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LGM INCISED VALLEY IN A VOLCANIC SETTING. THE NORTHERN CAMPANIA PLAIN (SOUTHERN ITALY)

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ABSTRACT: The study provides a first reconstruction of the LGM incised valley of the Volturno River, in the northern Campania Plain. A digital surface model was reconstructed for the Campania Grey Tuff top (39 ky), which represents the base for the Holocene and recent sedimentation. Stratigraphic data from the subsurface of the Volturno Plain have been correlated with a high-resolution (1kJ sparker) single channel reflection seismic profile offshore the Volturno River mouth in order to provide a sequence stratigraphic interpretation.

KEYWORDS: Campania Plain, Volturno river, last glacial maximum, incised valley, holocene evolution

1. INTRODUCTION

Incised valleys are stratigraphic systems, larger than a single channel, resulting from rapid river erosion of coastal regions in response to base level fall. Incised-valley systems at continental margins have been widely studied in the last decades, documenting a range of sedimentary architectures and evolutionary trends of depositional systems, as a function of global to local environmental and climatic changes (e.g.; Blum & Tornqvist, 2000; Boyd et al., 2006; Tanabe et al., 2006, and references therein).

Early investigations have mostly focused on the development of facies models for incised valley systems (e.g. Dalrymple et al., 1994) and the recognition of these features as a key to the identification of sequence-bounding unconformities. Growing attention has been paid also to prograding sand units filling incised valleys as modern analogues to buried sands in the ancient rock record, with a potential for hydrocarbon prospecting (e.g. Boyd et al., 2006; Tanabe et al., 2006). Case histories of incised-valley systems of the Mediterranean have been documented in the last decade along Italian continental margins (e.g. Fontana et al., 2014; Amorosi et al., 2012, 2017; Milli et al., 2016; Tropeano et al., 2013; Maselli et al., 2014). However, most studies have dealt with descriptive documentation on architecture of incised-valley fills in continental siliciclastic environments, whereas relatively little work has focused on correlation of marine and continental strata across continental margins, where sediment dynamics is dominated by mixed siciliclastic-volcaniclastic systems.

The aim of this research is to present a paleomorphological reconstruction of the buried incised valley of the Volturno River, across the coastal region connecting the northern Campania Plain and the Gaeta Bay during the Last Glacial cycle (Fig. 1). The study is based on comprehensive set of onland borehole data and offshore reflection profiles and will attempt an interpretation of the Volturno incised valley as an example of a highly dynamic stratigraphic system dominated by volcanic activity during severe climatic changes.

2. GEOLOGICAL SETTING

The Campania Plain is part of a large extensional sedimentary basin mostly formed during the Quaternary between the western flank of the southern Apennines and the eastern Tyrrhenian margin. This area remained largely submerged by the sea since Middle-Late Pleistocene, when the widespread volcanic activity that occurred along the Campania continental margin produced significant volcaniclastic aggradation. In particular, Campania Grey Tuff (CGT) deposition, originated by the Campi Flegrei caldera 39 ka eruption, covered previous marine-transitional settings and since 39 ky B.P. most of the coastal plain became emerged. The above piroclastic unit forms the substrate for the Holocene and recent sedimentation. Similarly to other Italian alluvial coastal plains, 6.5 ky cal BP a coastal progradational phase established, allowing the formation of a wave-dominated delta system, with strandplains forming beach-dune ridges partially enclosing lagoonal-marshy areas (Amorosi et al., 2012; Sacchi et al., 2014). The stratigraphic studies carried out by the above authors allowed the recognition of a palaeo-valley morphology in the upper surface of the GCT in the whole Plain, likely originated as a response to the Last Glacial Maximum sea-level drop.

3. MATERIALS AND METHODS

The Late Quaternary stratigraphic framework of the Volturno alluvial and coastal plain was assessed based on the analysis and correlation of over 800 stratigraphic data deriving from borehole and sediment cores. The

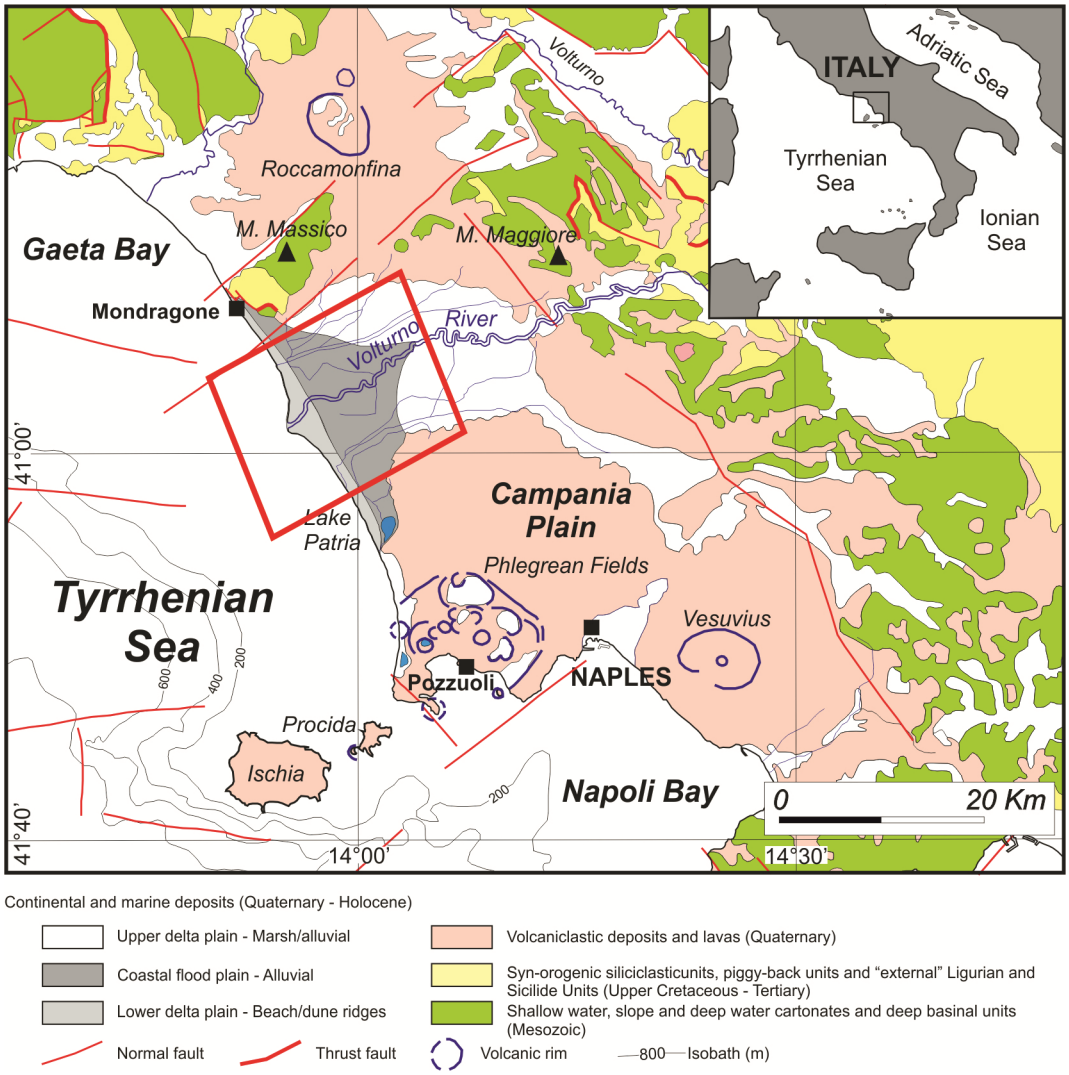

Fig. 1 - Geological map of a sector of northern Campania. Red box indicates the study area.

stratigraphic interpretation was previously published in Amorosi et al. (2012) and Sacchi et al. (2014).

In the present contribution all the information derived from the mentioned stratigraphic study were collected into a relational geodatabase concerning with well-log stratigraphy and further interpreted and homogenized in terms of lithologic units, also containing the related thickness and upper- and lower-boundary depth a.s.l. The upper CGT surface was reconstructed in order to highlight the buried morphologies. Stratigraphic data were correlated with high-resolution (1kJ sparker) single channel reflection seismic profile.

4. RESULTS AND DISCUSSION

The digital surface model reconstructed for the upper CGT surface shows a 15-20 km wide Late Quaternary paleovalley incised by the Volturno River into the thick ignimbritic unit (Fig. 2). The asimmetry of the southern valley flanks was shaped by the presence of an ancient river (Clanio River), reclaimed during the XVI century (Ruberti & Vigliotti, 2017), that resulted in the enlargement of the valley and the formation of a complex deltaic system in the southern part (Fig. 2).

Correlation of stratigraphic data from the subsurface of the Volturno Plain with sequence stratigraphic interpretation of high-resolution (1kJ sparker) single channel reflection seismic profile offshore the Volturno river mouth indicates that the Volturno buried paleovalley was likely incised throughout the Late Pleistocene – early Holocene, during the Last Glacial eustatic cycle (Fig. 3).

Valley incision progressively developed in relation with the lowering of the sea level between ca. 100 and 20 ka BP., and was accompanied by a forced progradation and seaward shift of continental and paralic depositional systems as the coastline was migrating seaward (e.g. Amorosi et al., 2012). During sea level fall, a major ignimbrite unit originated from the Campi Flegrei region and it was deposited all over the Campania area and

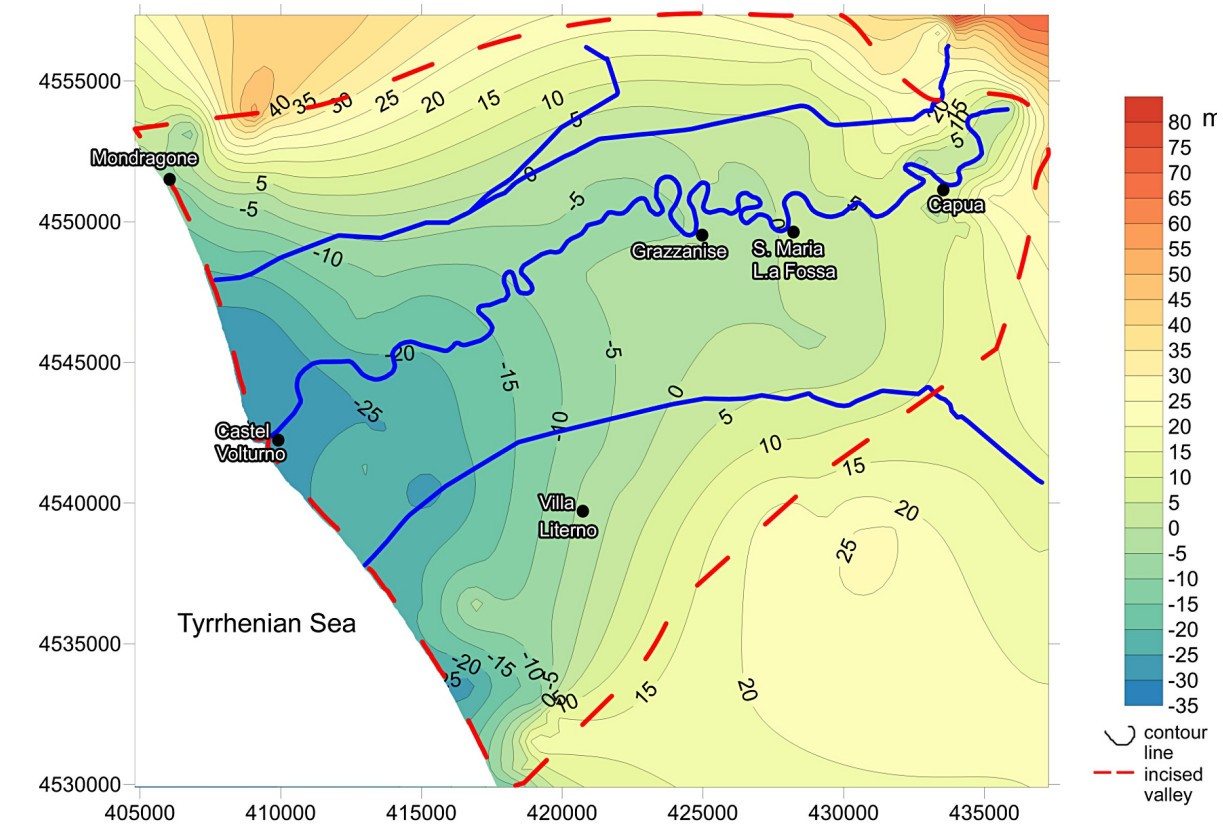

Fig. 2 - Contour map of the CGT upper boundary. The dotted red line outline the outer margin of the Incised Valley .

mantled large part of the coastal sector, also providing significant sediment input into the Volturno incised Valley as a part of a mixed siliciclastic-volcaniclastic source -sink system.

The boundary between the substratum of the paleo-Volturno valley and its sedimentary fill is marked by a well-developed unconformity and associated stratigraphic gap that separates the older Quaternary alluvial deposits and the Campania Ignimbrite (ca 40 ka BP) from the overlying uppermost Pleistocene-Holocene coastal prism entrenching the incised valley.

The onset of the sea-level rise, that followed the climax of the Last Glacial Maximum since ca. 15 ka BP, caused marine ingression deep into the Volturno incised Valley and was associated with rapid backstepping and landward shift of depositional systems. Maximum marine flooding conditions are documented at 7,0-6,5 ka BP by the occurrence of prodeltaic deposit, that have been cored between 18 and 25 m beneath the surface at CV001 drill site (Amorosi et al., 2012).

Since the middle Holocene, a progressive lowering of the Post Glacial sea-level rise created conditions

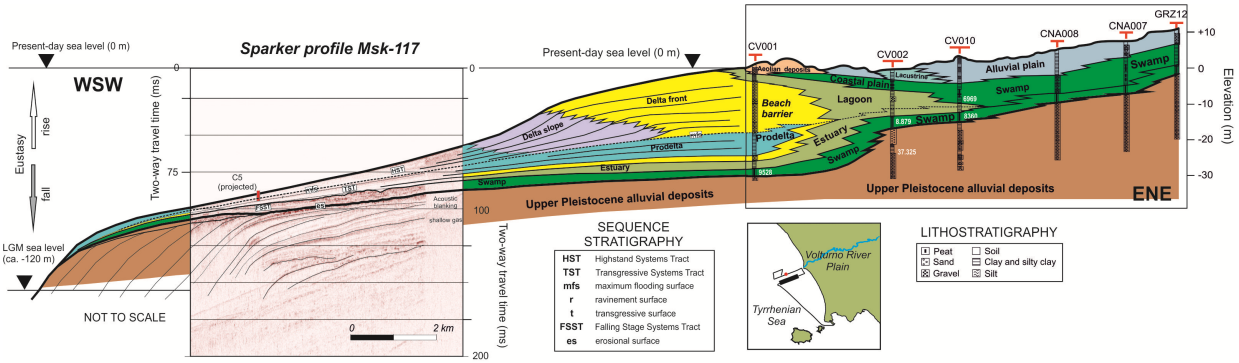

Fig. 3 - Land-sea correlation of stratigraphic data from the subsurface of the Volturno Plain with sequence stratigraphic interpretation of high-resolution (1kJ sparker) single channel reflection seismic profiles offshore the Volturno River mouth (after Amorosi et al., 2012; Sacchi et al., 2014; Margaritelli et al., 2016; Misuraca et al, 2018).

favorable to early aggradation (6,5 -4,5 ka BP) and late stage progradation (< 4,5 ka), accompanied by seaward shift of depositional systems (Sacchi et al, 2014; Margaritelli et al, 2016; Misuraca et al, 2018). This caused, in turn, a rapid filling of the accommodation space over the former incised valley, with the formation of the modern Volturno alluvial Plain, coastal lagoon and beach barrier system.

5. CONCLUSIVE REMARKS

The study provides a first reconstruction of the LGM incised valley of the Volturno River, in the northern Campania Plain. As previously outlined, the valley incision took place in a stepwise fashion, as documented by the presence of remnants of fluvial terraces along the valley flanks.

Stratigraphic data from the subsurface of the Volturno Plain have been correlated with a high-resolution (1kJ sparker) single channel reflection seismic profile offshore the Volturno River mouth in order to provide a sequence stratigraphic interpretation. The study allowed to better constrain the Holocene depositional evolution of the Volturno River delta.

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