



ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA

## **Geological report at the seismic station IV.TERO – Teramo (TE)**

### **Report geologico per il sito della stazione sismica IV.TERO – Teramo (TE)**

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<b>Subject:</b> Final report illustrating the geological setting for station IV.TERO	



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## 1. INTRODUCTION

The geological description is related to the site of studied seismic station. The coordinates are reported in Table 1.

**Table 1.**

CODE	NAME	LAT [°]	LON [°]	ELEVATION [m]
IV-TERO	Teramo (TE)	42.62279	13.60393	673*
ADDRESS	SP47, 64100 Teramo TE, Italy			

\* Coordinates from ITACA (Dec. 2019)

## 2. TOPOGRAPHIC AND GEOLOGICAL INFORMATION

Topographic information related to the site are reported in Table 2. Table 3 summarizes all available geological maps from literature for geological analyses.

**Table 2.**

Topography	Description	Topography Class	Morphology Class	EC8 Class
	reliefs with ridge top width much smaller than the base and slope $15^{\circ} \leq i \leq 30^{\circ}$	T3	SL*	A

\* According to the nomenclature of ITACA (Dec. 2019)

**Table 3.**

Geological map	Source	Scale
IV.TERO	Geological map of Italy sheet 140 (Teramo)	1:100.000
IV.TERO	Carta Geologica d'Abruzzo (Vezzani & Ghisetti, 1998)	1:100.000
IV.TERO	Carta geologica dei bacini della Laga e del Cellino e dei rilievi carbonatici circostanti (Marche	1:100.000



	meridionali, Lazio nord-orientale, Abruzzo settentrionale (Centamore et al., 1991)	
IV.TERO	Carta Geologica-Tecnica per la Microzonazione Sismica di Livello 1, Regione Abruzzo, comune di Teramo (May, 2019)	1:5.000

In Table 4 Geological, Lithological and Lithotechnical Units (according to Seismic Microzonation classification; Technical Commission MS, 2015) are described and are concerned to maps of following chapters. The term “original” means the result comes from a preexisting cartography (Table 3); the term “deduced” means the result comes from an interpretation of a preexisting cartography according to the nomenclature of corresponding cartography.

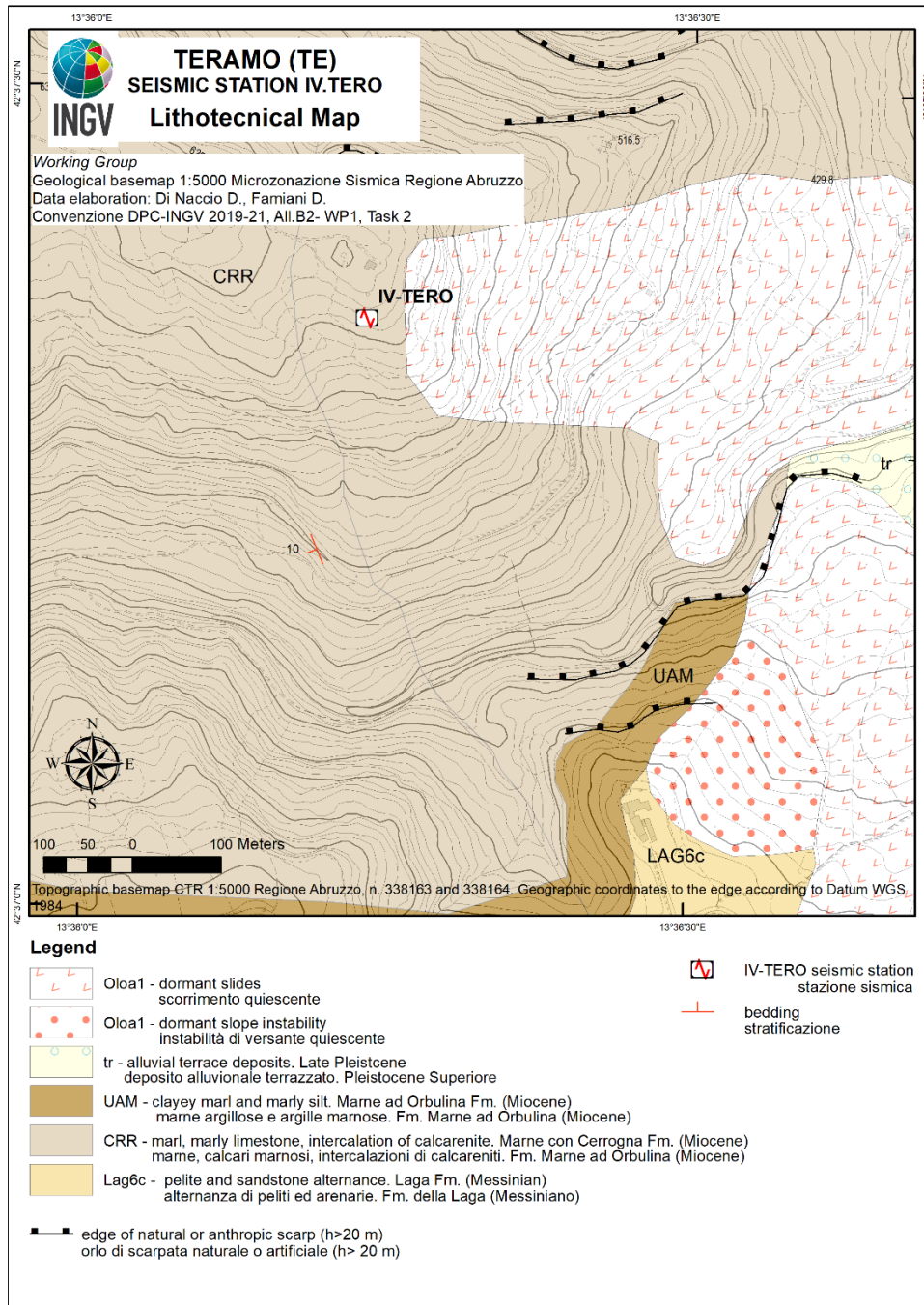
**Table 4**

GEOLOGICAL UNITS		LITHOTECHNICAL UNIT	
( 100k Geological map of Italy, n. 140, Teramo) <i>original</i>		(MZS) <i>original</i>	
code	description	code	description
CRR	marl, marly limestone, intercalation of calcarenite. Marne con Cerrognia Fm.	CO	Consolidated, cohesive geological bedrock.



### 3. GEOLOGICAL MAP

In Figure 1 Geological Map is reported in a 1kmx1Km square around the station.

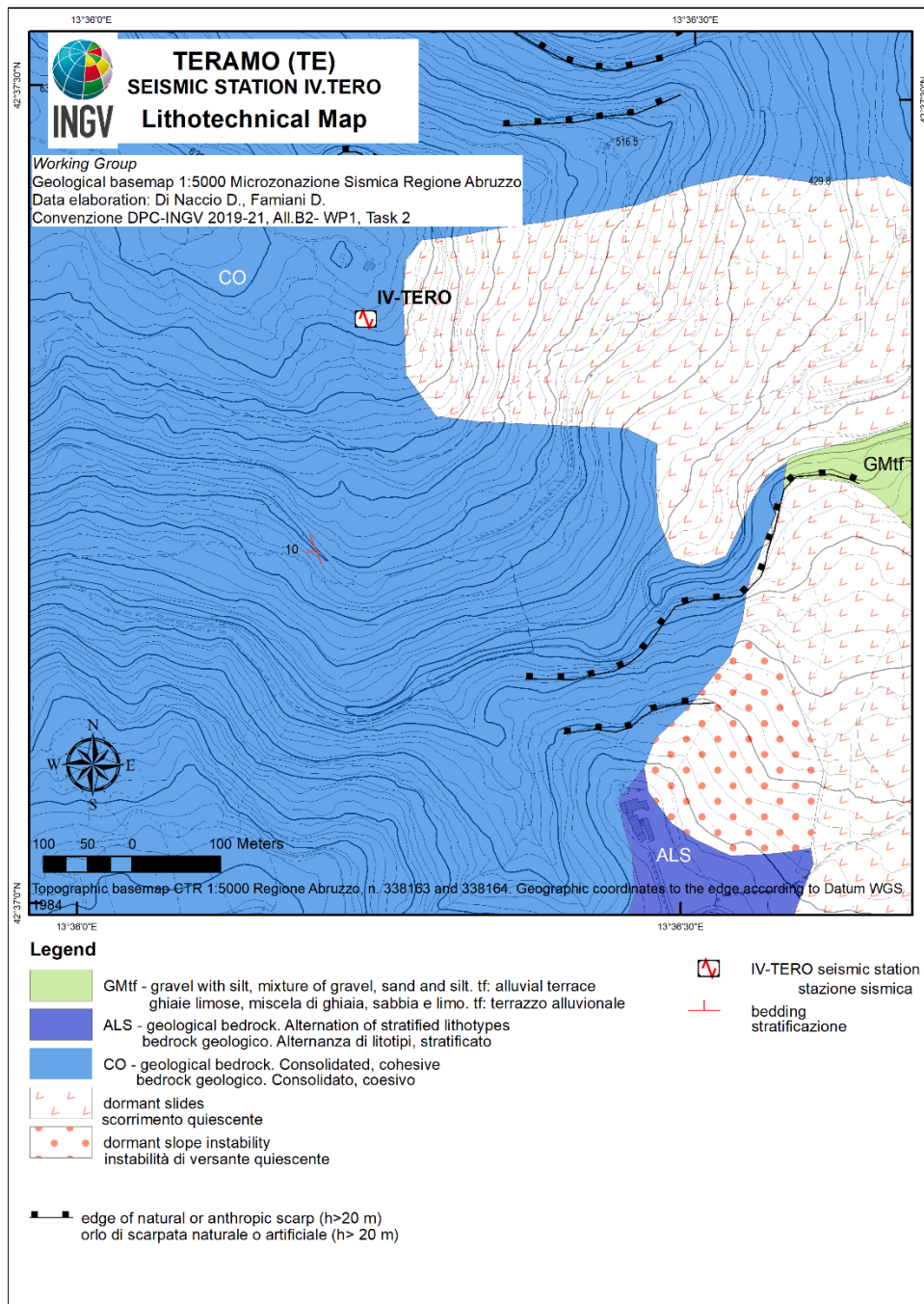


**Figure 1.** Geological map of seismic station IV.TERO. Scale 1:5.000. Geological units are established according to the nomenclature of geological map of Italy 1:100.000 (Sheet 140-Teramo).



#### 4. LITHOTECHNICAL MAP

In Figure 3 Lithotechnical Map is reported in a 1kmx1Km square around the station.



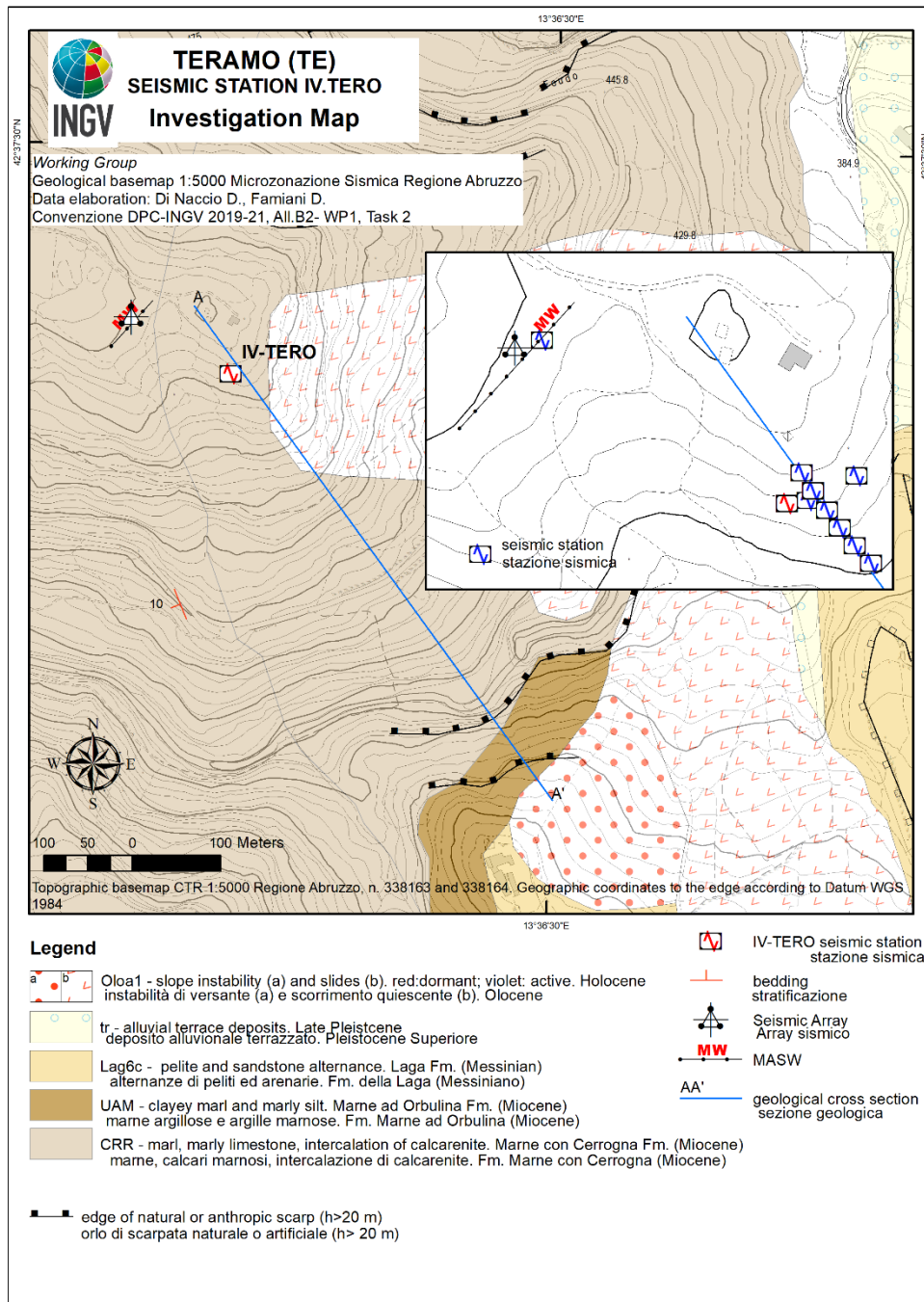
**Figure 2:** Lithotechnical map of the seismic station IV.TERO. Scale 1:5.000. The lithotechnical units are deduced according to the nomenclature of Seismic Microzonation (Technical Commission MS, 2015).





## 5. SURVEY MAP

Figure 3 shows the survey Map reported both previous investigations and geophysics surveys conducted by INGV Working Group.



**Figure 3:** Map of the surveys in the surroundings of the station IV.TERO. Scala 1: 15.000. The box at the bottom right contains a zoom of the area with the detail of the geophysical investigation conducted by INGV Working Group for the seismic characterization of the site (Convenzione DPC-INGV 2019-



21, Allegato B2-WP1, Task B, Velocity profile report at the seismic station IV.TERO, Teramo;  
<http://hdl.handle.net/2122/12948>)

## 6. GEOLOGICAL MODEL

### 6.1 General description

The seismic station is located in the piedmont of the Central Apennines in the NE-Abruzzo region.

The front of the chain is located along the Montagna dei Fiori and the Gran Sasso ridges and drops down to the piedmont area. The landscape is characterized by cuesta, mesa and plateau morphologies resulting from the evolution of the Adriatic foredeep domain of the Apennine orogenic system. From the mountain area to the piedmont, the landscape is carved by the main river valleys roughly perpendicular to the coast and by minor catchments flowing toward the main valleys and the coastal plain.

The geological bedrock consists of a sequence of marine pelitic-arenaceous rocks (Upper Miocene–Lower Pliocene) arranged in a fold and thrust setting, affected by regional NNW-SSE oriented Pliocene thrusts and high-angle normal faults, which are still connected to active moderate seismicity. It is overlain by a sequence of marine clayey-sandy-conglomeratic rocks (Upper Pliocene–Lower Pleistocene) in a gently NE-dipping monoclinical setting. Fluvial and alluvial fan deposits, as well as slope, colluvial and landslide superficial deposits (Middle Pleistocene–Holocene) extensively cover the bedrock.

The geomorphologic processes are mainly fluvial, gravity-induced and mass wasting.

The seismic station is at an altitude of ~ 700 m above sea level and is located along the slope flank of a marly carbonate relief. The bedrock is represented by the Marne con Cerrognia Fm. consisting of marl, marly limestone, with intercalation of calcarenite and its thickness ranges between 90m to 750m. The bedrock is blanket by a cover of colluvial-eluvial deposits of ~ 3-10m-thick.





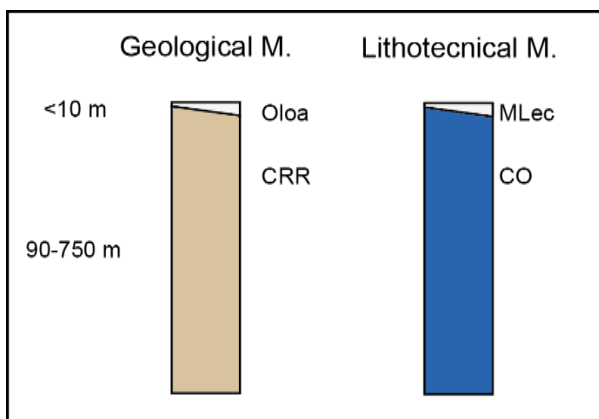
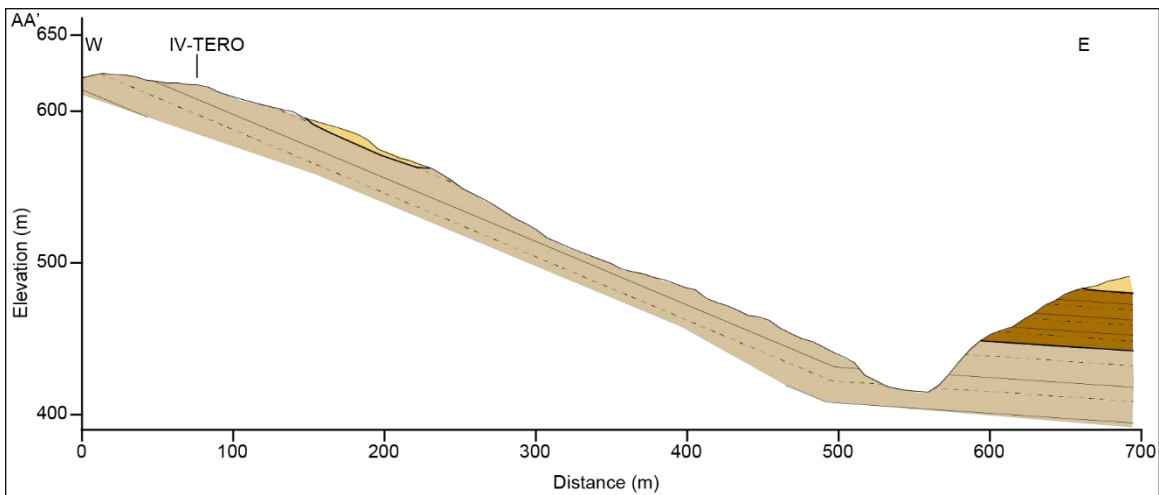
## 6.2 Geological Section

The geological cross section and the subsoil model (Figura 4) accompanying geological survey map provide an interpretation of the third dimension. It is based on the extrapolation of surface data in combination with pre-existing geological studies, recognized local structural style, geophysical investigations performed for the seismic characterization of the site (Convenzione DPC-INGV 2019-21, Allegato B2-WP1, Task B) and the determined seismic velocities profiles (IV.TERO – Teramo; <http://hdl.handle.net/2122/12948>) as well as data from other subsurface sources.

## 6.3 Subsoil model

The lithotechnical units considered representative of the site around the IT-TER-seismic station (Figures 1-2 and Table 4) are the following:

CO: geological bedrock consisting of marl, marly limestone, intercalation of calcarenite. A thin layer of colluvium-eluvium (MLec) can not be excluded as recognized by geophysical modeling (IV.TERO – Teramo; <http://hdl.handle.net/2122/12948>).



**Figure 4:** Top: Geological section A-A' crossing seismic station IV.TERO; bottom: subsoil model under the IV.TERO seismic station and classification according to the nomenclature of geological map of Italy 1:50.000 (CARG project): Oloa: colluvium-eluvium, CRR: Marne con Cerrognia Fm.; according to SM: MLec: inorganic silt, rock flour, fine-grained silty or clayey sand, silty clay of low plasticity, CO: Consolidated, cohesive. bedrock



## 7. REFERENCES

Carta Geologica-Tecnica per la Microzonazione Sismica di Livello 1, Regione Abruzzo, comune di Teramo (May, 2019);

Centamore, E., Adamoli, L., Berti, D., Bigi, G., Bigi, S., Casnedi, R., Cantalamessa, G., Fumanti, F., Morelli, C., Micarelli, A., Ridolfi, M., Salvucci, R. (1991). Carta geologica dei bacini della Laga e del Cellino e dei rilievi carbonatici circostanti (Marche meridionali, Lazio nord-orientale, Abruzzo settentrionale). Studi Geologici Camerti, Volume Speciale 1991/2;

Commissione Tecnica per la Microzonazione Sismica (2015). Microzonazione sismica. Standard di rappresentazione e archiviazione informatica, Versione 4.0b (Commissione tecnica inter-istituzionale per la MS nominata con DPCM 21 aprile 2011);

NTC08, 2008. Ministero delle infrastrutture e dei Trasporti (2008). Norme Tecniche per le Costruzioni (NTC08). Decreto Ministero Infrastrutture. GU Serie Generale n. 29 del 04-02-2008 - Suppl. Ordinario n. 30

NTC18, 2018. Ministero delle infrastrutture e dei Trasporti (2018). Norme Tecniche per le Costruzioni (NTC18). Decreto Ministero Infrastrutture. GU Serie Generale n. 42 del 20-02-2018 - Suppl. Ordinario n. 8

Servizio Geologico d'Italia (1963). Geological Map of Italy (Sheet 140, Teramo, scale 1:100.000). Istituto Poligrafico e Zecca dello Stato, Roma;

Vezzani, L., & Ghisetti, F. (1998). Carta Geologica dell'Abruzzo, Scala 1:100.00, Regione Abruzzo, Settore Urbanistica-Beni ambientali e culturali, S.E.L.C.A., Firenze;



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Working group INGV "Convenzione DPC-INGV 2019-2021, Allegato B2-WP1, Task2", (2019).  
Velocity profile report at the seismic stations IT.TERO - Teramo (TE).  
<http://hdl.handle.net/2122/12948>.



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