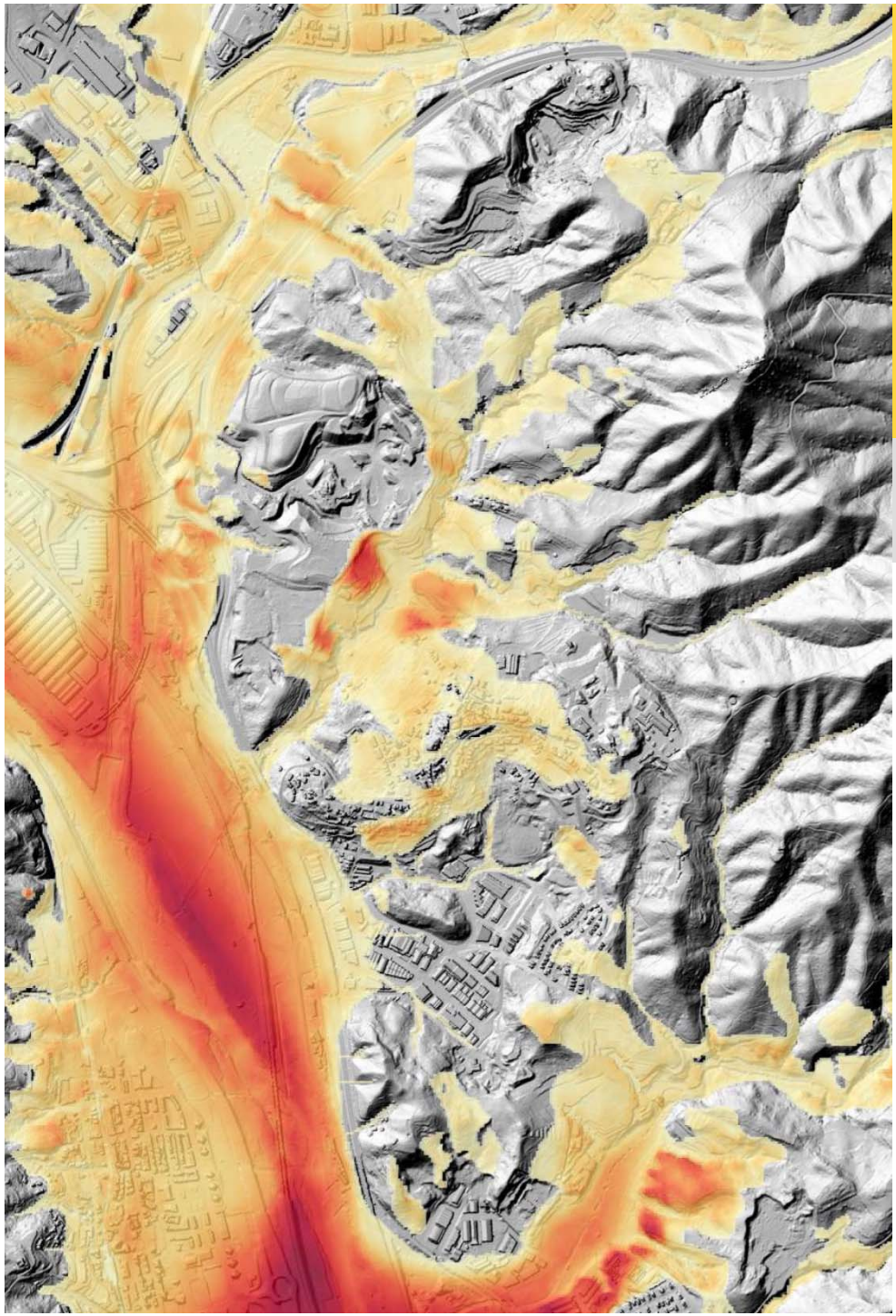


3D Geological reconstructions for the development of geothematic layers useful for urban planning:

El Papiol case study (Barcelona Metropolitan Area)

Roser Pi and Miquel Vilà (ICGC)

23/02/2018

4th Meeting of the European 3D Geomodelling community

21st to 23rd February 2018

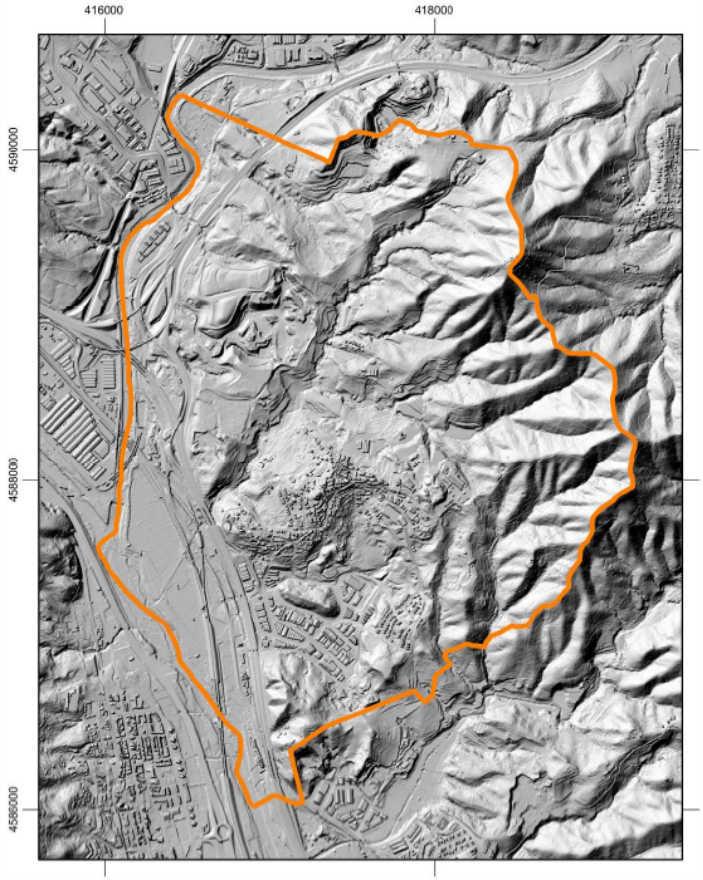
Orléans, France

ICGC
Institut
Cartogràfic i Geològic
de Catalunya

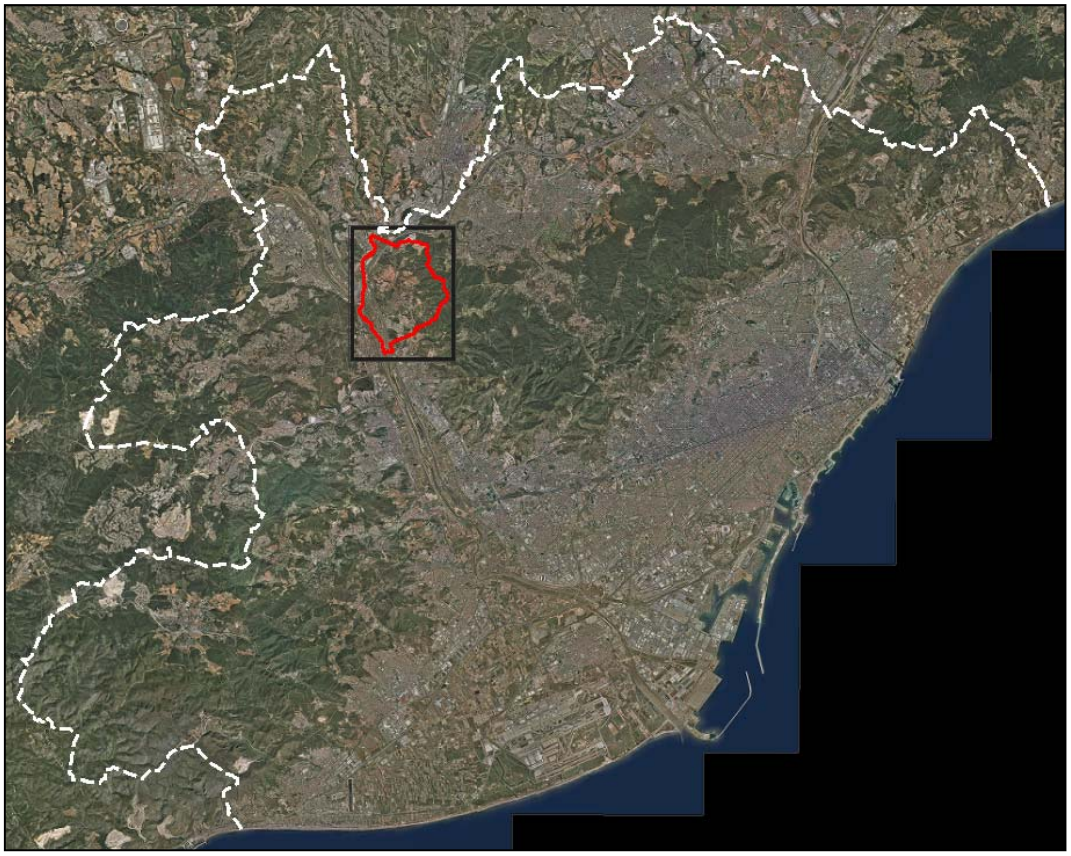
Generalitat
de Catalunya

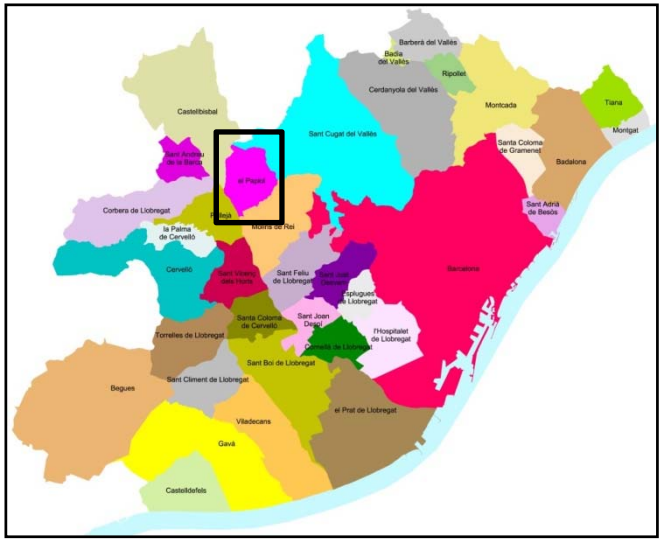
INDEX

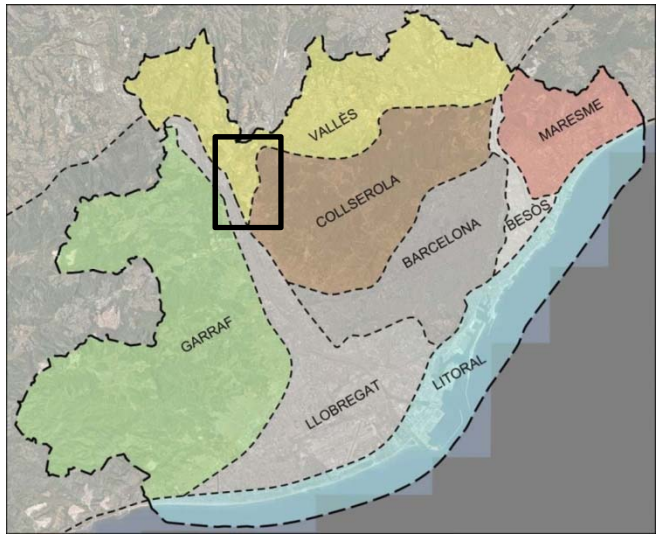
- Introduction
- 3D geological reconstruction process
- Application of the 3D model
- Summary



INTRODUCTION:
Study area







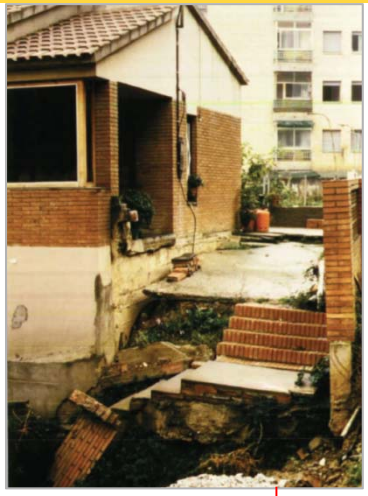
- **Metropolitan Area of Barcelona (AMB):**
  - ~ 3.240.000 inhabitants
  - 636 km^2 area
  - 36 municipalities
- **Study area:**
  - el Papiol
  - 18 km^2

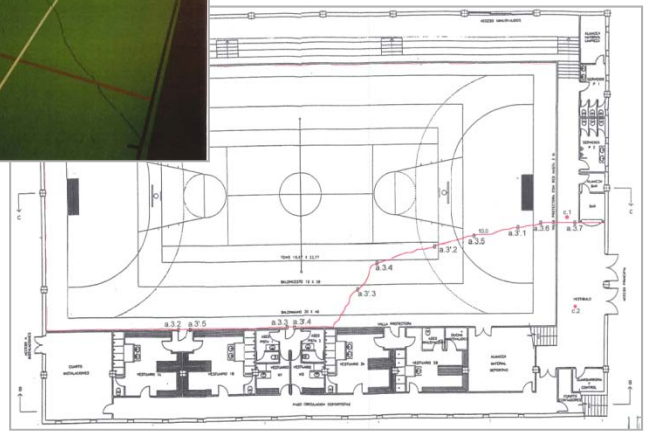
INTRODUCTION:
Historical evolution

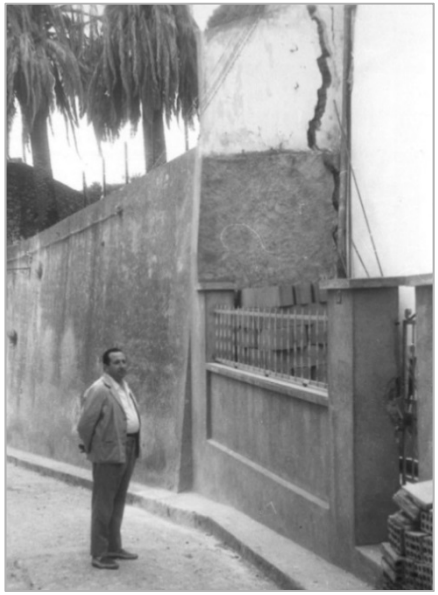
1929

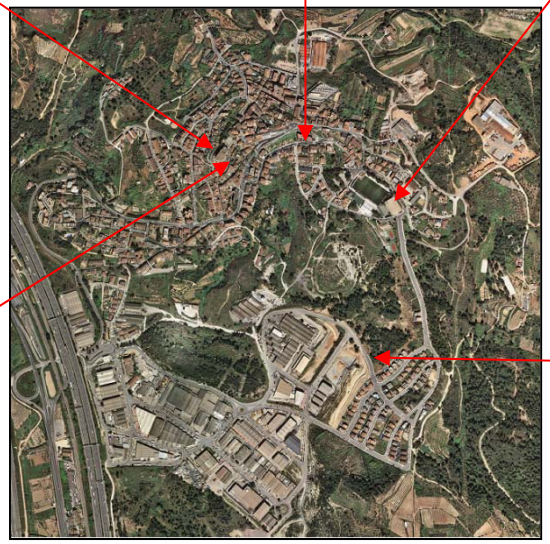
2018

INTRODUCTION:
Record of ground instabilities









INTRODUCTION:
Workframe: GUAMB Papiol project

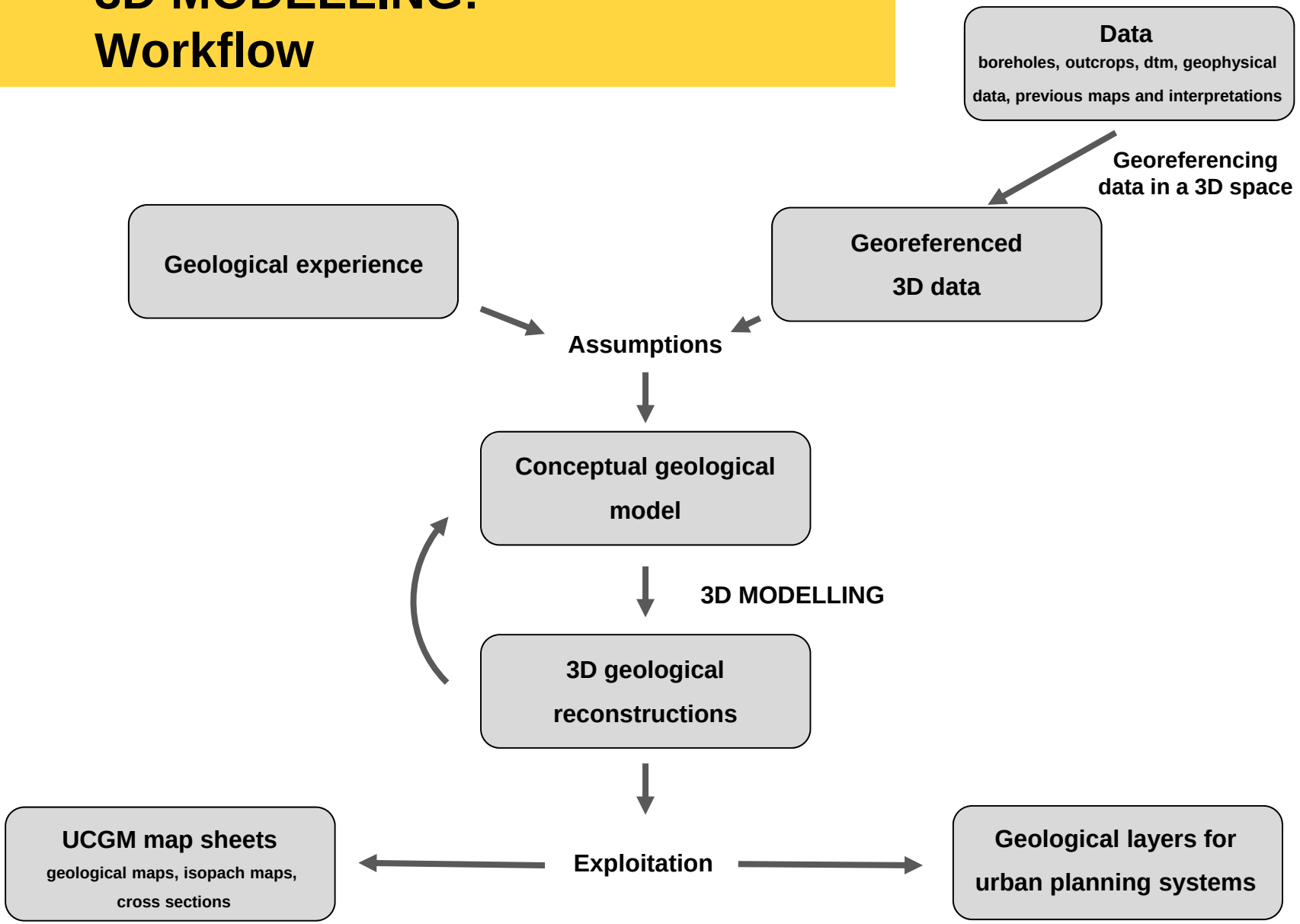
PROJECT: Urban Geology of the Barcelona Metropolitan Area: el Papiol case study

- **GEOLOGICAL BASIC LAYERS**
  - Outcrops
  - Boreholes
  - Samples
  - Anthropogenic deposits
  - Quaternary
  - Basement
  - 3D model
  - Inventory of ground instabilities

- **DERIVED INFORMATION**
  - Geological related hazards
  - Mining areas and aggregate extractions
  - Geochemistry levels
  - Soils capacity
  - Hydrogeology
  - Engineering conditions
  - Seismic response
  - Geological heritage

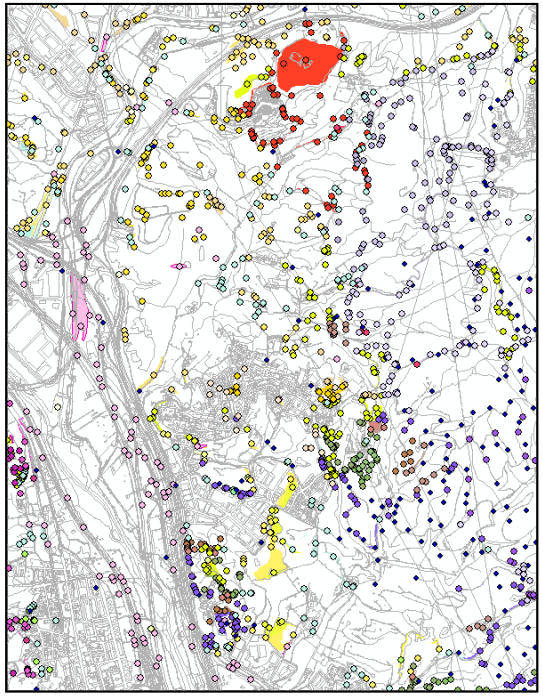
- **GEOLOGICAL HAZARD STUDY**

3D MODELLING: Workflow

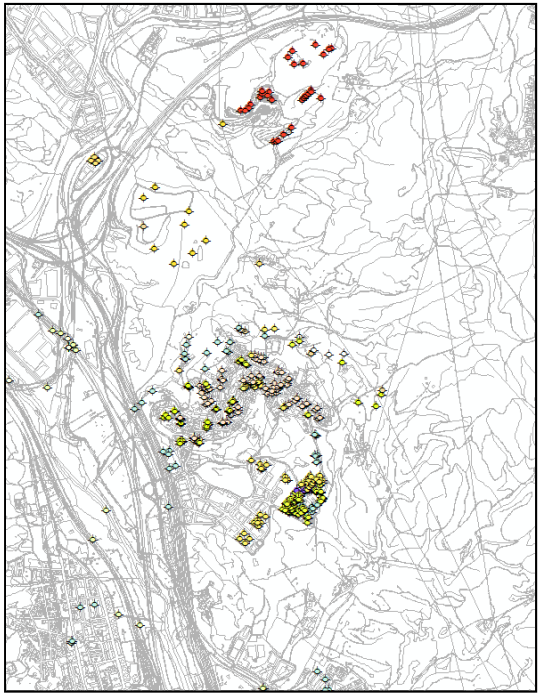


3D MODELLING: Information sources

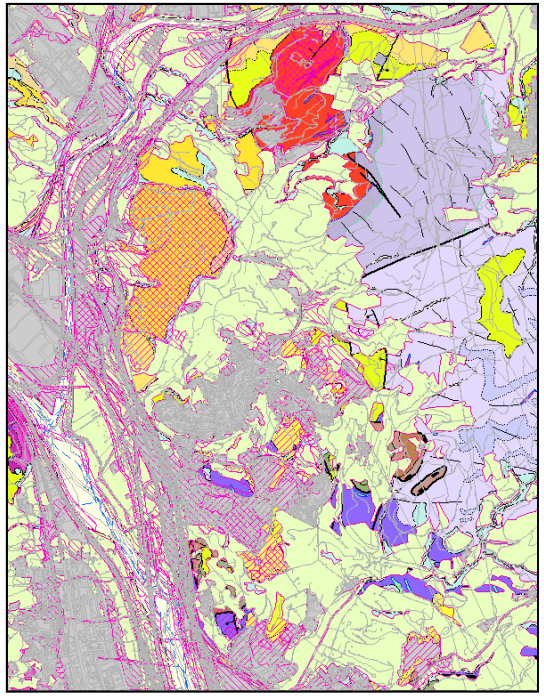
OUTCROPS



BOREHOLES



GEOLOGICAL MAPPING (artificial, Quaternary, pre-Quaternary)



ALSO: Historiographic documentation, Topographic maps, Digital Terrain Models (DTM), Geophysical data (H/V)

3D MODELLING: Surfaces to model

Artificial

Quaternary

Pliocene

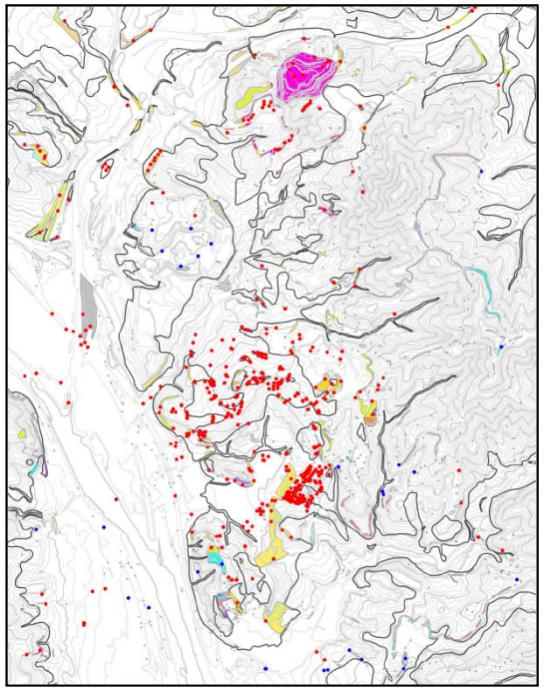
Miocene

Triassic

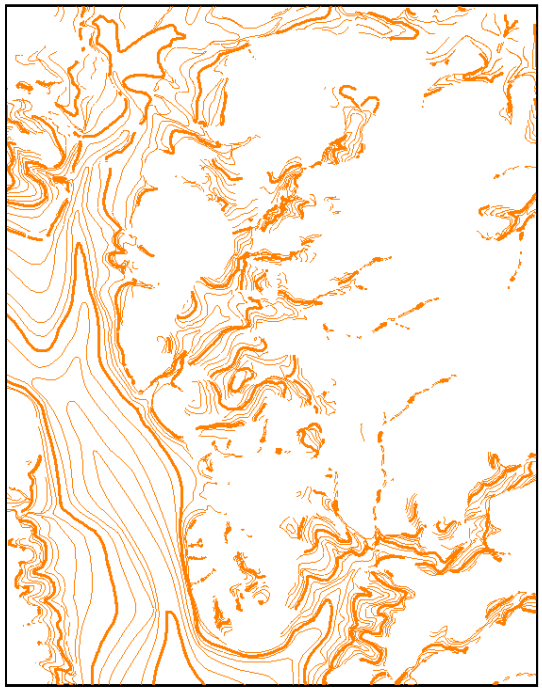
Palaeozoic

3D MODELLING: Reconstruction technique

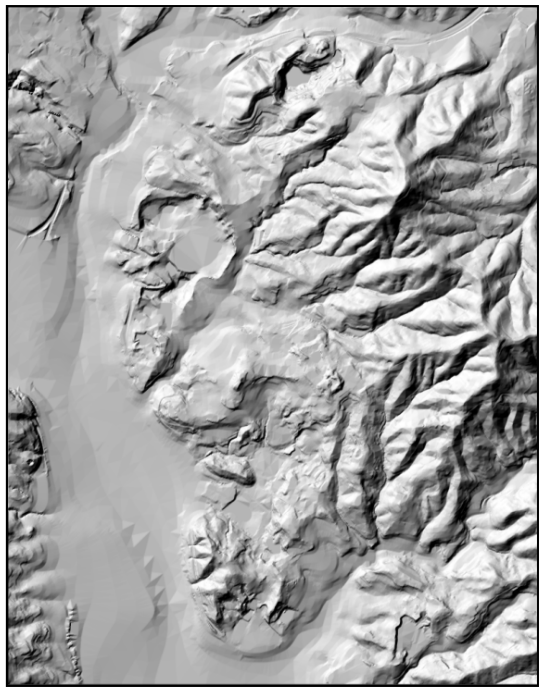
SPARSE 3D FEATURES



CONTOURN LINES (MicroStation)



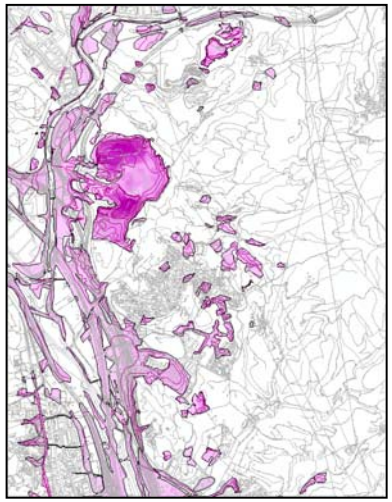
REGULAR GRID SURFACES (Surfer)



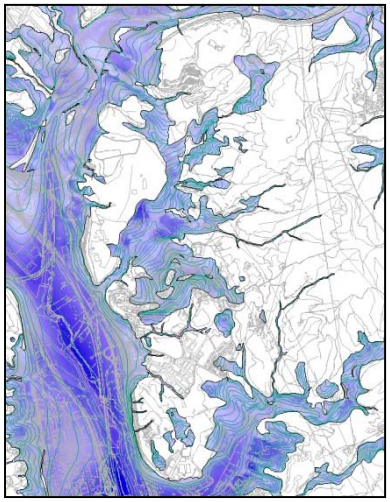
EXAMPLE: Base of the Quaternary deposits

3D MODELLING: Results

Artificial deposits

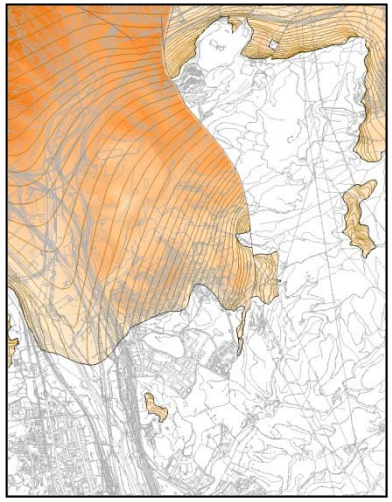


Quaternary



Pliocene

Miocene

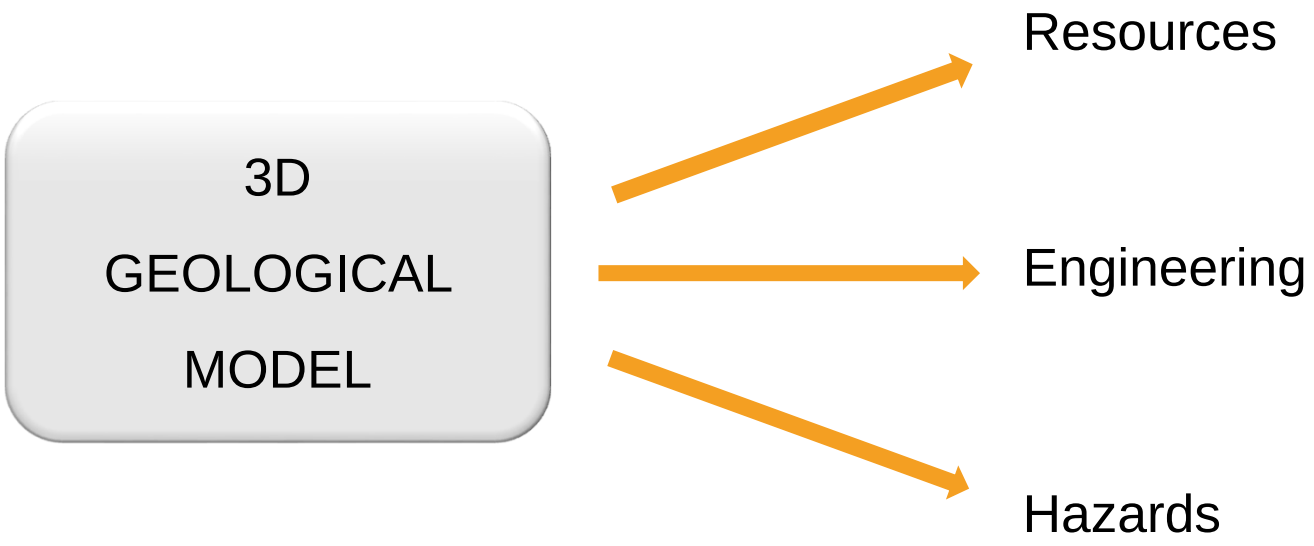


Triassic

These information was released as:

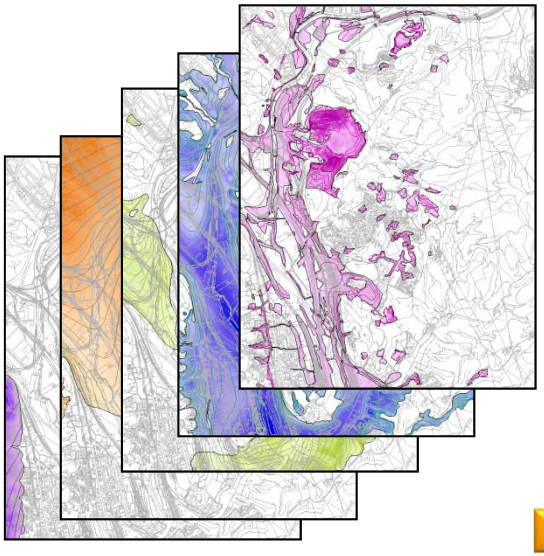
- **Contour maps**
- **Deposit thickness maps**

APPLICATIONS

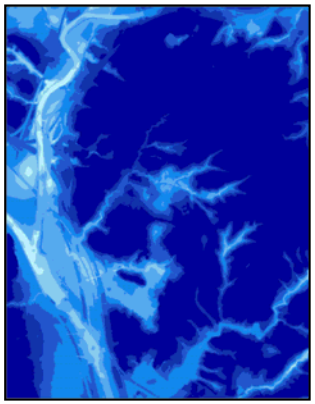


APPLICATIONS: Resources
e.g. groundwater vulnerability layer

3D geological model

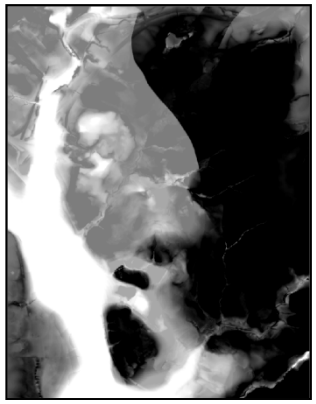


Groundwater base level



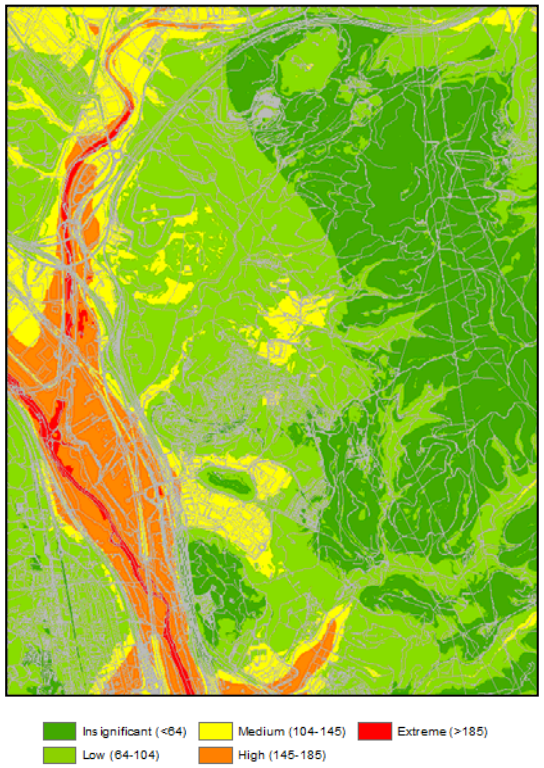
Properties of the aquifer media

Properties of the vadose zone media



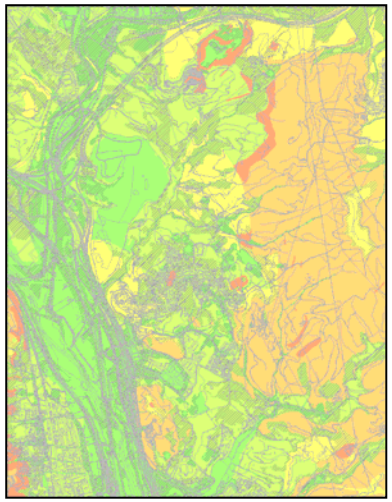
GROUNDWATER VULNERABILITY MODEL

(DRASTIC)



with Victor Camps

APPLICATIONS: Engineering
e.g. excavatability layer



Surface

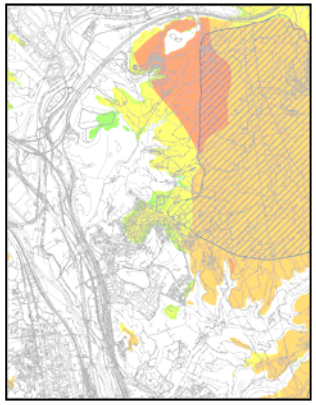
excavatability

TERRAIN CONDITIONS TO EXCAVATABILITY

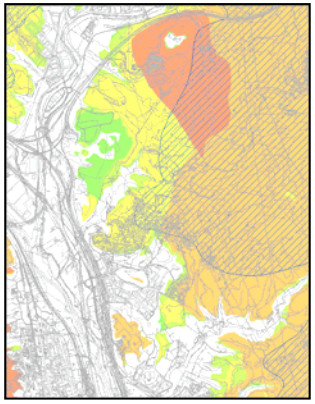
AT DIFFERENT ELEVATIONS

High, easily ripable
High, ripable
Low, ripable with difficulty
Very low, predemolition
Very low, demolition
Water saturated terrain

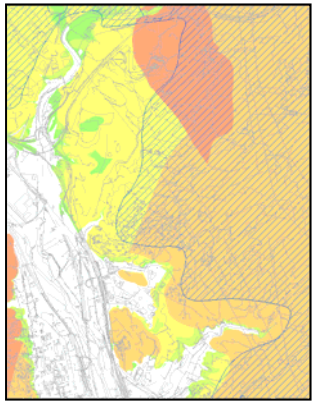
100 m elevation



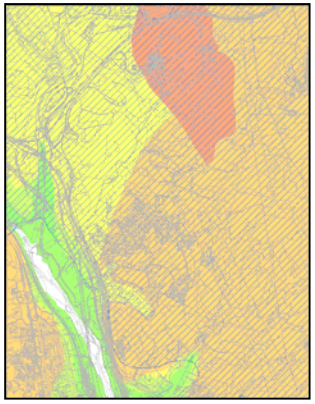
75 m elevation



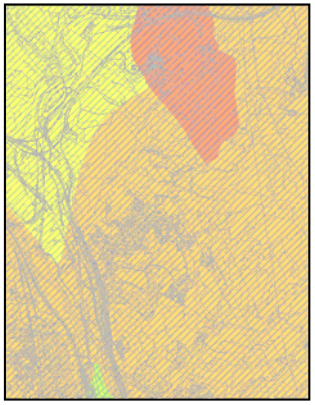
50 m elevation



25 m elevation



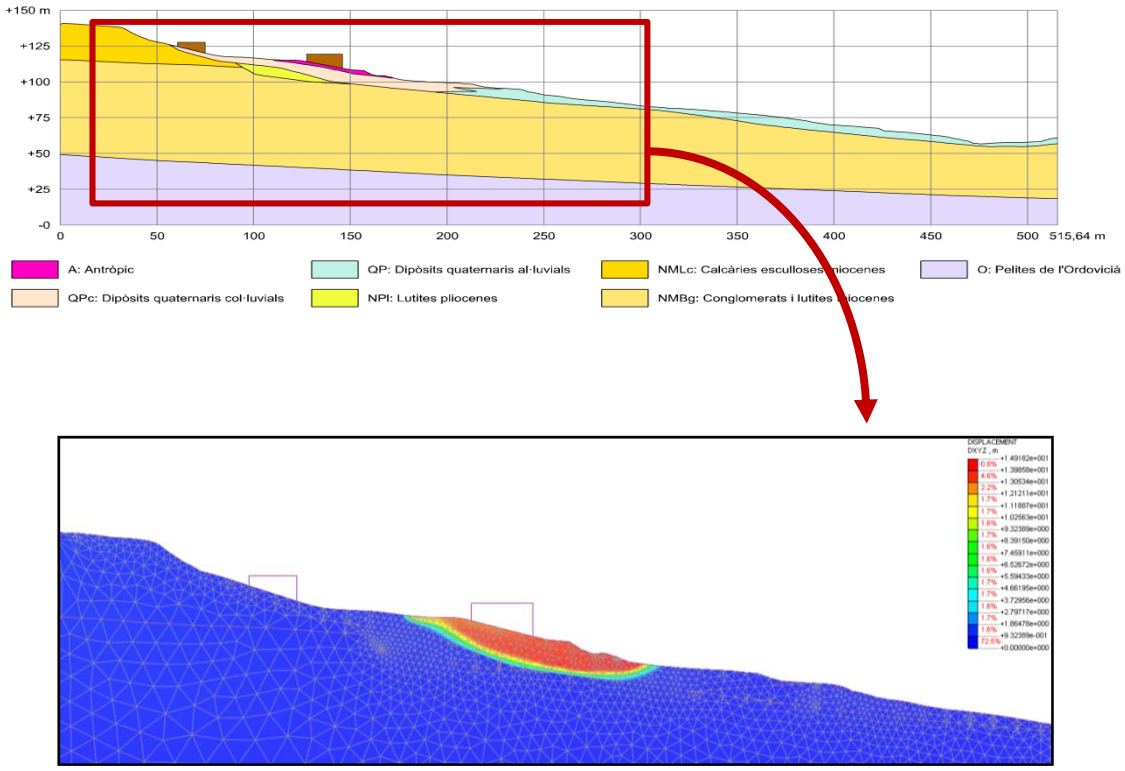
0 m elevation



with Ivan Garcia

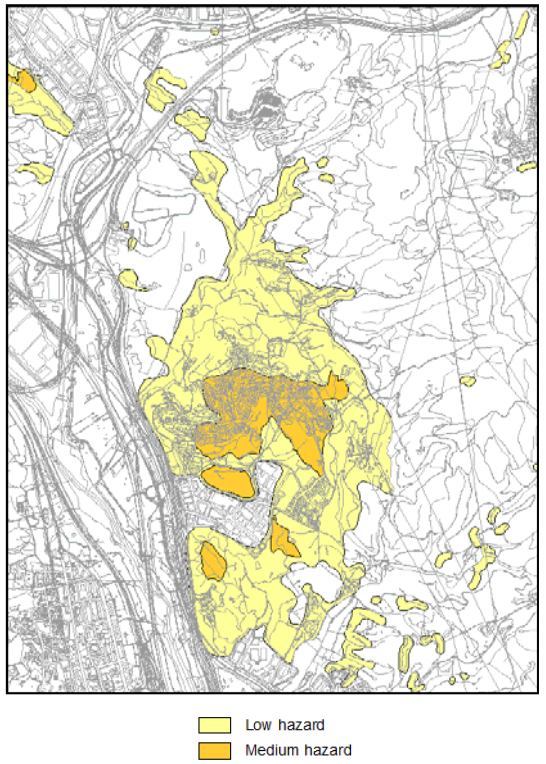
APPLICATIONS: Hazards
e.g. landslide hazard layer

Authomatic cross section (Terramodeler)



MAP OF HAZARDS

ASSOCIATED TO LANDSLIDES



with Ivan Garcia, Ferran López, Marta González, Jordi Pinyol

SUMMARY

- Creation of a 3D Geological Model
- Exploitation of the 3D model for the development of geothematic information related to resources, engineering and hazards.
- The base of the model: extensive regional geological knowledge and a large amount of outcrop and borehole data
- Methodology exportable for other urban areas (AMB or others)
- Moving from a simple delivery of information to an effective geological survey

THANK YOU

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Fax (+34) 93 567 15 67

FRIDAY 10h30-12h30
Urban geology

10h30 – 10h45	**Robida *et al.*** – BRGM, A role to play for geological surveys in urban information platforms?
10h45 – 11h	**Stafleu *et al.*** – TNO, Putting our models to work: Applications of 3D voxel models in real life situations
11h – 11h15	**Bourgine *et al.*** – BRGM, Modeling gypsum thickness in order to evaluate collapse hazard in Paris area
11h15 – 11h30	**Cripps *et al.*** – BGS, The use of 3-D models to manage the groundwater resources of the Lower Greensand aquifer, Hertfordshire and North London, England
11h30 – 11h45	**Pi Juan *et al.*** - ICGC, 3D geological reconstructions for the development of geothematic layers useful for urban planning: El Papiol case study (Barcelona Metropolitan Area)
11h45 - 12h	**Beaudouin *et al.*** – SYSTRA, BIM and GIS : Excavated Material Management
12h – 12h15	**Lehné *et al.*** – HLNUG, Supporting BIM by integrated geological 3D-modeling of urban underground– case study Darmstadt, Hesse, Germany
12h15 – 12h30	**Beaufils *et al.*** – BRGM, Setting interoperability between BIM and Geological Modeling: Feedback from the French MINnD UC8 project