Gruppo Nazionale di Geofisica della Terra Solida

BOOK OF ABSTRACTS
41st NATIONAL CONFERENCE

7-9 FEBRUARY 2023

BOLOGNA

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Istituto Nazionale
di Oceanografia
e di Geofisica
Sperimentale

EAGE
EUROPEAN ASSOCIATION OF GEOSCIENTISTS & ENGINEERS
SEG
SOCIETY OF EXPLORATION GEOPHYSICISTS
SEZIONE ITALIANA

22° CONVEGNO NAZIONALE

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Session 3.2

Near surface geophysics

Reconstruction of a 3D geological model of the quaternary deposits filling the Cassino intermontane basin (central Italy)

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This work aims to investigate the shape and engineering geological features of the subsoil of the city of Cassino (Central Italy) through the interpretation of an extensive database of geophysical, geognostic and bibliographic data. Geological models of urban areas provide critical information for geological and hydrogeological analysis and studies. In this case study, we develop a 3D subsoil model to describe the relationship between the different geological bodies and the lithologies composing the recent filling deposits. To this aim, Cassino's urban area (Central Italy) has been chosen as a test case. The area is located at the end of the Latina Valley. The carbonate structures of Mt. Cairo border it to the NW, Mt. Venafro to the NE and SE, and several main tectonic elements mainly in Apennine development.

The available dataset comprises about 180 geognostic boreholes from previous fieldwork performed in the past years that reach different depths up to 300m. This dataset provides information about the lithotypes' nature, thickness, and distribution. We also used about 100 HVSR measurements to estimate the resonant site period (RP) to identify the depth of the impedance contrast (Saroli et al., 2020). The collected data were processed through the 3D geological modelling software Leapfrog (Seequent Limited). The 3D model is made by stacking on top of each interpolated surface representing stratigraphic boundaries. Such a model highlights the subsoil's main structural and lithological elements, such as the surface of the bedrock buried below the city. A second detailed model was performed to define better the relationship between the different lithologies that compose the quaternary fluvial-lacustrine filling. We processed the same geological dataset with the Lithology Modeling tool by software Rockworks (RockWare) (Fig1).

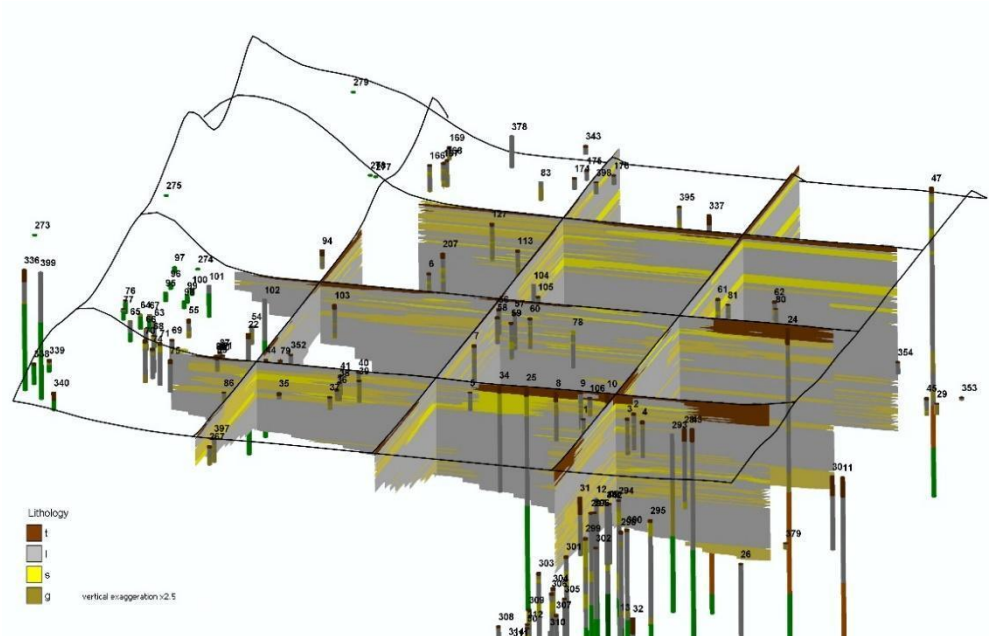

Fig. 1: Detailed model under the city center

With this tool, we can use the *Lateral Blending* option to extrude the data from each borehole point to the almost midpoint between the closest, laterally adjacent borehole point and randomizes correlations within the mid-zone region.

The results show that the carbonate bedrock is very articulated because of tectonics. On its top lies a clay and sandstone unit attributable to the *Frosinone Flysch* (Upper Miocene), followed by a complex of alloantigen series attributable to a generic *Messinian sea-lake* environment (Lower Pliocene). These sediments are covered by the lacustrine sequence of the *Lirino Lake*, formed by an alternation of clayey silt and sand with gravel, with thicknesses ranging from a few meters near the carbonate reliefs up to about 150 m in the NW of the Cassino urban area. It should be noted that this sequence, close to the relief of Mt. Cassino, is characterized by the presence of layers of gravel and sand attributable to the *Paleo-Rapido* riverbed, today diverted by anthropic activity, which probably constituted an ancient tributary of the *Lirino* Lake, which occupied the Cassino plain in geological times. Traces of the course of the *Paleo-Rapido* riverbed can also be observed in the buried morphology of the carbonate Bedrock.

The characterization of the subsoil has led to the definition of a conceptual geological model that highlights the persistence of the condition of the river-lake environment, at least until the end of the Late Pleistocene.

Reference

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