

PRELIMINARY RESULTS OF A 3-D STRATIGRAPHICAL MODEL OF THE NW SECTOR OF THE URBAN AREA OF ROME (ITALY)

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1. ABSTRACT

The aim of the present work is to illustrate a preliminary elaboration of a 3-D stratigraphical model of the NW sector of the urban area of the city of Rome, Italy. Stratigraphical and hydrogeological information has been taken from well databases from public and private institutions. A geo-referenced database of stratigraphical and hydrogeological information has been realized. The codification of standard criteria for classification and description of lithological and stratigraphical data and terms coming from very different sources was adopted. The database has been prepared with the purpose of carrying out data exportation to GIS environment or toward specialized software.

Preliminary stratigraphical cross-sections were realized in selected zones of the study area, aimed to define the geological features of the units constituting the investigated territory. In particular, the relationships among the different units and the low permeable bedrock were defined. Finally, 3-D models have been elaborated for improving the understanding of stratigraphical features of the study area. In this work, just a preliminary version of the model will be illustrated, since, for instance, information about tectonic lines and anthropic covers, as well as hydrogeological features, were not still fully elaborated.

Four main stratigraphical units have thus been here distinguished: 1) a basal clayey marine unit having a good spatial continuity, but variable thickness; 2) a following generally thick (with only local width variations) transitional to continental unit characterized by a good lateral continuity; 3) a widespread but laterally discontinuous and generally thick unit constituted by volcanic deposits coming from the Sabatini magmatic district; 4) a recent continental deposit unit of alluvial-colluvial origin.

2. INTRODUCTION

The aim of the present work is to illustrate a preliminary elaboration of a 3-D model of the NW sector of the urban area of the city of Rome, Italy. Like other urban areas, the stratigraphical reconstruction has been elaborated by subsoil information coming from drillings, soundings and wells logs. In particular, the present study represents an attempt for the verification of adequateness of the distinguished stratigraphical units and of the spatial correlation of their inferred reciprocal boundaries, in support of the correct understanding of the geological features of the investigated area.

The stratigraphical and hydrogeological information has been mostly taken from the Well National Database, constituted at the Geological Survey of Italy (ISPRA) in appli- cation of the Italian governmental law N.464/84, the well database of VENTRIGLIA (1989) and other well databases from public and private institutions. All those who have contributed to the collection of this information are gratefully acknowledged.

4. METHODOLOGICAL ASPECTS

A geo-referenced database of stratigraphical and hydrogeological information from the study area has been realized. The codification of standard criteria for classification and description of lithological and stratigraphical data and terms coming from very different sources was adopted. The database has been prepared with the purpose of carrying out data exportation in a GIS environment or toward specialized software.

Preliminary stratigraphical cross-sections were realized in selected zones of the study area, aimed to define the geological features of the units constituting the investigated territory. In particular, the relationships among the different units and the low permeable bedrock were defined.

Finally, 3-D models have been elaborated for the improving of the understanding of the study area stratigraphical features.

3. - GEOLOGICAL, STRUCTURAL AND HYDROGEOLOGICAL SETTINGS

The paleogeographical evolution of the Roman area is characterized by differentiated environmental conditions from marine Plio-Pleistocene clayey and sandy deposits to continental Middle-Upper Pleistocene shales and conglomerates. Starting from 0.6 Ma two main explosive alkali-potassic volcanoes began their activity: the Sabatini volcanic apparatus in the NW sector and the Alban Hills at SE. A deep tectonic control has also revealed, clearly connected with NW-SE and NE-SW regional structural-tectonic trends of the Apennines; these lineaments are crossed by N-S youngest elements (FACCENNA et alii, 1995).

The following post-orogenic geological succession, starting from Early Pliocene on an articulated calcareous-silicic-marly substrate, may be outlined, from bottom to top, in the Roman area (e.g., PAROTTO, 2008, FUNICIELLO et alii, 2008):

- Pliocene marine units (Monte Vaticano Formation and Palombara Sabina Unit), characterized by grey shale with fine sand and conglomerates.
- Lower Pleistocene marine units (Monte Mario and Monte delle Picche formations), sand with green clays and shale and sandy shale.
- Lower-Middle Pleistocene transitional to continental units (Ponte Galeria and Fosso della Crescenza formations), conglomerate, clay, silty sand and sand.
- Middle-Upper Pleistocene volcanic deposits (Sabatini and Alban Hills districts), ignimbrite with lapilli, ash, lava, breccias, scoria and xenoliths layers and inclusions, and conglomerates, sand and silt intercalations.
- Quaternary units (travertine and lacustrine, slope, aeolic, beach and alluvial deposits).

Furthermore, five main hydrogeological units may be distinguished in the Roman area (CAPELLI et alii, 2008):

- 1) Sabatini Mts unit, characterized by volcanic deposits;
- 2) Alban Hills unit, volcanic deposits;
- 3) Ponte Galeria unit, sedimentary deposits;
- 4) Alluvial unit, recent and present deposits,
- 5) Tiber River delta unit, alluvial deposits.

A hydrogeological complex of clayey-marly deposits of low permeability has also been recognized.

The paleomorphology of the pre-orogenic bedrock top surface has very variable features, thus conditioning the hydrogeological features and the thickness of aquifers.

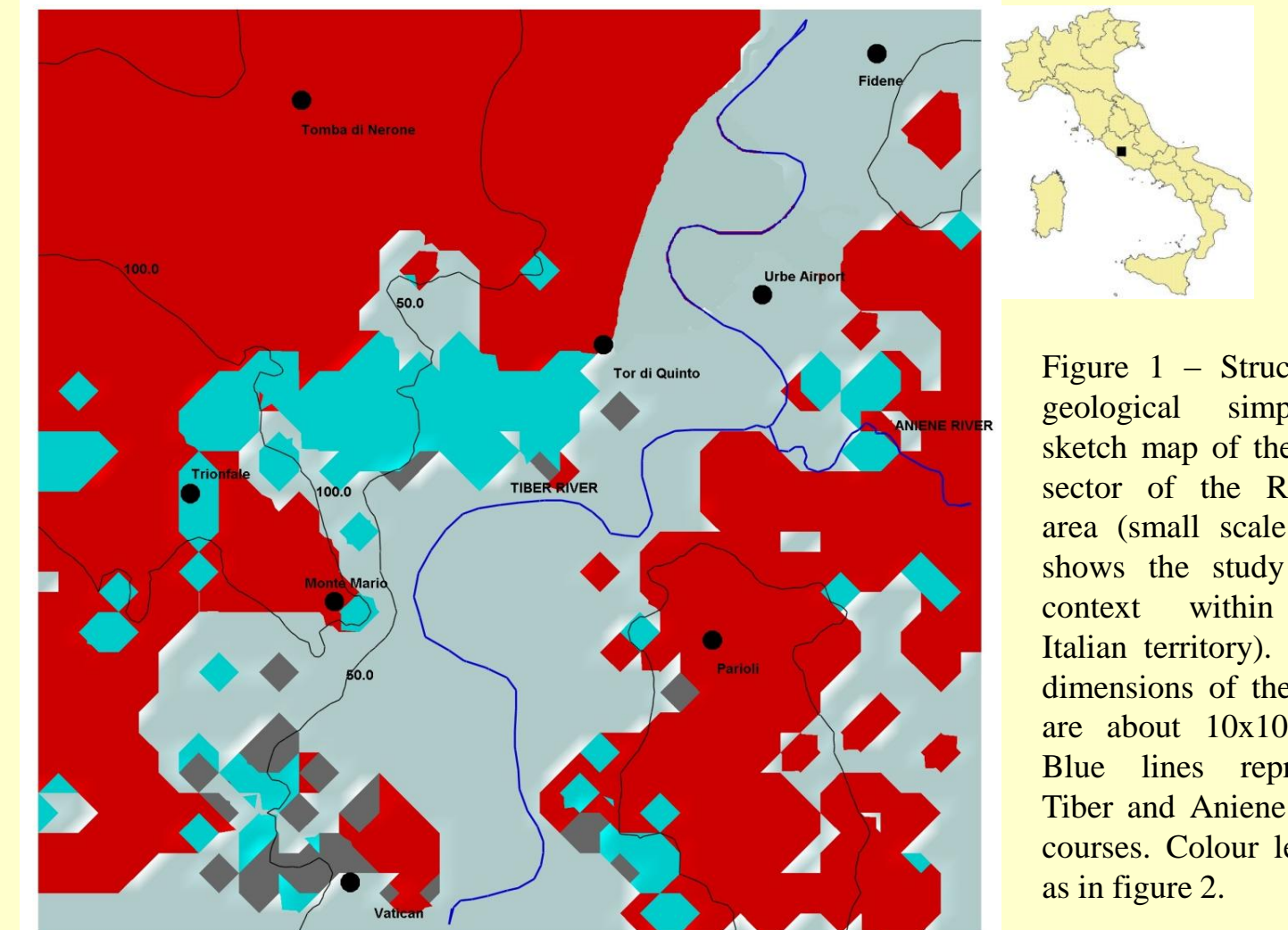


Figure 1 – Structural-geological simplified sketch map of the NW sector of the Roman area (small scale map shows the study area context within the Italian territory). Plane dimensions of the area are about 10x10 km. Blue lines represent Tiber and Aniene river courses. Colour legend as in figure 2.

5. DISCUSSION

In this work, just a preliminary version of the stratigraphical model will be illustrated, since, for instance, information about tectonic lines and anthropic covers, as well as hydrogeological features, were not still definitively elaborated and included in the model itself. As a whole, the model available up-to-date have been here elaborated to understand the general characteristics of the local stratigraphical succession (Fig. 2). To this purpose, representative stratigraphical cross-sections (see Fig. 3 for reference) have been realized.

Four main stratigraphical units were thus here distinguished:

- 1) A basal clayey marine unit having a good spatial continuity, but variable thickness depending on morphological and structural asset of pre-orogenic substrate. The basal clayey marine unit has been generally drilled for by 5-20 m within the study area, but in some places up to 60-80 m have been found. Its largest outcropping area is around the Vatican (e.g., Monte Vaticano Formation).
- 2) A following generally thick (with only local size variations) transitional to continental unit characterized by a sedimentation process with a good lateral continuity. This unit is volumetrically the most diffuse in the study area, but it generally crops out diffusely only in some of the hilly Roman relieves (the largest is in the Monte Mario-Tor di Quinto sector; e.g., Monte Mario Formation). Its thickness has been estimated by up to 80-100 m.
- 3) A widespread and generally thick unit constituted by volcanic deposits coming from the Sabatini magmatic district; they actually lack in the sectors constituting paleomorphological and/or structural highs. The Sabatini volcanic deposits have very variable thickness (locally up to 40-50 m). The Tiber River erosional activity led to thinning or absence of this unit in some places beneath the course of this stream.
- 4) A recent continental deposit unit of alluvial-colluvial origin. It is related to depositional processes of the Tiber River and its tributary streams. In some sectors of the study area the presence of those deposits is probably due to paleochannel occurrences. Tiber River alluvial-colluvial deposits are up to 40-50 m thick and its lateral extension is up to about 3-4 km in correspondence of the southern sector of the study area. Alluvial-colluvial deposits of Aniene River, the main left tributary of Tiber River (locally up to 10 m thick and about 1 km wide), and of other minor local streams are also present.

An anthropic cover is well represented in the urban area and especially in the historical centre of Rome and its thickness is estimated to be up to about 10 m.

In addition to the refinement of the preliminary stratigraphical model here proposed, a next step of the present study might deal with hydrogeological features of the cited distinguished units.

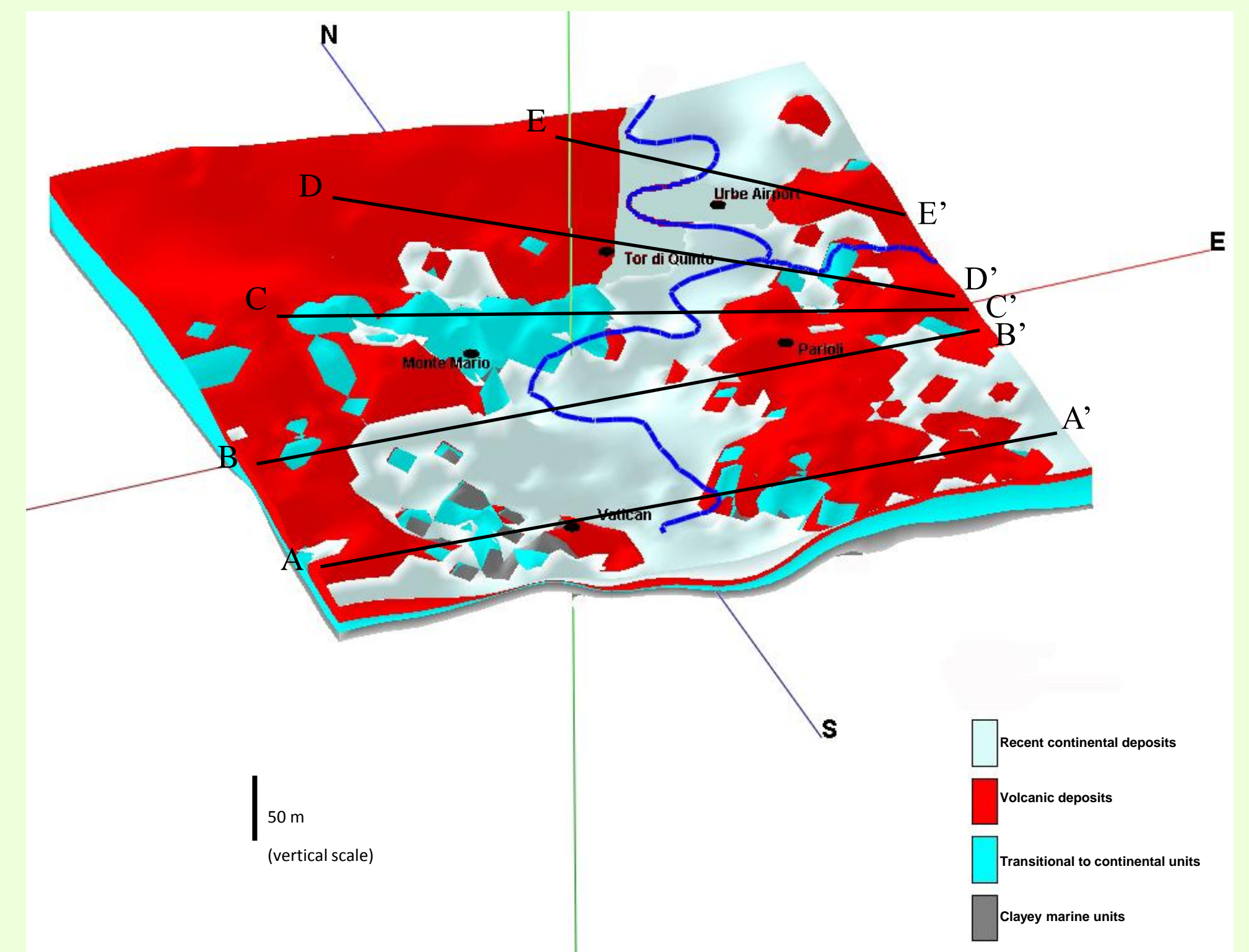


Figure 2 – Preliminary 3-D stratigraphical model of the NW sector of the Roman area. Plane dimensions of the area are about 10x10 km; vertical exaggeration x10. Blue lines represent Tiber and Aniene river courses. Black lines mark cross-sections positions.

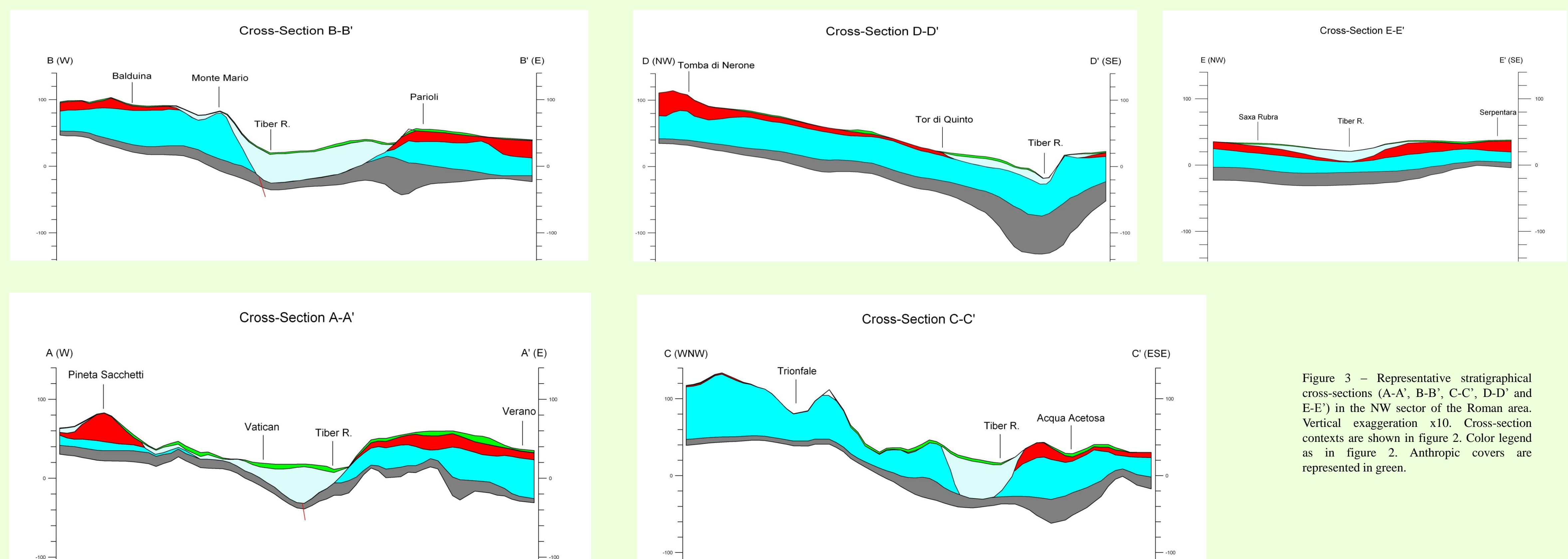


Figure 3 – Representative stratigraphical cross-sections (A-A', B-B', C-C', D-D' and E-E') in the NW sector of the Roman area. Vertical exaggeration x10. Cross-section contexts are shown in figure 2. Color legend as in figure 2. Anthropic covers are represented in green.

6. CONCLUDING REMARKS

A preliminary elaboration of a 3-D model of the NW sector of the urban area of the city of Rome, Italy, is illustrated in the present work. The stratigraphical and hydrogeological information has been mostly taken from subsoil information from drilling, sounding and well logs coming from databases of public and private institutions. Preliminary stratigraphical cross-sections were realized in selected zones of the study area, aimed to define the geological features of the units constituting the investigated territory. Then, 3-D models have been elaborated for improving the understanding of the stratigraphical features of the study area. In this preliminary version of the model, information about tectonic lines and anthropic covers, as well as hydrogeological features, were not still definitively interpreted and included in the model itself. Then, the model available up-to-date illustrates the general characteristics of the local stratigraphical succession.

Four main stratigraphical units were thus here distinguished:

- 1) A basal clayey marine unit having a good spatial continuity, but variable thickness. This unit has been drilled for by 5-20 m within the study area, but in some places up to 60-80 m have been found. Its largest outcropping area is around the Vatican.
- 2) A following generally thick transitional to continental unit having a good lateral continuity. This is volumetrically the most diffuse unit in the study area but it generally crops out diffusely only in some of the hilly Roman relieves. Its thickness has been estimated by up to 80-100 m.
- 3) A widespread and generally thick unit constituted by volcanic deposits coming from the Sabatini magmatic district; they actually lack in sectors constituting paleomorphological and/or structural highs and have very variable thickness (locally up to 40-50 m). The Tiber River erosional activity led to thinning or absence of this unit in some places beneath the course of this stream.
- 4) A recent continental deposit unit of alluvial-colluvial origin. It is related to depositional processes of Tiber River and its tributary streams and probably also to paleochannel occurrences. Tiber River alluvial-colluvial deposits are up to 40-50 m thick in the southern sector of the study area (lateral width up to 3-4 km). Alluvial-colluvial deposits of Aniene River (locally up to 10 m thick and about 1 km wide) and of other minor local streams are also present.

In addition, an anthropic cover is evident especially in the historical centre of Rome and it is estimated to be up to about 10 m thick.

Finally, a next step of the present study might also deal with hydrogeological features of the distinguished units.

7. REFERENCES

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