **Humans**
  - They may alter the structure, on occasion, producing damage.
- **Capillarity**
  - Groundwater rises from the soil and lubricates up to the stone structure.

**Rain**
- Rain falls on the building and penetrates the coating.

**Wind**
- Water evaporates from the surface and dries the material.
- Wind then moves particles that hit the surface and already exist on the surface.

**The pyramid of Quetzalcoatl**
- The pyramid is exposed to the passage of time and the lack of care and lack of maintenance.

**Microscopic Processes**
- Water is the most damaging agent on the surface of the pyramid. It produces dissolution of materials and salt crystallization.
- Salt crystals produce three effects:
  1. Leads to the appearance of cracks and damage of the surface.
  2. Salts migrate to the surface.
  3. Phases in water, causing damage on the surface.

**Documentation, Research, and Diagnosis**
- Fieldwork, monitoring, and survey.
- Drawings and 3D models architecture survey.
- Identification and documentation of damage.
- Microscopic analysis with different materials inside the pyramid by means of electron microscopy, microscopy.
- Petrographic and X-ray diffraction, optical microscopy, and scanning electron microscopy.
- Petrochemical analysis, salts,/pyramidal and stone materials identification.
Every problem of the pyramid was treated with a different strategy to stop the decay.

**Consolidation**
The surface was consolidated before it was disassembled in order to consolidate the loose portions.

**Borders protection**
Plaster borders were protected with lime mortar injections in order to avoid water seepage.

**Holes**
Holes that allow ingress of water were filled with lime mortar.

**Plants removal**
Plants growing on the surface were removed and holes sealed with lime mortar to avoid water penetration.

**Cement removal**
Cement mortar was removed and holes were sealed to recover the water-repelling surface in order to avoid water accumulation and seepage into the pyramid.

**Injections**
Plaster detachments were treated with lime injections.

**Water drainage**
Moisture parts of the stepping pavement were protected in order to avoid water drainage.

**Handrail**
A new structural stone piece was installed and the deteriorated old one was removed.

**Sacrificial layers**
"Sacrificial layers" were applied where the stone started to disintegrate. The stone surface.
These layers are the minor replacements that cover the original surface, accepting the visualization and thus preserving the original pyramid.
The sacrificial layer is periodically replaced thus preventing stone deterioration.

**Restored volumes**
Volumes are restored with new lime mortar where figures were lost. These restorations allow to understand the original shape and they also work as "sacrificial layers".

**Salt removal**
Salts on the surface-forming stains on white stucco were removed using "paper pulp positives". This is an antibiotic measure integrated with distilled water that attacks stains removing them from the surface.

**Substitution**
Cracked mortar compromising the stability of the structure was replaced with new lime paste of a similar material.

**Drains**
Drains were made to avoid water accumulation under the surface and consequently water seeps by constantly creating an underground drainage system that diverts water outside the building area, avoiding water accumulation under the structure.