1400 years of man-environment interactions and soil evolution in the Saint-Mont mountain (Remiremont, Vosges)


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SoHoM project
1400 years of man-environment interactions and soil evolution in the Saint-Mont mountain (Remiremont, Vosges)


1. Context of the study

The Saint-Mont site

A relatively inhospitable mountain:
- Hard climate, steep slopes,
- Acid soils developed from a granitic rock,
- Nowadays covered by forests.

Remains suggest human presence for at least 1400 years:
- At the top, the monastery Habedenium (from the 7th century to the French Revoluion) and a late antique occupation (Chenal 2016).
- Monumental enclosure dry-stones walls of unknown age (Grzeszczuk 2019).
- The “Point des Fées”: An enigmatic structure.

2. Objectives

To investigate traces of ancient anthropic activities in soils and landscapes, on areas where archaeological structures have not yet been detected.

3. Material and methods

Joint work involving soil scientists, archaeologists, geographers, geologists and computer scientists

Approaches from the landscape to the microscopic scales.

Archaeological data

Field prospections / rocks and soils data and sampling, forested surveys.

Studies along gradients from highly to poorly human impacted areas.

4. Results

Interactive extraction of linear structures from LiDAR raw data

Development of new algorithms based on digital geometry tools to directly process 3D ground points and get rid of digital terrain model approximations in forested areas (Even and Ngo, 2020).

Immediate visualization of extracted structure, cross and longitudinal profiles and of geographic estimations (height or depth, width, volume, ..).

Time and precision performance evaluated on well controlled structures: forest roads (Even and Ngo, 2021).

Usability assessed on archaeomorphological enclosure walls and old hollies (Even et al., 2021).


5. Landscape and geological materials

A tectonic and glacial heritage

- 3 axes of fractures highlighted from rock outcrops and preferential feldspar orientations in thin-sections measurements.

- Tectonic fracturing guided the action of the Quaternary. Both factors structure the massif and control its triangular shape.

Geological heritage

The rock descriptions (macroskopically and in thin sections) confirm that most of the Saint-Mont is composed of Remiremont granite (Vincent, 1970).

- New informations, not noted on the geological map:
  * Longer vein of apatite (supposed by the presence of apatite fragments in our studied profiles).
  * At the bottom of unit 6, a feldspah vein rock more basic than granitel.

6. Soil covers

1. Soils not clearly disturbed

- Far from any known archaeological remains, two main types of soils develop on granite:
  * Humic acrolith (Rhyolite Carbonatite, WRB).
  * Rankolefs (Rhyolite Carbonatite, WRB).

Acidic pH (pH<4) in the organo mineral horizon and desaturated Fe (15-15%).

Strict acidiphyte vegetation

Reference soils not affected by ancient activities

- Undisturbed soils associated to ancient walls:
  * Physico-chemical characteristics close to those of reference soils.
  * Low human activity?

Black unit (1-1m thick) very rich in organic matter.

Almost neutral pH (pH>6.5) in the organo mineral horizon and saturated soils (50%)

Acidline to neutraline vegetation

Clues of long term tillage and regular manure inputs

2. Highly anthropised soils on platform B

Anthroposol (B) = Transformed on a man made terrace = Anthrosol with a pristic horizon (WRB)

→ Reference soils not affected by ancient activities

- Undisturbed soils associated to ancient walls:
  * Physico-chemical characteristics close to those of reference soils.
  * Low human activity?

Black unit (1-1m thick) very rich in organic matter.

Almost neutral pH (pH>6.5) in the organo mineral horizon and saturated soils (50%)

Acidline to neutraline vegetation

Clues of long term tillage and regular manure inputs

3. Other evidence of ancient human influence on soils?

Detection of same anomalies:

- Light when pH is between 4 and 5.
- More significant when pH is > 5.
- Easily related to the long-lasting human occupation on the summit.
- More surprising on some western or southern platforms:

→ Leads for future archaeological studies?

Conclusion and perspectives

Our results confirm:
- A very strong imprint of historical human activities on soils close to the summit part of the massif.
- An heritage on the western slope mainly from natural glacial and pedogenetic processes.
- Possible other human activities on some western or southern platforms.

We hypothesize that the weak anomalies are due to older and/or different human activities than those that took place at the top of Saint-Mont (like breeding).

Other analyses are being acquired and interpreted on soils, rocks and LiDAR images.