

THE LABORATORY OF ENVIRONMENTAL ANALYSES (LEAT)*

FREQUENT ANSWERS AND QUESTIONS



***(BEFORE: LABORATORY OF EXPERIMENTAL TAPHONOMY LET)**

Who can use this laboratory?

LeaT-users can be anyone, someone that is interested in making mechanical, weather, thermal and environmental experiments!!!.

PLEASE CONTACT THE LABORATORY... YOUR NEEDS WILL ALWAYS MEET A GOOD BUDGET.

The Laboratory of Environmental Analyses and Experimental Taphonomy (LeaT) aims to cover both research and teaching of Universities, Museums and Public Research Institutions, as well as private companies and professionals involved in potential damages to organic and inorganic matters. The origin of the laboratory is the research of paleontological, archaeological and historical materials, management and protection of natural and historic heritage. The laboratory is also involved in the study of mineral, organic and artificial materials affected by mechanic and environmental agents.

Are you interested in knowing whether the materials you have in your store room will be well preserved?, for how long? Will there be color changes? Textural changes?

“There are some modifications that I do not know what they mean ... may anyone advice me?”

What kind of materials can be tested?

Any kind, so far we have been experimenting with osteological samples, fossils and pollens, hard and soft tissues, biofilms, DNA and collagen preservation and transformation/deterioration. No problem with shells, seeds, coals, wood, lithic, building materials, paper, textiles, furs, preparation and restoration materials, pigments, fabrics, varnishes, resins, metals, cements, prostheses, glass, plastics, tar...

What are the basic laboratory equipments?

- Climatic chamber designed to control individual climatic parameters (cold, heat, humidity, solar radiation, rainfall and CO₂ pollution) independently or to reproduce climatic cycles (desert, savannah, tropical forest, Mediterranean climates) accelerating or including extreme situations to reproduce any condition that can be given on Earth.
- Programmable greenhouse of temperature, humidity and soil, with infrared and ultraviolet light (simultaneous and / or independently) simulating longer or shorter days with values of tropical climates, temperate or extreme climates and experiments of corrosion by different soils and pHs.
- Programmable compression and flexing equipment (ZWICK_ROELL 5kN) to apply different magnitude of weight and speed to detect elastic and visco-plastic deformations, fissures and ductile-fragile fractures shown in a graphic record to characterize the sample.
- Hydraulic shop press to get long-lasting compression / deformation experiments. This equipment maintains a constant weight (up to 30 tons).
- Sandblasting polishing machine to simulate erosion in deserts. Works with air guns.
- Polishing tumblers operating at a constant motorized movement to simulate friction and erosion movements by streams of water with different sediments.
- Muffle furnace of high temperatures and grills.
- Ultrasonic baths, manual rotary micro cutter (DREMEL 4000), glass tanks, scales, stoves, freezers, optical microscopes and portable and fixed magnifiers with image and digital video recording. They are adapted to the study of samples of large format or microscopic dimension.

Before starting a laboratory work.

-We will advice and design the experiment protocols with the **LeaT-users** or just run the experiment designed by the user, gathering observations/collecting the samples requested.

- Bibliographic background and current state of experimental research. Observations in different environments and climates.

- Characterization of atmospheric parameters of different climates by means of weather stations (Internet or user-provided information) to establish climatic cycles that reproduces different known conditions.

- Monitoring and survey of experiments and systematic sampling and data collection is performed by an experienced technician who can write the technical report of the experiment .

WE ARE OPEN TO HELP FROM THE VERY BEGINNING TO THE END OF THE PUBLICATION OR TECHNICAL REPORT.

SOME PRACTICAL EXPERIMENTS ALREADY PERFORMED AND PRICES.

Could an extreme climate be simulated and see structural and colour changes on the material subjected to experiment?

Yes, the climatic chamber allows us programming climate cycles with temperatures between minus 20°C and 80°C in conventional mode and up to minus 60°C with cryogenic liquid nitrogen. Regardless of temperature, relative humidity, hours of solar radiation and rain can act in each cycle. It also allows the performance of experiments in polluted environments up to 2500ppm CO₂ concentration. Thus, desert, polar or high mountain climates, shelters and deep chamber in caves could be simulated, as well as any conditions that may be on Earth.

For example, we could simulate a desert climate, with a great thermal oscillation (60 to -10°C) between day and night, relative humidity very low (~20%) and hours of light to be determined.

What is the purpose of experimentation with environmental chamber?

The objective of the experiments performed with the environmental chamber is to know the incidence that each of the parameters programmed (e.g. T^o, relative humidity, solar radiation, rainfall and CO₂ pollution) produces on the study sample, both surface modifications and different changes that may be produced in the geo- and biochemical composition of the sample.

Could the effect of lithostatic compression on a sample be simulated?

Yes, for this experiment we have two different equipments. One is a hydraulic shop press that allows long-term compression experiments, from half a ton up to 30 tonnes, in dry, wet (immersed in water) or on different sediment grain size. The second is a material testing that reach to 0.5 ton of weight, but moving at a variable speed, connected to a computer to record different physical parameters of the experiment. Both equipments can be used separately, or they can also be combined to first observe the deformation/breakage traits of the material during the first compressing efforts up to half ton with the material testing equipment and extend the weight and length of time of compression using the hydraulic shop press.

The material testing (ZWICK_ROELL 5kN) can simulate both compaction processes by sediment and any subaerial compression event with different duration and speed (trampling, falling blocks, anthrop breakage by impact, bites or chewing). Two load cells are available, one for small pieces such as microvertebrates (up to 500Nw) the other up to 5kNw for more compact materials (e.g. large mammal bones). The equipment is connected to a PC to graphically show all deformations, microfractures and breakage during the compression efforts, as well as parameters of viscosity, deformation and strength of the material.

Could we reproduce plant activity (and the root marks) or the effects of different pH soils (alkaline/acidic) under different climates (wet/dry hot sunny/dark conditions)?

Yes, the laboratory has a programmable greenhouse to simulate long-term situations. The greenhouse allows us programming temperature and ventilation, with air and soil humidity, with infrared and ultraviolet lights (simultaneous and / or independently) that allows us simulate longer days with values of tropical, temperate or arid extreme climates.

Could we simulate sand grains abrading/eroding/blasting a specimen like in a desert environment?

Yes, for this type of experiments we have two equipments. The first is a sand-blasting cabinet that works with sand projected by compressed air guns, designed to simulate erosion in the deserts. This experiment has a destructive effect on fragile specimens (e.g. small mammals) due to the compressed air. This equipment needs the attendance of the technician.

The second equipment is polishing motorized tumblers with constant rotation movement to simulate friction and erosion movements. This experiment is planned for

lasting long time span and be non-attended. The latter are also designed to simulate bone erosion by water currents in different types of sediment.

Once the experiment is done, does it include any report with the results?

There are two possibilities, the first is to give the user the data resulting from the experimentation in digital format including an oral/email explanation (not a real report) of the results and the user will be responsible for processing and interpreting them. The second is to provide a written technical report of the experiment and results by the laboratory personnel who are highly qualified.

- The laboratory also offers to the **LeaT-users**:

a) Sample photograph before and after experiments using Z-motorized microscopes and high-resolution cameras from 8x to 160x magnification.

b) Sieving and sorting of sediments to recover micro-remains in rescue/excavation works may also be provided. Assistance and guidance on field and laboratory works for rescue excavations. Report of taphonomic study and/or palaeontological report.

The price of this service is budgeted according to the sample size, type of sample, nature of the site and whether the study exceeds 40 working days.

WE ARE HERE!



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