“Morphostructural analysis of Tirana city center (Albania) under GIS and CAD technology”

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Urban areas: first approach

- Landscape forms and related geological processes in an urban area are heavily masked by a very intense "coverage" caused by buildings, infrastructure, and underground utilities.
Reconstruct main recent and relict morphostructures despite the intense urban coverage of Tirana.
The study area is the city center with the available data's maximum density.
The data set provided by Polytechnic University of Tirana treated under GIS and CAD environments:

- 27 stratigraphy from continuous core surveys furnished with geotechnical parameters
- Digital Terrain Model acquired by laser scanner and filtered by infrastructure and buildings heights (year 2007)
- Orthophotos (year 2007)
- Historical topographic maps (1927-1937)
Study phases

1. Reconstruction of the geological subsurface model

2. Identification of surface forms in connection with the geological model proposed

3. Comparision
1. Subsurface model

- At first data from boreholes allowed the production of geological sections that have been used to reconstruct the geometric relationships between the lithotypes and to analyze these ones as depositional facies.
The sections follow 2 main directions:

- One more or less N-S, normal to main rivers flow direction
- One approximately E-W, parallel to the main rivers flow direction
Were thus identified 2 depositional systems with related facies:

- **Marine depositional system:**
  - Ramp facies

- **Continental fluvial depositional system:**
  - Flooding facies
  - Channel facies
  - Lateral accretion facies
  - Overbank facies
Slightly clayey silty sand

Channel

Section A-A' (depositional facies analysis)

Older Lana river

Horizontal scale: 1:100

Vertical scale: 1:250
Section B-B' (depositional facies analysis)

- **Silty clayey sand**
- **Sand**
- **Overbank**
- **Lateral accretion**
2. Surface morphostructures

- In this phase the DTM was used under ESRI ArcGIS 10© environment to highlight the surface morphostructures.
3D Analyst Tools -> Terrain and TIN Surface -> **Surface contour**: first of all a detailed contouring was done (with metric gradient).
The contour lines along with several height profiles (obtained using 3D Analyst Toolbar -> Interpolate Line) allowed the identification of plain areas and scarps related to river terraces of the main waterways.
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3D Analyst Tools -> Terrain and TIN Surface -> **Surface slope**: a steepness map was generated to outline the hills basis.
This map together with the contour lines allowed the identification of some tectonic evidences at the hill basis such as triangular facets, hills line-up, fault scarps, etc.
Spatial Analyst Tools -> Hydrology -> Flow direction and Flow accumulation: these tools have been applied to highlight the trend of surface water runoff.
Flow accumulation map

Ortophotos (2007)

Actual urban secondary workflow
Actual urban secondary workflow
- Actual secondary urban waterflow
- Historical maps (1927-37)
- Older Lana river course
Older Lana river course
In the last phase of the study a comparison between surface and buried morphostructures was done.
Good match between the surface fault scarps and the buried slope of the bedrock top surface.
Good match between the surface trend and the buried channels of the older Lana course.
Conclusions

- In spite of a small amount of data and the intense urban coverage of Tirana, in this study we recognized the depositional, erosive, tectonic landscape forms and the related processes that represent the geological background of Tirana urban area.

This was made under GIS and CAD environment that helped, with 3d image analysis tools, to figure out all the morphological elements of study area.
References:
CHIRICO S., DAJA S., NARDI G., STRATI B. (2011) - Reconstruction of a geological underground model in the center of Tirana (Albany) (Geology degree thesis - University of Naples "Federico II")

- 3D volume interpolation
- Sequence stratigraphy
- Hydrogeological model
- Seismic noise acquisition
GRAZIE PER L’ATTENZIONE

FALEMINDERIT PËR VËMENDJEN