TEMA 2: CARATTERIZZAZIONE SISMICA DEL TERRITORIO

Sessione 2.2: Effetti di sito e microzonazione sismica

ADVANTAGES OF INTEGRATING PHOTO-GEOLOGY AND FIELD-BASED GEOLOGICAL MAPPING.

AN EXAMPLE FROM POST-SEISMIC ACTIVITIES IN AMATRICE (CENTRAL ITALY).

Cardinali M., Santangelo M., Mancini M., Moscatelli M., Vignaroli G., Working group CNR IRPI and IGAG
After the 24 August 2016 earthquake, Seismic Microzonation Studies were planned and initiated in order to provide the basis for reconstruction of the most damaged villages comprising the Amatrice area (Macroarea 3).

Unfortunately updated geological maps at scale 1:50,000 (CARG Project) do not cover the epicentral area.

There is need of providing methodologies and products (maps, cross sections) for a wide area approach to perform advanced MS Studies:

1) Photo-geological mapping (“fast” procedure; scale 1:10,000)

2) Broad scale geological survey and mapping (time consuming procedure; scale 1:5,000)

(ISPRA, 2016)
Methods to produce a photo-geological map

DRAFT OF THE PHOTO-GEOLICAL MAP AT SCALE 1:10.000, BY AERIAL PHOTO-INTERPRETATION OF A 140 KM² WIDE AREA (AMATRICE AND ACCUMOLI MUNICIPALITIES).

OBJECTIVE: DETECTING AND SHOWING MORPHO-STRUCTURAL DATA TO SUPPORT FIELD GEOLOGY.

The procedure has required:

- The use of double discussion stereoscopes, 1,5 × a 13,5 × zoom

- Set of black and white stereoscopic aerial photographs IGMI (flown 1954, scale 1:33.000)

- 2 Photo-interpreters: preliminary interpretations
- 10 Field geologists: Control and validation
- 2 GIS operators: Editing, Data-base Digital Mapping

Literature data:

- PAI
- IFFI
- Geology 1:100,000
- Geologia: Cacciuni et al.
- Geologia: Festa, 2005
Photo-geological map (1:10,000)

Morphological elements and Covers
- Landslide
- Trench
- Alluvia
- Adjoining Alluvial Fans
- Tabular surface (t) and scarps

Structural Elements
- Bedding trace
- Uncertain b. trace
- gently dipping
- moderate
- elevate
- Upside down
- Facet (escarpment)
- Fault
Morpho-structural domains of interest

- Thrust and transversal faults
- Mt. Gorzano Fault, in relation with trenches and landslides
- Morpho-structural evidences of the Torrita – Scai small basin
- Adjoining alluvial fans and terraced deposits of the Conca di Amatrice
- Distinguishing Arenaceous-Pelitic Lithofacies from Pelitic Lithofacies
- Basal bounding surfaces of terraced units
Morpho-structural evidence of the Mt Gorzano Fault

Clustered trenches of tectonic or gravitational origin: they are parallel to the Gorzano Fault and on the topmost edge of landslides (Pizzo di Sevo).

Escarments and stepped landscape with triangular facets NNW-SSE trending (Mt Gorzano Fault).

Different attitudes of strata at the hanging-wall (SW dipping) and foot-wall (NW dipping) blocks of the Mt Gorzano Fault.

Facet (close to Capricchia)
Quaternary covers of the Conca di Amatrice

The adjoining fans:
• their outer edges do not reach the Tronto River, but are confined by a topographic lowered area.
• They show different tone and texture, from aerial photos, interpreted as being related to different lithologies.

The terraced fluvial deposits of the Conca di Amatrice:
• Crop out mostly on the right bank of the Tronto River.
• Have flat top surfaces.
• Thin in the central sector where the geological bedrock crops out.
The adjoining fans:
- their outer edges do not reach the Tronto River.
- but are confined by a topographic lowered area.
- They share different tone and texture, from aerial photos, interpreted as being related to different lithologies.

Quaternary covers of the Conca di Amatrice
Quaternary covers of the Conca di Amatrice

Hypothesis:
A lowered area widens at the outer edge of fans, presumably linked to an antithetic element (A. Festa, 2005)
Geological map of Amatrice from field geology (scale 1:5,000)
Bedding of the geological substratum

Distinguishing and mapping different lithofacies (Arenaceous dominant (A) and Pelitic dominant (AP), basing on different textural characters.

- lithofacies (A) with poorly evident «stripes», uniform texture,
- lithofacies (AP) with well defined and thin «stripes», with alternated dark and light tones.
Rarely are the contrasting lithotypes well exposed.
Field geology to solve photo-interpretation ambiguities: substratum bedding

Bedding orientation (up side) from sedimentological markers (flute casts outcropping close to the Amatrice Hospital)
New: LIDAR to support Photo-geological mapping. The Torrita basin
Concluding remarks

Photo-geological interpretation and mapping is a procedure which allows to produce preliminary interpretations over wide areas in a short time (~15km² per day in this study) compared to field geology.

The Photo-geological Map should then be validated by field geology to detail the local morpho-structural setting and to test preliminary interpretations.

The integration between photo-geology and field geology is thus an interactive and iterative process that allows to produce reliable geological models from surface data, useful for:

1) planning new geophysical and geotechnical investigations,

2) providing a frame to the interpretation of acquired data

3) and defining an integrated subsoil model for MS