



GIS-based variability of building materials toward the Ile-de-France cuesta (Paris Basin, France): inventory, distribution, uses and relationship with environment

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In the Paris Basin, the various geological substrata deliver numerous building materials. Stones, clays and sands have been extracted since the Antiquity to nowadays, even if the number of stone quarries has largely decreased over the twentieth century. Characterizations of building materials, for traditional construction and for monuments linked with geological resources, show the different relationships between stone resources, men, buildings and environment.

On the eastern part of Paris Basin, we focused on the "Pays Rémois" which is an administrative area constituted of 137 towns and villages in the surroundings of Rheims. From west to east of this area, 60 km wide and 25 km long, two main substrates are visible limited by the Ile-de-France cuesta : on the west part, the Tertiary substratum is composed of various type of building materials (sandstone, limestone, millstone) and on the east part, the Cretaceous substratum is composed of chalk.

In each towns and villages, a prospecting inquiry leads to indentify the geological building materials. Characterizations of archaeological materials and of well-dated monuments help to understand the chronology of the use of the various indentified geomaterials.

The different traditional geomaterials observe on the studied area are:

- White chalk without chert (Santonian and Campanian stages),
- Various facies of marine limestones from Lutetian : a russet stone named "Courville stone" in reference to the latest quarry opened in the area), Ditrupa limestone, Milliolids limestone and micritic limestone,
- Various facies of upper Lutetian/Bartonian lacustral limestones : a grey-greenish limestone with *Limnea* and a grey yellowish *Potamides* one,
- Grey sandstones : attributed to continental Thanetian,
- Chert and siliceous rocks from Bartonian or Rupelian,
- Adobe composed by earth, chalk gravel and other components like piece of bricks, bones. . .
- Different kind of bricks according to their composition (earth, clayor sand).

This region was largely destroyed during the First World War, the massive use of non-local materials (Euville and Savonnières stones) during the rebuilding phase make sometimes distorted the comprehension of traditional geomaterials distribution.

A geo-referenced database creates on Access[®] and introduces in geographic information system software (ArcGis[®]) takes into account the spatial variability between extracting sites and between the building itself where materials were observed. For a building, each geomaterial is indexed on Access[®] depending on it localization on the building itself.

In addition of the distribution of the various identified materials, spatial analysis shows the close relation between location of resources and the way of the materials are used in buildings. Indeed, on a local level, some building materials are widely used without any particular localization on the building and more away from the quarries they are used only for specific building elements.