Geological Field Trips and Maps

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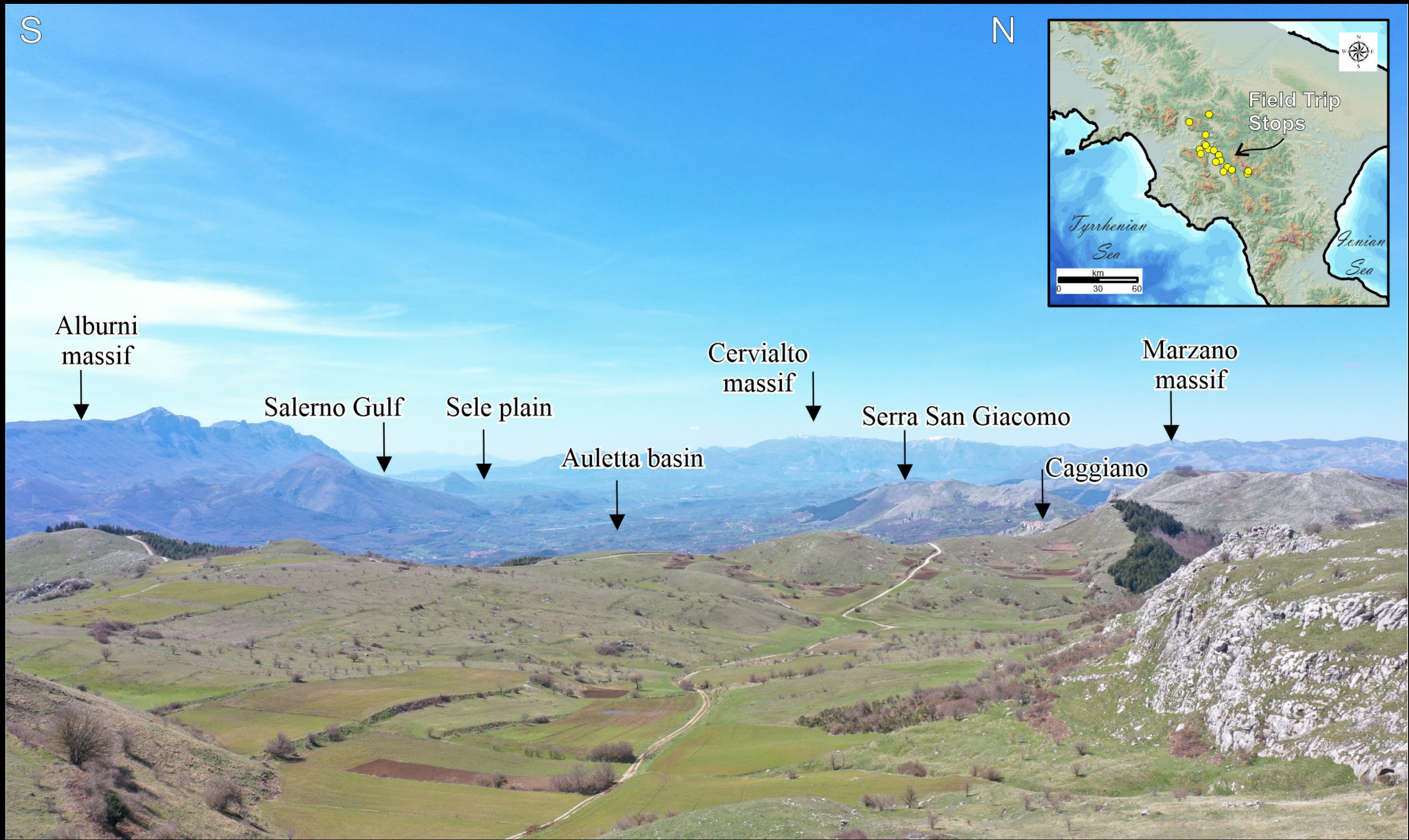

A structural-geological tour across the Campania-Lucania potentially seismogenic extensional fault system (Southern Apennines, Italy)

Itinerant Workshop in the frame of the MUSE-4D PRIN project, which took place on 12-16 July 2022

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A structural-geological tour across the Campania-Lucania potentially seismogenic extensional fault system (Southern Apennines, Italy)

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Simone Bello[1,2,3], Francesco Brozzetti[1,2], Carlo Andrenacci[1,2], Federico Pietrolungo[1,2], Daniele Cirillo[1,2], Rita de Nardis[1,2], Marco Menichetti[2,4], Carmelo Monaco[2,5,6], Luigi Ferranti[2,7], Giorgio de Guidi[2,5,6], Giovanni Barreca[2,5,6], Salvatore Gambino[2,5], Salvatore Giuffrida[5], Francesco Carnemolla[5], Giusy Lavecchia[1,2]

[1] DiSPuTer - University G. d'Annunzio Chieti-Pescara, 66100, Chieti, Italy.
[2] CRUST - Centro inteRUniversitario per l'analisi Sismotettonica Tridimensionale, Italy.
[3] CNR - Istituto di Geologia Ambientale e Geoingegneria, Monterotondo 00016 Rome, Italy.
[4] Universita degli Studi di Urbino Carlo Bo, Urbino, 61029, Italy.
[5] Dipartimento di Scienze Biologiche Geologiche e Ambientali, Università di Catania, 95129, Italy.
[6] INGV, Osservatorio Etneo-Sezione di Catania, 95129, Catania, Italy.
[7] Università degli Studi di Napoli Federico II, Naples,80138, Italy.

Corresponding author e-mail: simone.bello@unich.it

Cover page Figure: Cover Page Figure: Panoramic view of the area between the Alburni Mountains to the south and the Monte Marzano area to the north, centered on the Auletta Basin and taken from the hills southeast of the town of Caggiano.

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ABSTRACT

The field trip focuses on the Quaternary tectonic structure of the Campanian-Lucanian Apennines. This area is responsible for some of the most destructive southern Apennine earthquakes, which were studied within the context of a PRIN-2017 project referred to as MUSE-4D, that stays for "*Overtime tectonic, dynamic and rheologic control on destructive multiple seismic events - Special Italian Faults & Earthquakes: from real 4D cases to models*". Part of the project focuses on two M7-class multi-event Special EarthQuakes (SEQs): Irpinia 1980 and Basilicata 1857, which released similar cumulate magnitudes in time lapses variable from few seconds (1980) to few minutes (1857). These events and their host structures were analysed in innovative overtime (Quaternary and active) and multi-scale (local to regional) approaches within the project context. The geometry, kinematics, and structural style of the potentially seismogenic sources of these events are still questioned in the literature. A full constraint of their surface setting is fundamental to reducing the number of variables in assessing the extensional tectonics of the area and in the 3D fault model building. The three-days field trip is finalized to visit both the largely agreed and the controversial fault exposures to discuss them among the geo-scientific community.

Keywords: Field trip, extensional tectonics, strong earthquakes, southern Apennines, Italy.

PROGRAM SUMMARY

This field trip (stops in Fig. 1) aims to capture the attention of the scientific community and beyond, by exploring some of the most significant structural-geological sites related to Quaternary tectonics in the Campanian-Lucanian Apennines, in Southern Italy. The seismotectonic relevance of this area, one of the most seismically active in the Italian peninsula and Europe lies in its association with two destructive earthquakes in recent history: the 1857 Basilicata earthquake (M_w 7.1) and the 1980 Campania-Lucania earthquake (M_w 6.9), which caused about 10,000 and 3,000 casualties, respectively, and produced widespread damage, razing dozens of villages to the ground (Fig. 2).

The evolution of seismology in its contemporary form traces its roots back to the 1857 event (CPTI15; Rovida et al., 2020). Mallet's (1862) comprehensive report provided the first thorough examination of the macroseismic features of an earthquake and marked a pivotal moment in the systematic examination of earthquakes.

The 1980 event definitively stimulated the establishment of the Italian state's first organised civil protection system and prompted a new approach to modern seismotectonic investigations in Italy. This approach fully integrates multi-scale and multi-depth geological and seismological data to understand the earthquake source.

The field trip navigates through some of the most representative outcrops of the region, where most of the fault planes bordering major Quaternary sediment-filled basins exhibit evidence of recent activity. The structural interpretation of this portion of the Apennines traditionally emphasised compressive tectonics, which is responsible for the eastward stacking of the orogen during Paleogene and Neogene times. In contrast, extensional tectonics has long been given less importance despite its role in shaping the current morphology and structural settings, with normal faults, NE- and SW-dipping, detaching on a low-angle NE-dipping fault system, all framed within the context of regional geodynamic relevance.

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A step forward in highlighting the relevance of Quaternary extensional tectonics in this area has recently been achieved through the QUIN 2.0 database (Lavecchia et al., 2024). The latter, together with its initial release for the central-northern Apennines (QUIN 1.0), compiles and provides the scientific community with thousands of georeferenced points related to fault planes showing kinematic evidence (slickensides) compatible with an extensional stress field in average oriented ~NE-SW.

In this guide, after a regional introduction to the late Quaternary to present tectonic and seismotectonic setting of the southern Apennines, we describe a stop-by-stop field trip for a total of 16 key sites located within the Campanian-Lucanian sector of the Apennines. Care will be paid to the evidence of surface faulting and the outcrops of the Quaternary faults responsible or possibly responsible for the previously mentioned earthquakes.

The field trip, organised over three days, takes place from north to south, starting from the Irpinia area, through the Auletta basin and the Tanagro valley, the Vallo di Diano, and the Val d'Agri (Fig. 1). The goal of the first day is the faults and the coseismic rupture related to the Campania-Lucania 1980 earthquake. This broke into a M_w 6.9 multi-event and opened the scientific community to the possibility of the surface rupturing in the Apennines. The second day will focus on the key area between the Auletta and Vallo di Diano basins, from the Alburni mounts, and across the Monti della Maddalena ridge. Here, the northern segment of the "Caggiano-Montemurro fault" (CMF; Bello et al., 2022), possibly associated with the Basilicata 1857 earthquake (M_w 7.1), crops out. The third day focuses on the structures cropping out on the northern side of the Val d'Agri basin, where outcrops of the southern segment of the CMF are exposed.

SAFETY

The sites of this three-days field trip are generally easily reachable, although walks of a few hundred meters are often necessary. Although some stops are at the edge of paved roads, in many cases, to reach the outcrops it is necessary to walk on stony ground, country lanes, and sheep tracks. We, therefore, recommend appropriate clothing. For stops close to roads we recommend the use of high-visibility jackets. In the southern Apennines, the climate is typically favourable, but we recommend adequate information before starting the field trip, especially during the winter season. A hat, sunglasses, hiking sticks, and an adequate supply of water are strongly recommended. In some cases, depending on the weather during the days/months before the field trip, the paths could be slippery or invaded by large puddles. We advise caution. To cover some off-road sections, it would be preferable to use a 4WD vehicle. In case of emergency dial the unique European emergency number (112).

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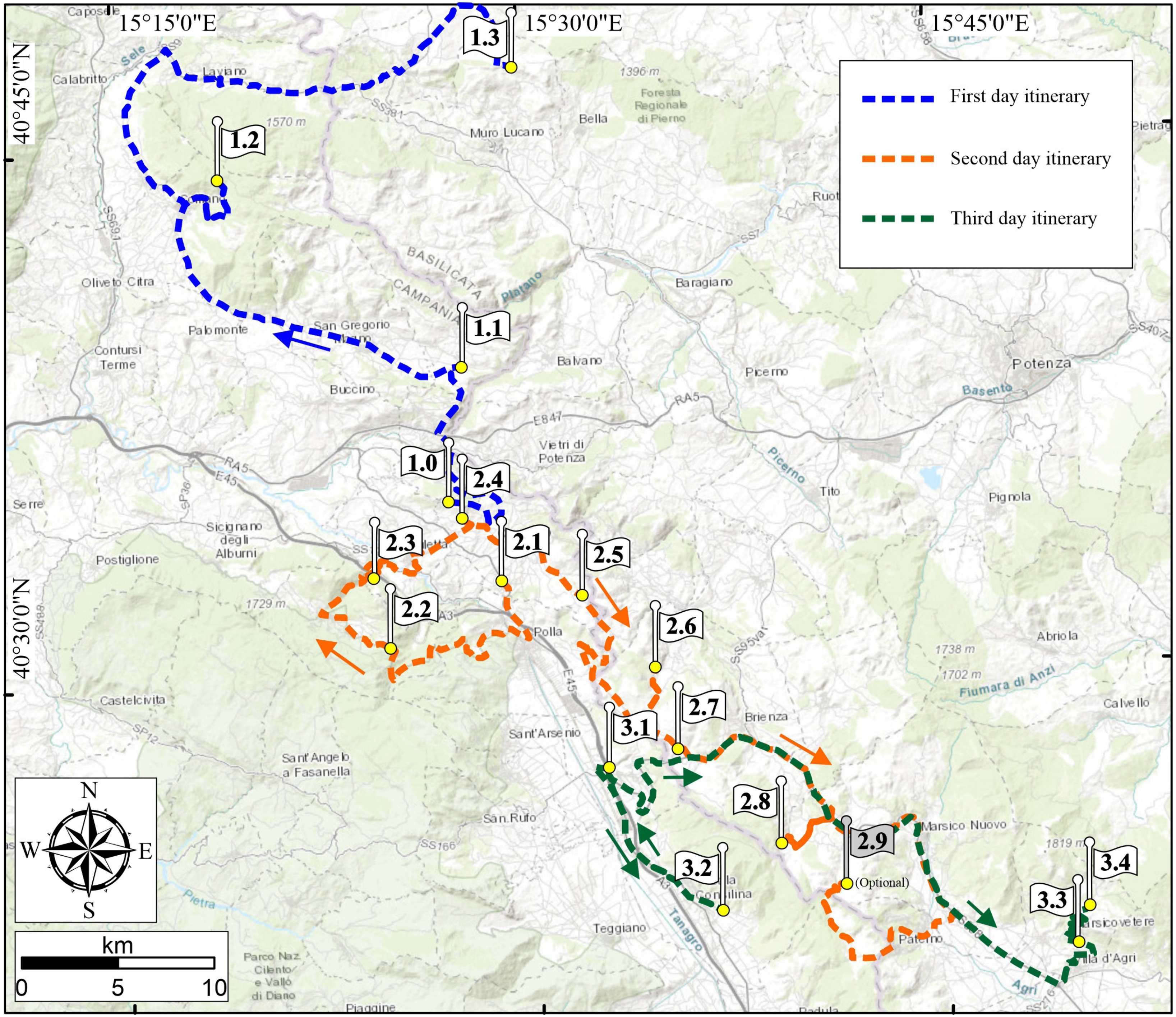

Fig. 1 - Day-by-day itinerary and geographical location of the field trip stops.

HOSPITALS

For the Irpinia area: Presidio Ospedaliero "S. Francesco D'assisi" Piazza Bergamo, Oliveto Citra (SA). Tel: +39 0828 797111.
For the Vallo di Diano area: Presidio ospedaliero Luigi Curto di Polla, Via Luigi Curto, 84035 Polla (SA). Tel: +39 0975 373111.
For the Val d'Agri area: Presidio Ospedaliero di Villa d'Agri "Ospedale San Pio da Pietrelcina", Via Cristoforo Colombo, 17, 85050 Villa D'agri (PZ). Tel: +39 0971 611111.

ACCOMMODATIONS

During the field trip, the participants can find valid accommodation solutions both in the Irpinia and Vallo di Diano-Val d'Agri areas. A central place to reach all the stops can be found between the municipalities of Polla and Atena Lucana. The whole area is a tourist destination and therefore offers numerous hotels and B&Bs which can be booked from Apps and websites.

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GEOLOGICAL SETTING

The field trip develops through the central part of the Southern Apennines extensional belt, in the Campania and Lucania regions. This portion of the orogen consists of a tectonic edifice built during Neogene times due to the consumption of the Alpine Tethys Ocean and the deformation of the western Adria Plate. The outcropping tectonic units are here briefly described moving from west to east, but for an exhaustive synthesis of the deformation history before Quaternary times we reference the reader to the broad literature present (e.g., Ogniben 1969; Mostardini & Merlini, 1986; Patacca & Scandone, 1989, 2007; Pescatore et al., 1999; Menardi Noguera & Rea 2000; Patacca, 2007; Vezzani et al., 2010).
The internal units, originating from the deformation of basinal domains formerly placed between the Alpine Tethys and the Adria continental crust, include the Ligurian nappe (Jurassic to Lower Miocene) and the Sicilide units (Upper Cretaceous–Lower Miocene).
The Apennine Platform consists of thrust sheets of Meso-Cenozoic carbonate shelf succession (Upper Triassic to Middle Miocene). The facies distribution led to differentiate the western platform margin (Monte Bulgheria Unit) from the intermediate lagoonal sector (Monte Cervati Unit) and the eastern edge (Monte Marzano Unit). In addition, an easterner slope environment (Maddalena Mountains Unit) is also well documented.
The Lagonegro and Sannio-Molise units include thrust sheets made of pelagic (Middle Triassic–Aquitanian), and flysch deposits (Burdigalian–Messinian) of deep basinal environment originally located east of the Apennine Carbonate Platform. These units show high imbrication and shortening, with a repeated tectonic doubling of the stratigraphic succession (Patacca, 2007).
The Apulia Platform is a thick pile (up to 6,000 m) of shallow water carbonates and anhydrites (Upper Triassic–Middle Miocene) lying on a sedimentary terrigenous-metapelitic basement (Permian–Early Triassic). The western sector of the platform, buried under the previous imbricated units, is deformed by contractional structures (Inner Apulia or Apulian Belt), whereas the eastern sector, cropping out east of the Bradanic foredeep, has been uplifted during extensional Quaternary faulting.
The Campania-Lucanian Apennine's present structure can be schematized due to the superposition of detached allochthon units on the Apulian platform (Mostardini & Merlini, 1986; Ferranti et al., 2024).
The allochthon units include the Apennine Platform and the pelagic successions pertaining to both the "internal" (i.e., Liguride and Sicilide *Auctt.*) and Lagonegrese basins. They show a complex imbrication that mainly arose due to "in sequence" thrusting mechanisms, locally complicated by out-of-sequence propagations.
The "Apulian belt" is described as a structure delimited at the top by a roof thrust located at the base of the Lagonegrese allochthon units.
Recent bio-stratigraphic reviews of the foredeep and wedge-top successions (Patacca & Scandone, 2007; Vezzani et al., 2010) point out that the orogenic deformation started to involve the internal units during the Early Miocene, the Apennine Platform during the Middle Miocene interval, and the Lagonegro–Molise basin during the late Tortonian. During the Early Pliocene, the allochthon tectonic pile overthrust the Apulian domain, which, in turn, was affected by significant contraction during the Late Pliocene.

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During the Quaternary, at least up to the Middle Pleistocene, two coupled eastward migrating deformation belts coexisted in the Apennines. This is testified by the synchronous compression and crustal thickening along the chain front and extension and crustal stretching at the rear of the orogen (Elter et al., 1975; Doglioni et al., 1999; Lavecchia et al., 2021).

Consequently, the western and axial portions of the chain underwent an extensional stress field that caused the displacement of the contractional edifice (Hippolyte et al., 1994; Barchi et al., 1998; Cinque et al., 2000).

The alignment of the main Quaternary and active extensional faults is shown in Figure 3. According to a broad literature, crustal stretching generated both Low-Angle (LANFs) and High-Angle (HANFs) Normal Faults in the internal side of the Campania-Lucania arc (Amato et al., 1992; Ascione et al., 1992; Ferranti & Oldow, 1999; Scrocca et al., 2007; Schirripa Spagnolo et al., 2024). LANFs have been recognized as the cause of diffuse younger-on-older sub-horizontal tectonic contacts in the Picentini, Maddalena, Lauria, and Morano Calabro mountains (D'Argenio et al., 1987; Ferranti & Oldow, 1999; Casciello et al., 2006; Mazzoli et al., 2014) and have been generally referred to an early extensional stage preceding the origin of the high-angle normal faults bounding the Quaternary basins.

According to Ferranti & Oldow (1999), in the Salerno area, the activity of the Picentini detachment fault would be referable to the Upper Miocene - Late Pliocene times and would be separated from the age of high-angle extension.

In the same area, Casciello et al. (2006) hypothesise a Late Pliocene onset for the Mts. Picentini LANFs and an activity lasting up to the very Early Pleistocene. However, they agree in relating the origin of large morphostructural depressions to the onset of high-angle normal faults.

Conversely, Brozzetti (2011) does not recognise a clear division between the LANF and HANF stages and suggests that the tectonic style change occurred through continuous deformation.

Several works deal with the geometry of the main intra-mountain extensional basins and their infill of continental deposits, the kinematics of their boundary faults and associated earthquakes (Brancaccio et al., 1991; Ascione et al., 1992; Schiattarella, 1998; Cinque et al., 2000; Maschio et al., 2005; Zembo et al., 2009; Brozzetti, 2011; Giano et al., 2014; Brozzetti et al., 2017; Bello et al., 2021, 2022). Despite this, faults' subsurface geometry is generally poorly defined and the age of activity of high-angle extensional tectonics is still debated. For example, the earlier stages of some intramountain basins (Tanagro, Diano, Agri, and Mercure) have been referred to a regional strike-slip phase (Monaco et al., 1998; Schiattarella et al., 1994; Schiattarella, 1998) that would be active in these basins until the Early Pleistocene (Hippolyte et al., 1994; Giano et al., 2000). Conversely, according to other authors (Ghisetti et al., 1994; Brozzetti et al., 2017), during the same period, the extensional tectonics dominated, and the earlier strike-slip faults were reactivated with normal and oblique kinematics.

Also, Papanikolaou & Roberts (2007) backdate the onset of the high-angle normal faults and the related intramountain basins, suggesting that the area between the Picentini Mountains and the Pollino massif underwent extension since the Late Pliocene times.

Finally, using seismic reflection profiles crossing the Tanagro and Diano basins and some calibration wells, Barchi et al. (2007) and Amicucci et al. (2008) provide data on the age and thickness of their syn-sedimentary continental fills and infer for the extensional boundary faults an age of activity older than Early Pleistocene.

SEISMOTECTONIC SETTING

The field trip develops across a portion of the Italian Apennines' extensional seismotectonic province (*sensu* Lavecchia et al., 2021), extending throughout the peninsula. Its Southern Apennine portion, which extends about 450 km from Campania-Lucania and Calabria, consists of a Quaternary extensional fault system dissecting pre-existing fold-and-thrust structures (Cinque et al., 2000; Casciello et al., 2006; Papanikolaou & Roberts, 2007). The field trip area encompasses the Campania-Lucania Extensional Fault System (Brozzetti, 2011), which extends for ~100 km in NNW-SSE direction from central Irpinia to the High-Agri Valley and includes conjugate sets of ENE- to NNE-dipping and WSW- to SSW-dipping active normal and normal oblique faults (Amicucci et al., 2008). The area was hit by the 1980 earthquake M_w 6.9 (Bernard & Zollo, 1989; Pantosti & Valensise, 1990; Pantosti et al., 1993; Ascione et al., 2013, 2020; Galli & Peronace, 2014; Galli et al., 2014a,b; Galli, 2020; Bello et al., 2021) in its northern sector, and by the 1857 earthquake in the southern sector (Benedetti et al., 1998; Galli et al., 2006; Burrato & Valensise, 2008; Bello et al., 2022), reaching X and XI MCS intensity, respectively (Fig. 2).

The Campania-Lucania earthquake (also Irpinia earthquake; M_w 6.9) was released with three in-sequence events in a time-lapse of about 40 seconds (Bernard & Zollo, 1989). The fault system

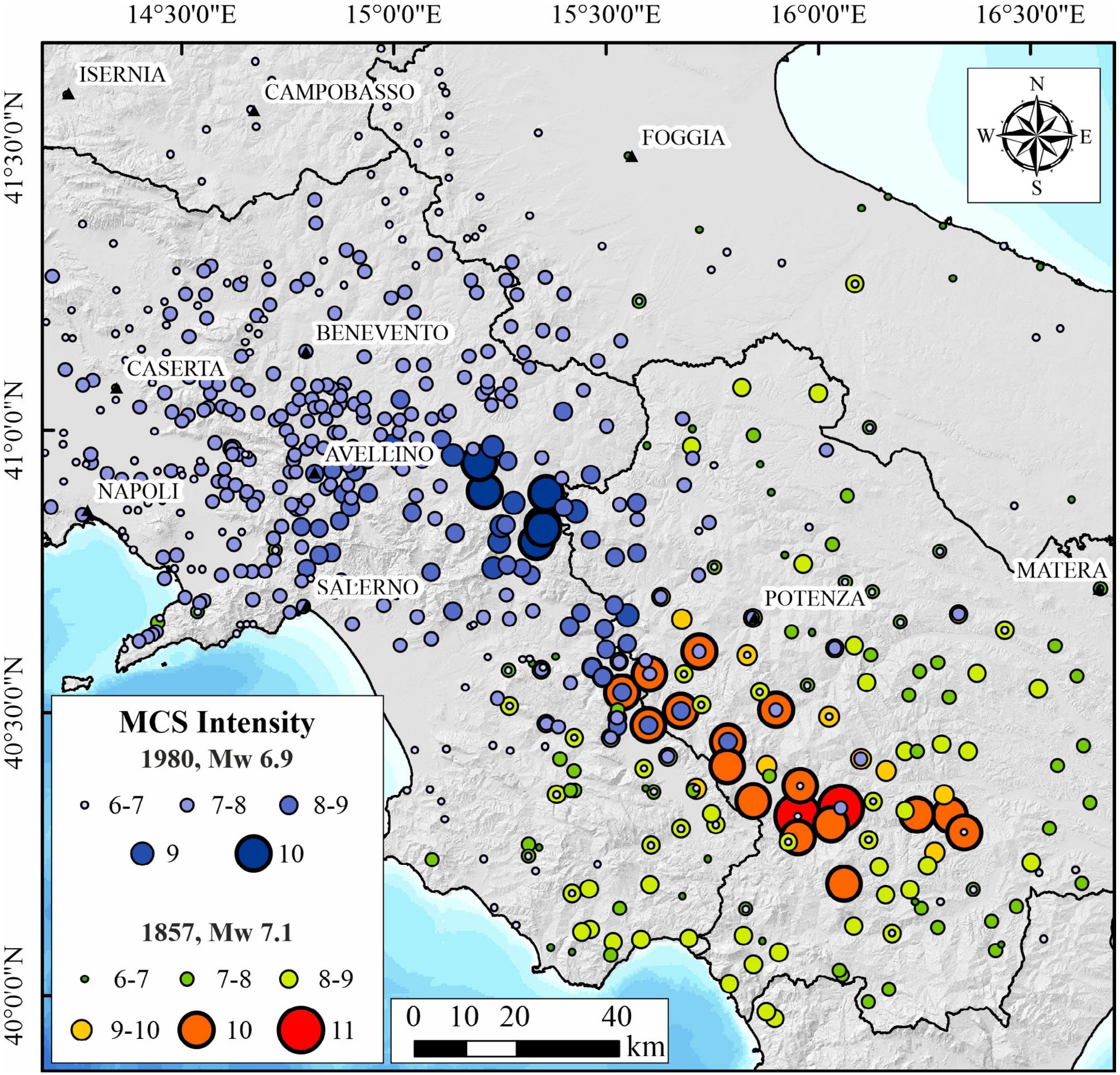

Fig. 2 - Mercalli-Cancani-Sieberg intensities (from DBMI15, Locati et al., 2022) of 1857 (coloured circles on the yellow-red scale) and 1980 (coloured circles on the blue scale) earthquakes.

responsible for the three events is composed of three main fault strands, which are referred to as Inner Irpinia Fault (InIF) and Irpinia Fault (IF), north-eastward-dipping, and Antithetic Fault Alignment (AFA), which is instead south-westward-dipping (Fig. 3, 3b; Bello et al., 2021). Each has an along-strike length in the order of several tens of km. They have been divided into segments of a few tens of km and sections of some km and form a graben-like fault system (Amoruso et al., 2005, 2011; Bello et al., 2021; Ercoli et al., 2023) with an E-W bent in the southern portions. The three faults reach a depth of ~12 km, which has been considered as the base of the seismogenic layer and detach on a basal decollement layer represented by the westernmost east-dipping listric normal structures of the Alburni-Picentini system (Brozzetti, 2011). According to Brozzetti (2011), the latter is considered the breakaway structure of the wall Campania-Lucania fault system, with cumulative Quaternary displacement exceeding 3 km.

The 16 December 1857 Basilicata earthquake had M_w 7.1, and it is classified among the strongest earthquakes in peninsular Italy (CPTI15, Rovida et al., 2020). It was felt in the entire central and southern Italy, causing 10,000 to 19,000 casualties. In the only municipality of Montemurro, it caused ~4000 deaths out of a population of ~7000 inhabitants, while in the municipality of Polla, the victims were ~2000 on a population of ~7000 inhabitants (Mallet, 1862). Two major sub-events were released in a time-lapse of ~3 minutes, either rupturing two east-dipping faults (Melandro-Pergola and Val d'Agri; Fig. 3; Burrato & Valensise, 2008) or the southwest-dipping Val d'Agri fault (Benedetti et al., 1998) and Caggiano-Montemurro Fault (CMF; Fig. 3c; Bello et al., 2022). Whatever the dip-direction of the causative fault, its estimated magnitude suggests activating one or more seismogenic sources for several tens of km. Moreover, the seismogenic fault trend and extent must be suitable to justify the configuration of a macroseismic intensity field that includes the northern sector of the Monti della Maddalena Ridge and the reliefs located east of the Val d'Agri. According to Bello et al. (2022), the recently highlighted CMF could be the structure responsible for the earthquake (Fig. 3c). It is a ~65 km-long highly segmented fault, ~WNW-ESE striking, composed of two main segments and shows evidence of recent activity.

Below is a description of the stops comprising the itinerary of this guide, including location coordinates, geological and structural-geological description of the outcrops, and structural data from the QUIN 2.0 database (Lavecchia et al., 2024) about the fault portion covered by the stop.

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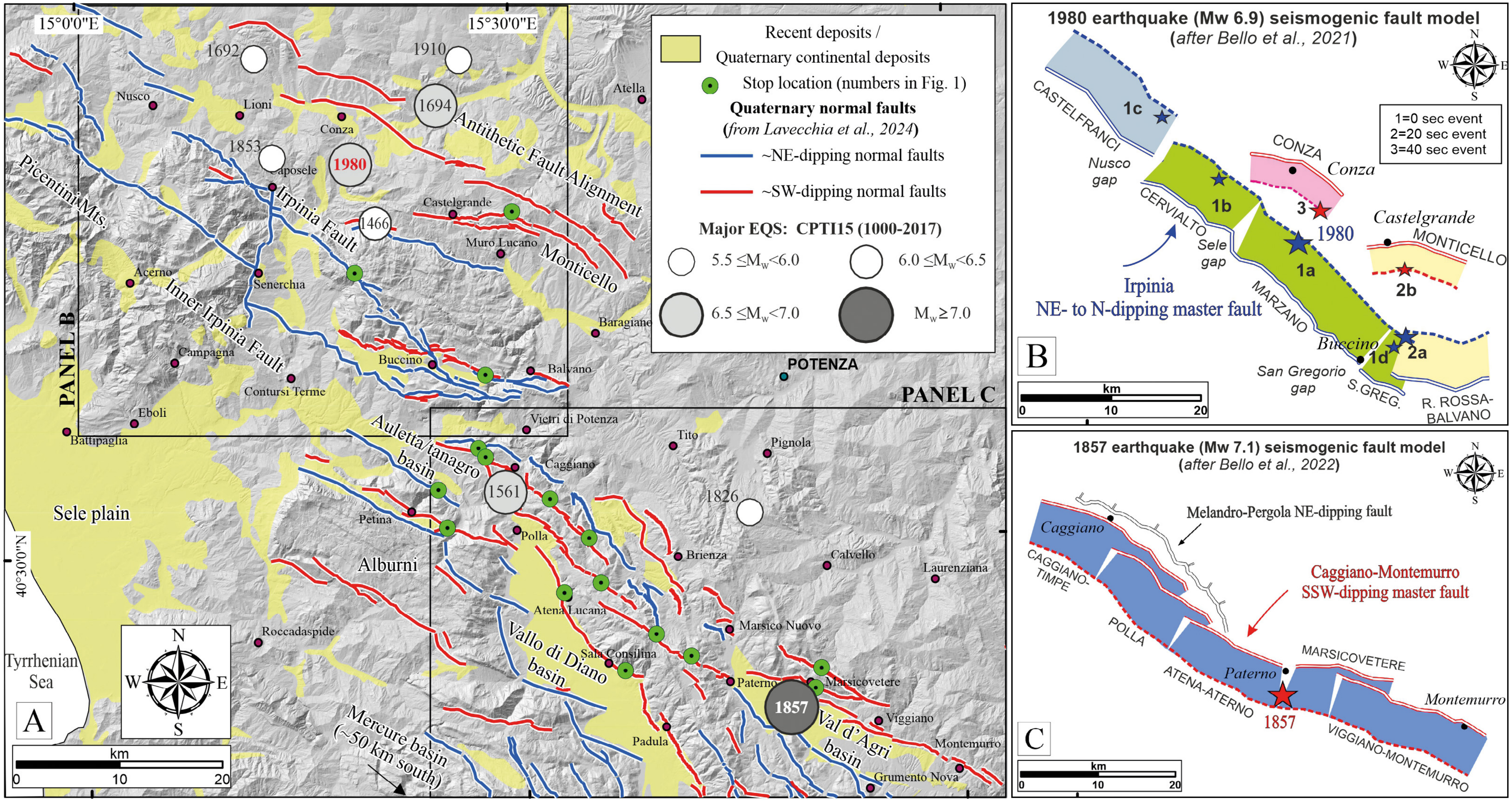

Fig. 3 - A) Seismotectonic map of the Campania-Lucania sector of the field trip with stops indicated as green circles. Main historical earthquakes (M>5.5) are from the CPTI15 database (Rovida et al., 2020). Fault traces are from Lavecchia et al. (2024). B) 1980 earthquake seismogenic fault model after Bello et al. (2021). Blue and red stars represent the events on east-dipping and west-dipping normal faults, respectively. C) 1857 earthquake seismogenic fault model after Bello et al. (2022). The red star represents the hypothesised location of the 1857 event. For both panels b and c, the width of the boxes is inferred assuming an average dip angle of ~60° and a base of the seismogenic layer at a depth of ~12 km.

Fig. 4 - Composition of several panels taken from a comic by Palumbo et al. (2018) titled "*La Visione di Mallet*" (Mallet's Vision) depicting the destruction of two of the towns most affected by the 1857 earthquake: Montemurro (above) and Polla (centre). Below, Robert Mallet is depicted annotating in his notebook.

DAY 1

THE CAMPANIA-LUCANIA FAULT SYSTEM

Stop 1.0 - Regional introduction at the top of Serra San Giacomo

Coordinates: Lat. 40.58444 N, Long. 15.45069 E

In the sector crossed by the field trip, integration of original field data, deep wells stratigraphy, and interpretation of seismic lines, also supported by previous literature (Amato et al., 1992; Ascione et al., 2003; Maschio et al., 2005; Casciello et al., 2006; Barchi et al., 2007; Moro et al., 2007; Papanikolaou & Roberts, 2007; Brozzetti, 2011) highlight a significant imprint of the Quaternary extensional tectonics on the present morphologic and structural setting.

In the last decade, a NW-striking regional system of extensional faults, extending for at least 250 km, from northern Campania to northern Calabria, was recognised to affect the inner and axial portion of the Southern Apennines chain (Brozzetti, 2011).

This fault system referred to as the “Campania Lucania Extensional Fault System” (CLEFS) is an articulated megastructure arranged in three main fault alignments, each one comprising conjugate NW-SE striking fault segments which, based on the age of the sediments filling the associated basins, are Early Pleistocene to Holocene in age (e.g., Amato et al., 1992; Schiattarella et al., 1994; Abate et al., 1998; Brancaccio et al., 2000; Moro et al., 2007).

The northern alignment can be recognised for ~80 km from the western sides of the Volturno Valley to the Caudina Valley (Northern Campania region; ~40 and ~70 km northward from the map of Figure 3, respectively).

The central alignment displaces the eastern side of the Picentini Mountains and bounds westward the Acerno basin, reaching the Alburni Mountains eastern slope (Petina-Sicignano and Tanagro faults) with a total length of nearly 110 km (Fig. 3); its southern termination is not well defined. It could be identified in the Melandro– Pergola fault, east of a left step-over south of Pertosa (Fig. 3).

The southern alignment includes an east-dipping fault set developing along the east side of Mt. Cervati and crossing the Lagonegro area, reaching the northern reliefs of the Catena Costiera Calabra (Monte Gada–Monte Ciagola) and the inner side of the Mercure and Morano Calabro basin (Southern Basilicata and Northern Calabria regions; few km to ~50 km southward from the map of Figure 3; Brozzetti et al., 2017).

The above fault alignments show the following common structural features: 1) onset during the Pleistocene and activity continued at least up to the Late Pleistocene (Papanikolaou & Roberts, 2007; Brozzetti et al., 2017); 2) presence of asymmetrical basins (i.e. depocenters located to SW and south-westward tilted syn-tectonic deposits) in the hanging wall block, whose clastic fill spans from Early Pleistocene to Holocene;

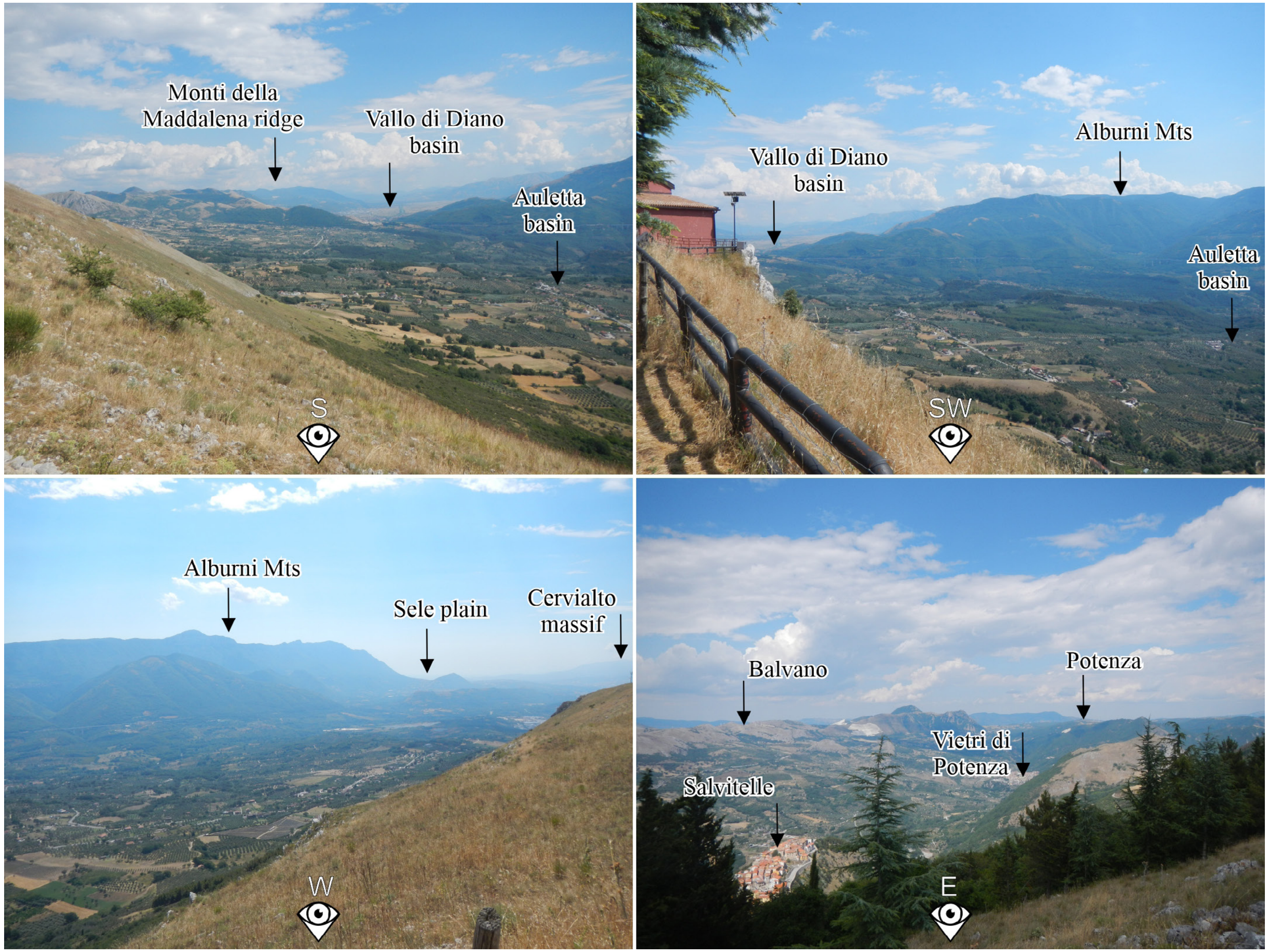

Fig. 5 - Panoramic views from stop 1.0.

3) similar extent of the individual fault-segments, varying in length from 10 to 25 km along-strike, and (4) amount of associate displacements reaching several kilometres on E-NE dipping faults (exceeding 2-3 km on the whole), which is significantly higher than the offset estimated for the antithetic SW dipping faults (some hundred meters, up to 1.5 km).

The Irpinia Fault system is recognised to be the source of the destructive 1980 M_w 6.9 earthquake (Pantosti & Valensise, 1990; Pantosti et al., 1993; Improta et al., 2003; Bello et al., 2021) and target of the first day of the trip, is here considered an external, synthetic structure belonging to the intermediate alignment of the CLEFS.

From the vantage point at stop 1.0, it is possible to observe the central alignment, with the Mts. Alburni in the foreground, the southern termination of the northern alignment, and the northern tip of the southern alignment with Cervati Mt. (Fig. 5).

Stop 1.1 - The Ripa Rossa locality (San Gregorio Magno)

Coordinates: Lat. 40.64735 N, Long. 15.46091 E

The stop is devoted to observing the coseismic ruptures of the 1980 Campania-Lucania earthquake. Stop 1.1 is located near the east termination of the Pantano di San Gregorio Magno basin, along a ridge named Ripa Rossa (Fig. 6a,b). As mentioned, this early instrumental

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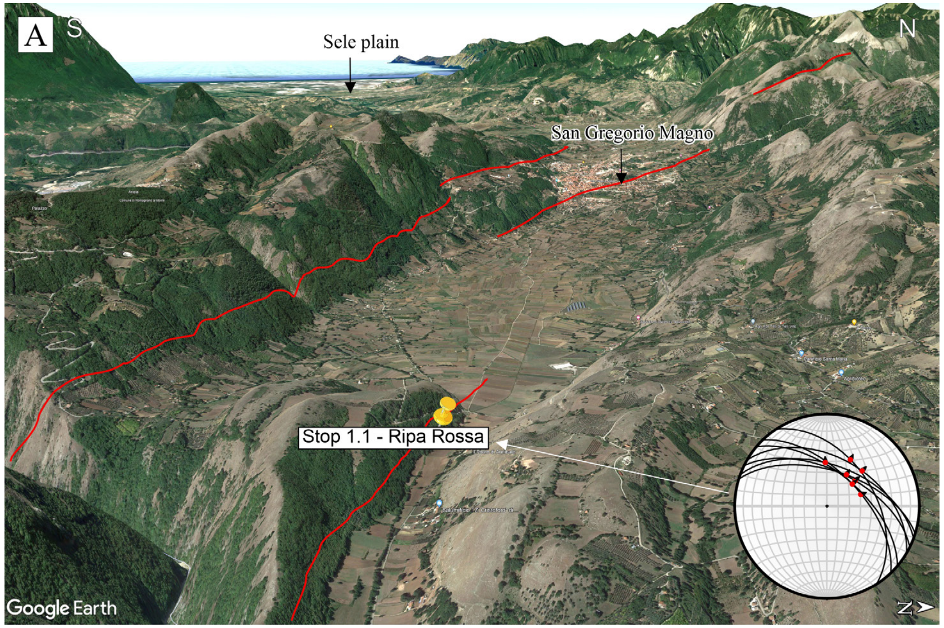

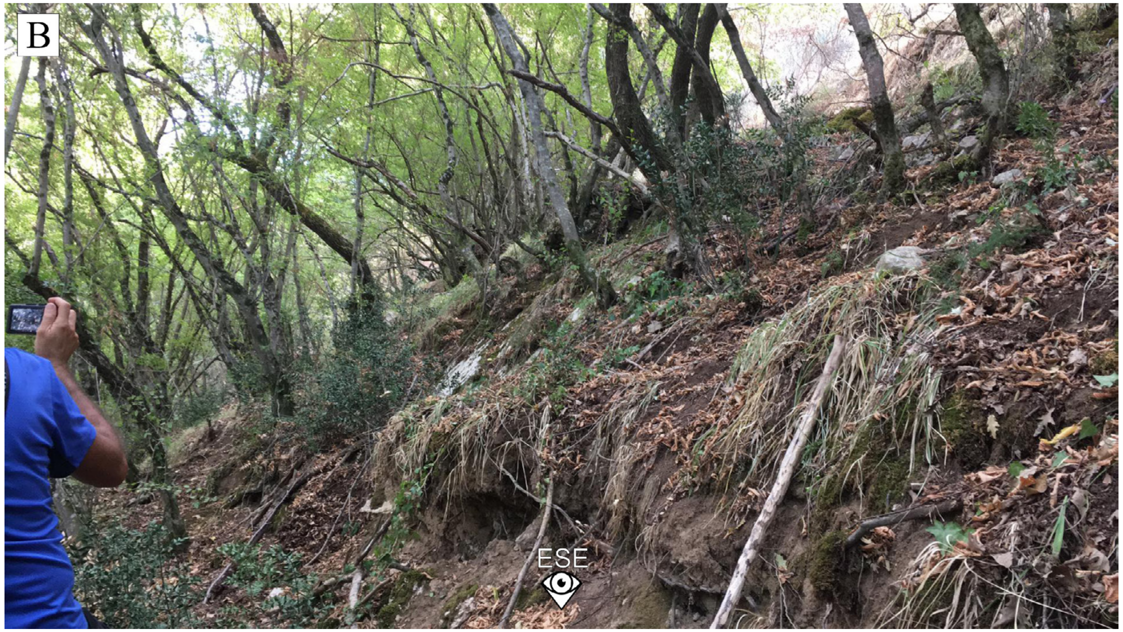

Fig. 6 - A) location of the stop 1.1 “The Ripa Rossa Locality (San Gregorio Magno)”. Red lines represent the main normal faults of the area (from Bello et al., 2021). The stereoplot illustrates the structural data (fault plane and striae) at this stop. Google Earth image is vertically exaggerated (2x). B) 1980 coseismic rupture at site 1.1 terminating on a carbonate fault scarp.

earthquake ruptured the surface along the three main segments of the Irpinia fault (i.e., Mt. Cervialto, Marzano-Cucuzzone, and Pantano di San Gregorio Magno segments).

An interesting observation is that the researchers studying the area immediately after the earthquake reported the ruptures as gravitational phenomena with tectonic origins (Ortolani & Torre, 1981). A few years later they started to consider them as primary coseismic ruptures. For example, Westaway & Jackson, (1987) reported on 20 km-long primary coseismic faulting while Pantosti & Valensise (1990) described 38 km ruptures. Porfido et al. (2002) presented new field data and demonstrated the importance of an antithetic west-dipping system. Finally, Galli & Peronace (2014) reviewed the effects of surface faulting through a structural and topographic survey along a 43-km-long fault, and Bello et al., (2021), by integrating both geological and geophysical data, reanalysed the earthquake effects from the surface to the base of the seismogenic layer.

At stop 1.1, the coseismic ruptures reached a vertical displacement of up to ~90 cm (see Fig. 7; Bello et al., 2021). These ruptures have been measured halfway up the slope of the Ripa Rossa Ridge, spreading over the slope deposits locally cemented and ending up on carbonate platform bedrock fault planes.

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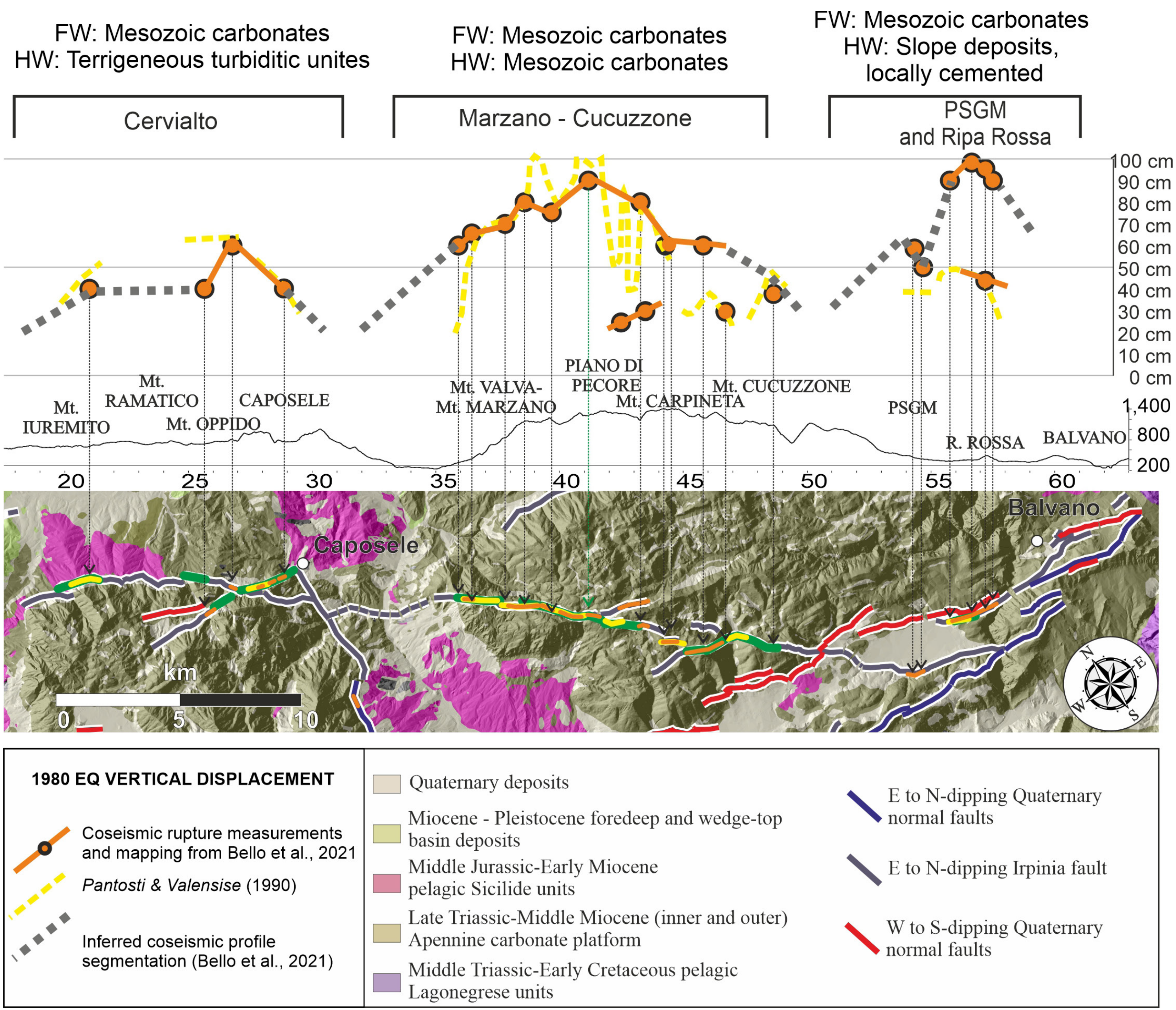


Fig. 7 - Coseismic ruptures mapped by Bello et al. (2021) (orange lines and circles) and by Pantosti & Valensise (1990) (yellow dashed lines) reported in map view through the topographic profile on the trace of Irpinia Fault. A schematic summary of the geologic contacts between the hanging wall and the footwall of the Coseismic ruptures along the different segments is reported. The Figure is modified from by Bello et al. (2021).

Stop 1.2 - The Piano di Pecore locality (Mt. Marzano)

Coordinates: Lat. 40.73766 N, Long. 15.31403 E

Stop 1.2 is located a few tens of meters uphill to the road that coasts the Piano di Pecore on Marzano Mount (Fig. 8a,b). Here it is evident the surface faulting due to the 1980 earthquake of ~1 meter. The coseismic ruptures on Mt. Marzano have been widely described in the last forty years (e.g., Pantosti & Valensise, 1990; Pantosti et al., 1993; Galli & Peronace, 2014; Bello et al., 2021) and they are still well-preserved even if, in some cases, the scarps have been eroded to leave only abrupt slope breaks. Interesting to note in this locality are the roots of the trees along the slope, which, after being truncated by the 1980 earthquake coseismic ruptures, remained suspended on the footwall of the ruptures and are still preserved. On Mt. Marzano, the displacement of the 1980 earthquake reached its maximum. Although the rupture appears almost always covered by the vegetation of the undergrowth, and by the large volumes of beech leaves that cover these forests in the fall, in some places the scarp (also close to this stop) is clearly visible thanks to the presence of the bedrock fault plane.

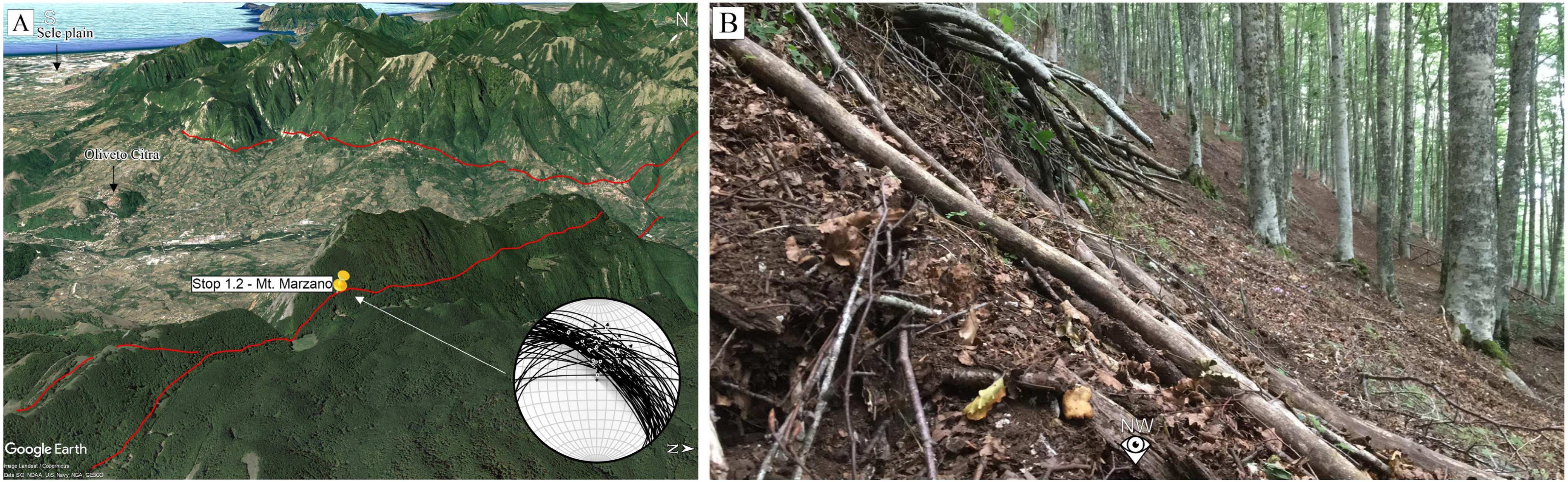


Fig. 8 - A) Location of the stop 1.2. Red lines represent the main normal faults of the area (from Bello et al., 2021). The stereoplot illustrates the structural data (fault plane and striae) at this stop. Google Earth image is vertically exaggerated (2x). B) 1980 earthquake coseismic rupture at the Mt. Marzano – Piano di Pecore locality, where roots were cut by the surface faulting.

Stop 1.3 - The Monticello locality (Muro Lucano)

Coordinates: Lat. 40.78691 N, Long. 15.496842 E

The Campania-Lucania fault system is composed of two E-dipping master faults (InIF and IF) and a W-dipping antithetic master fault (AFA), arranged in a graben-like setting and all with various splays (see the geological cross-section in Fig. 9). The stop 1.3, at the Monticello locality, is located along one of these splays, the one which has been considered responsible for the third event (i.e., at 40 seconds) of the 1980 earthquake (Fig. 3b). The Pescopagano and Monticello splays, synthetic with respect to AFA and antithetic with respect to IF, are overall ~18 km-long. They extend in the E-W direction from the village of Castelgrande to Monticello and in the NW-SE direction from Monticello Mount to the locality of Baragiano. The outcrops are characterised by well-preserved planes showing ~ N190/200°-trending normal slickenlines with a rake of ~ –110° (Fig. 10a,b). Along the Monticello splay it is possible to observe at the base of the fault planes a white free-face of ~20 cm some tens of meters-long, interpreted in Bello et al. (2021) as the surface expression of the 1980 earthquake. In the same locality, a rupture in the slope deposits with a ~20 cm offset is visible for some hundreds of meters.

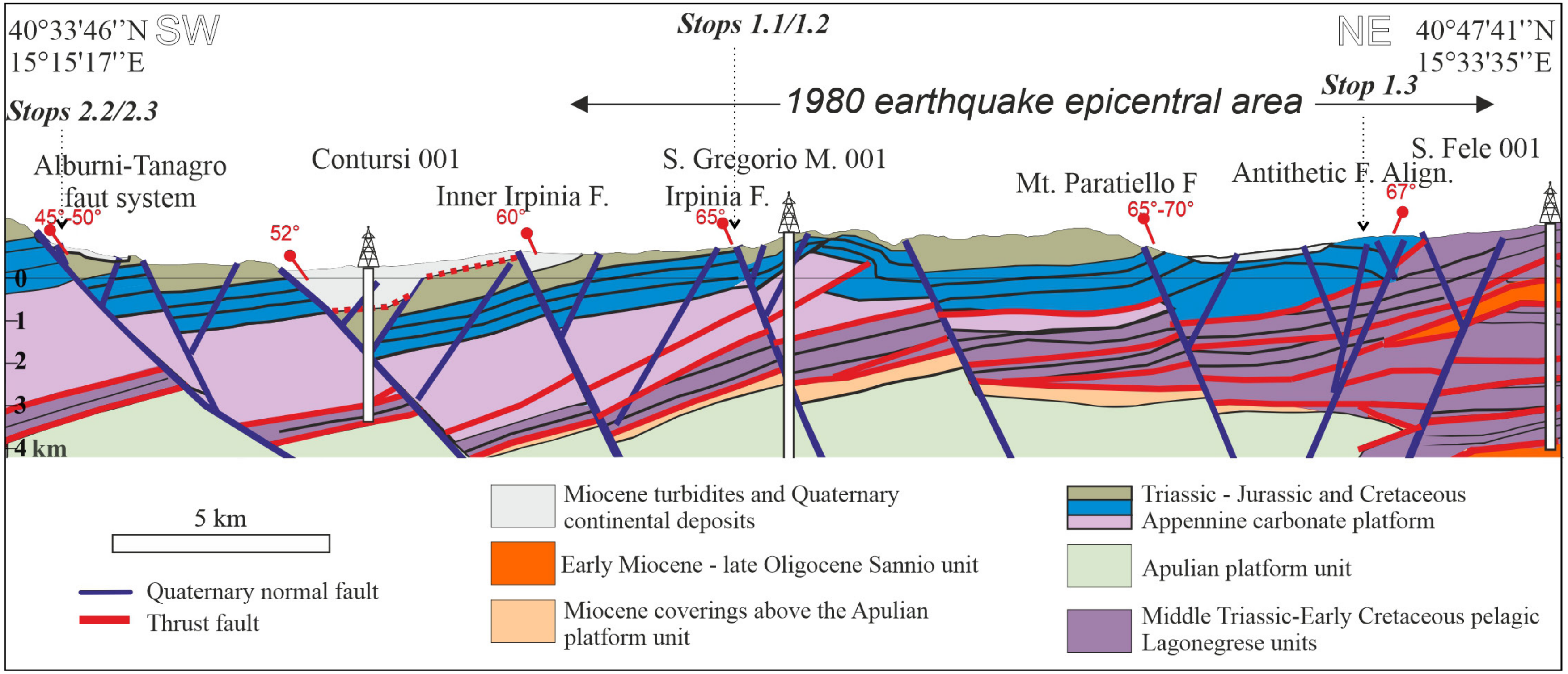
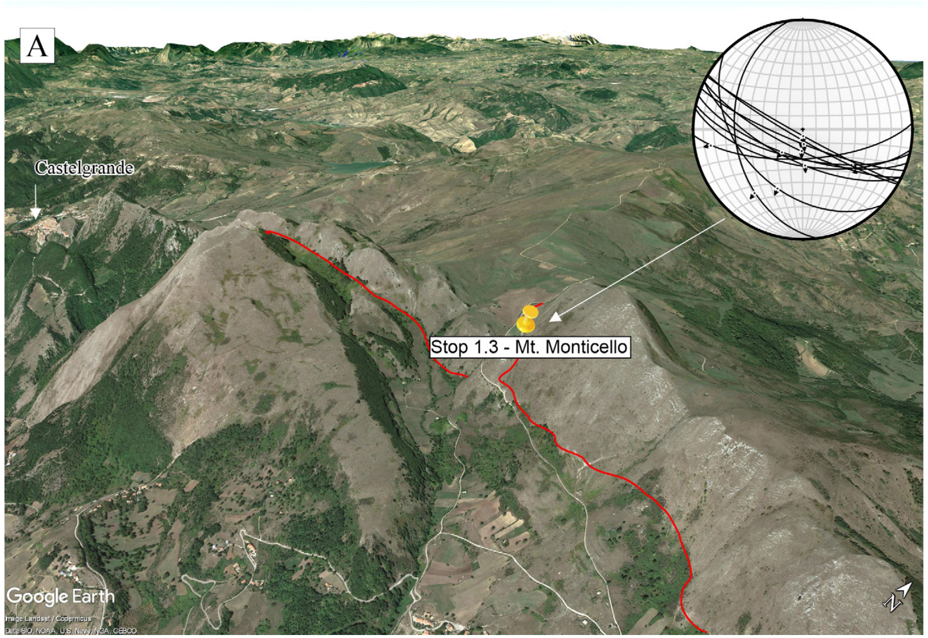


Fig. 9 - Schematic geological cross-section along the trace of the CROP-04 seismic line, through the epicentral area of the 1980 Irpinia earthquake (from the Alburni-Tanagro fault system to the Antithetic Fault Alignment), modified from Bello et al. (2021).



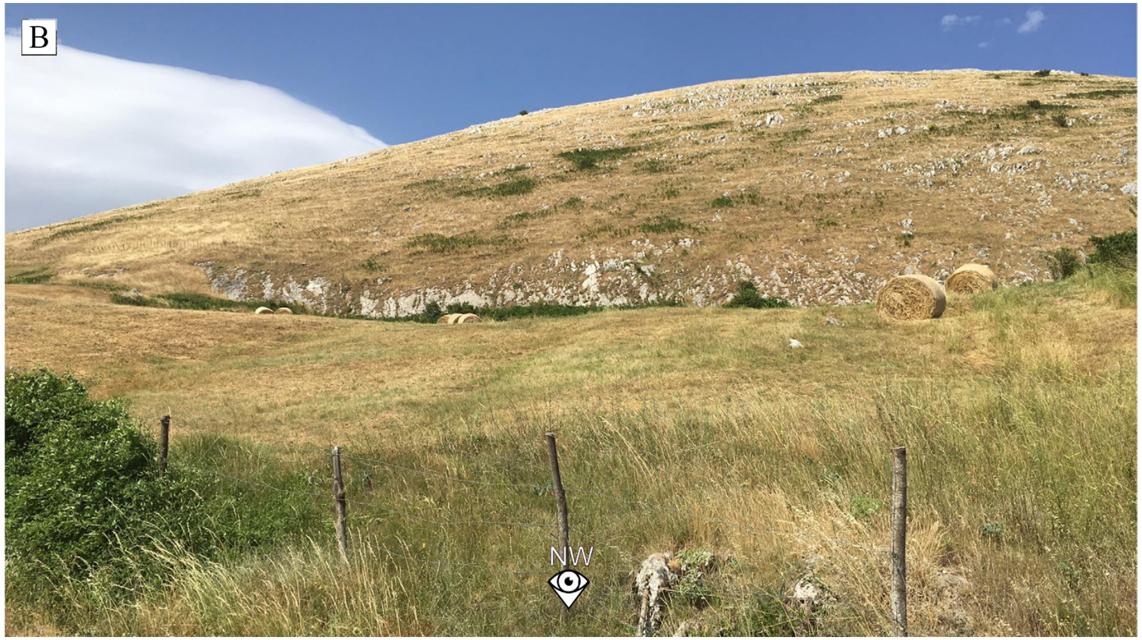


Fig. 10 - A) Location of the stop 1.3. Red lines represent the main normal faults of the area (from Bello et al., 2021). The stereoplot illustrates the structural data (fault plane and striae) at this stop. Google Earth image is vertically exaggerated (2x). B) Fault plane of the AFA cropping out at the Mt. Monticello locality, east of the village of Muro Lucano.

DAY 2

EXTENSIONAL TECTONICS IN THE ALBURNI AND MADDALENA MTS. RIDGES

Stop 2.1 - Mattina locality – Panoramic view on the eastern side of Alburni Mts. Ridge and the Auletta-Tanagro basin

Coordinates: Lat. 40.54683 N, Long. 15.48186 E

To the east of the Alburni Mountains, the Quaternary extension has originated a complex system of conjugated, synthetic and antithetic normal faults with prevailing WNW-ESE or NW-SE directions (Fig. 3). This system is markedly asymmetrical as it is characterised by a clear prevalence of the displacements associated with the NE-dipping faults. From this stop 2.1 it is possible to observe the westernmost structures, and in particular, from SW to NE, the Alburni-Tanagro fault system (ATF), including the Petina-Sicignano fault (Mt. Forloso and the Tanagro basin border fault, TF) (Fig. 11). To the east, the trace of the northern termination of the SW-dipping Caggiano – Serra San Giacomo fault, is

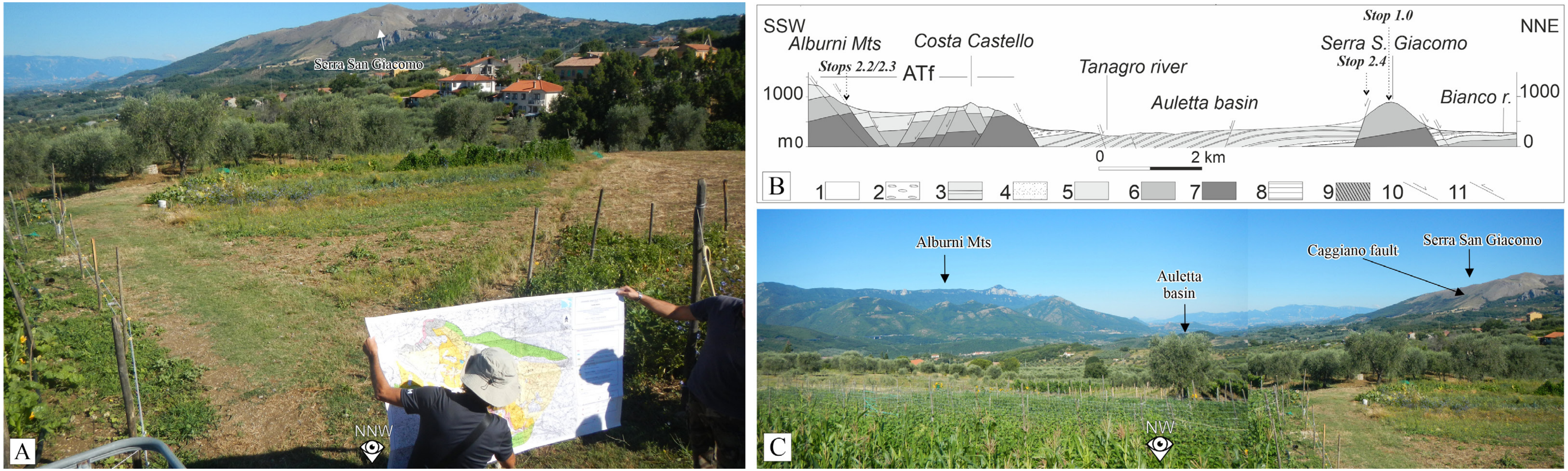


Fig. 11 - A and C) Panoramic views of the Auletta basin and the extensional boundary faults (Alburni-Tanagro and Caggiano-Mt. S. Giacomo faults). B) Fault section showing the same area of the lower photograph (panel C), modified from Brozzetti (2011). Key: 1 = Late Pleistocene–Holocene continental deposits; 2 and 3 = Auletta conglomerate (Middle Pleistocene and Early Pleistocene, respectively); 4 = shallow water, satellite basin siliciclastic sediments (Early-Middle Pliocene), Castelvetere Flysch (Late Miocene) and Sicilide Complex (Oligocene–Early Miocene); 5 = Upper Cretaceous shelf succession; 6 = Lower Cretaceous shelf succession; 7 = Jurassic shelf succession; 8 = Galestri Formation (Early Cretaceous); 9 = Scisti Silicei Formation (Middle–Late Jurassic); 10 = normal fault; 11 = thrust fault.

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also clearly visible. The imprint of the extensional tectonics is evident in the sector between the eastern slope of the Alburni Mounts and the Auletta basin where we can recognise: a) the general geometric structure of the carbonate massif characterised by a series of homoclinal blocks repeatedly faulted and tilted towards the SSW; b) the marked asymmetry of the extensional Quaternary basin and the relative clastic fill which shows an evident growth towards SSW and roll-over anticline geometries; c) the fresh geomorphic signature of the antithetical Serra San Giacomo – Caggiano fault highlighted by a continuous well-exposed free face.
A set of geological sections based on detailed surveys (scale 1:10,000) and synthesised in Figures 8 and 13 in Brozzetti (2011), allowed us to establish that the displacements that occurred along the east-dipping structures are significantly higher than those associated with the antithetical fault planes. The curvimetric balancing of these sections has also made it possible to evaluate the considerable extent of the Quaternary extensional deformations which, in this sector of the Apennine extensional belt, reach 10% of the pre-extensional length. According to some interpretations of the CROP-04 profile (Brozzetti, 2011; Bello et al., 2021), supported by other works based on the analysis of reflection seismic lines (Amicucci et al., 2008), the AF would represent the break-away zone of a regional extensional detachment fault while the outermost structures could be interpreted as splays originated in progressively more recent times, from west to east. In this context, the easternmost faults of the Piani di Buccino-Pantano di San Gregorio (IF) and, even further to the east, the Mt. Paratiello boundary fault (PF), would be genetically linked and would represent the master faults of as many intramontane basins characterised by continental Quaternary fills.

Stop 2.2 - The Alburni fault system: Petina – Sicignano fault

Coordinates: Lat. 40.51689 N, Long. 15.41259 E

The Petina-Sicignano fault is exposed in several places along the road from the villages of Petina to Polla. In the stop 2.2 locality, clear outcrops of a south-eastern branch of the fault can be observed in detail (Fig. 12a,b). Here, a N030/50 fault mirror affects the Cretaceous bedrock but, also within the overhanging Quaternary slope debris, a planar fabric, sub-parallel to the fault plane occurs. This suggests its involvement in extensional deformations. It is difficult to exactly assess the displacement associated with this single structure because only the Cretaceous platform succession in the footwall block crops out extensively. Stratigraphic considerations, based on the offset of the Cretaceous-Tertiary boundary across to the Petina-Sicignano fault, provide a cumulative throw that exceeds 1,000 meters.

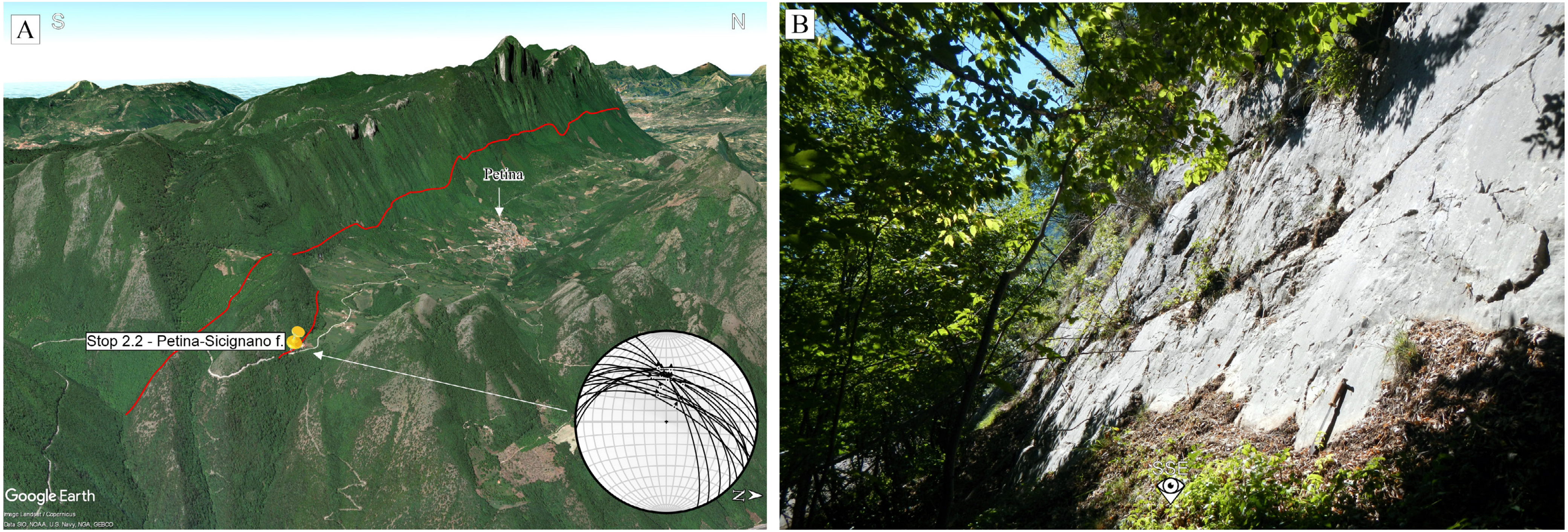

Fig. 12 - A) location of the stop 2.2. Red lines represent the main normal faults of the area (from Lavecchia et al., 2024). The stereoplot illustrates the structural data (fault plane and striae) at this stop. Google Earth image is vertically exaggerated (2x). B) Fault mirror of the Petina – Sicignano fault cropping out at this site.

Stop 2.3 - The Alburni fault system Orto Manco – east slope of Mt. Forloso

Coordinates: Lat. 40.54965 N, Long. 15.40357 E

The Alburni-Tanagro fault system (ATF, Brozzetti, 2011) consists of numerous sub-parallel fault planes with an ~ N120/130 average direction and dip-angle varying between 40° and 65°.
The main structures dip toward the NE (N025-N040) and, from west to east are: i) the Petina-Sicignano fault (located SW of the homonymous towns), ii) the Mt. Forloso Fault, and iii) the Tanagro Valley border fault. All these structures cause displacements of many hundred meters, sometimes exceeding 1,000 meters. Minor antithetical faults (offset of tens to hundreds of meters) were observed on the western slope of the Mt. Forloso-Costa Castello ridge.

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In this stop locality between Orto Manco and Piano delle Capre, it is possible to observe the outcrop of the intermediate fault (Mt. Forloso Fault; Fig. 13a,b) which, displaces Quaternary slope debris.

The fault mirror shows clear normal kinematics, locally with a slight oblique component. The precise offset cannot be accurately assessed since the hanging wall block is covered, all along the slope, by continental sediments. Also, the bedrock formations occurring below the deposits of the Auletta basin are unknown.

In general, the ATF activity was referred in the past to the Early Pleistocene (Amato et al., 1992; Ascione et al., 1992); more recently it has been reviewed by Barchi et al., (2007) and its start time has been moved back to the very Early Pleistocene.

The Middle Pleistocene activity is confirmed by the backward (i.e., SW-ward) tilting of the Auletta basin deposits, which are referred in the literature to the Early Pleistocene.

The upper deposits of the alluvial fan, affected by the Mt. Forloso Fault, are commonly attributed to the Middle Pleistocene period. However, there are no chronostratigraphic constraints available for the slope debris deposits displaced in the stop locality.

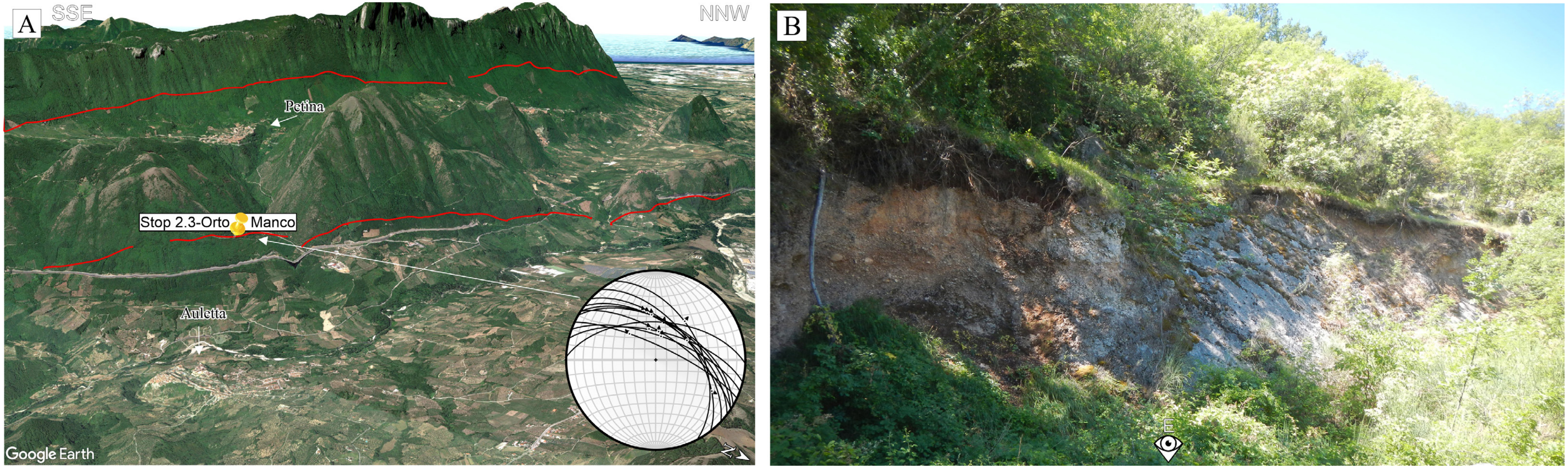

Fig. 13 - A) Location of the stop 2.3. Red lines represent the main normal faults of the area (from Lavecchia et al., 2024). The stereoplot illustrates the structural data (fault plane and striae) at this stop. Google Earth image is vertically exaggerated (2x). B) Fault plane of the Mt. Forloso fault.

Stop 2.4 - Caggiano

Coordinates: Lat. 40.57669 N – Long. 15.45868 E

The Mt. San Giacomo fault represents, according to a hypothesis by Bello et al. (2022), the north-westernmost section of a longer master fault, referred to as the Caggiano-Montemurro fault (CMF; Fig. 14). It crops out, with a continuous and spectacular free face for nearly 3 km, with an average N110-N120 strike, NW of Caggiano (Fig. 14a,b).

On the free face, carved in rudists-bearing Cretaceous limestones, rest late Quaternary slope deposits which are affected by dense gully erosion. It is noteworthy that the heads of the furrows are in correspondence with the fault scarp. Locally also lenses of sheared cemented breccia, consisting of white limestone clasts scattered in a reddish matrix, are smeared along the fault scarp.

This fault scarp was first interpreted as due to exhumation processes and subsequently referred to neotectonics processes (Ascione et al., 1992). The latter authors suggest that the uplift of the Serra San Giacomo ridge interposed between the F. Tanagro, and F. Bianco valleys was due to the activity of the fault whose starting age would post-date the deposition of the Auletta conglomerate (Early Pleistocene).

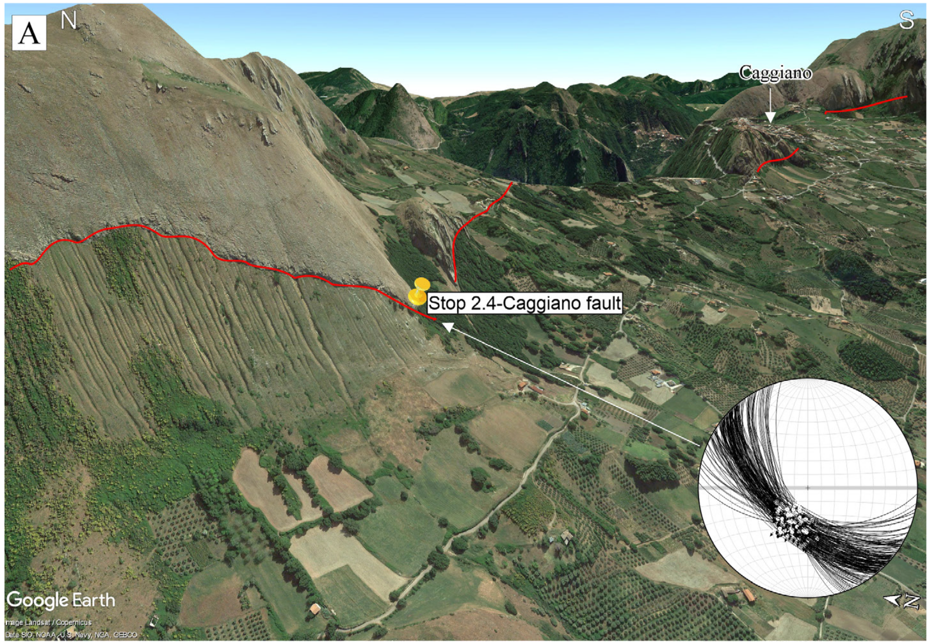

Fig. 14 - A) Location of the stop 2.4. Red lines represent the main normal faults of the area (from Lavecchia et al., 2024). The stereoplot illustrates the structural data (fault plane and striae) at this stop. Google Earth image is vertically exaggerated (2x). B) View of the Caggiano fault segment cropping out at the Mt. S. Giacomo locality.

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The compositional data on such conglomerates and their scattered outcrops lying unconformably on the Serra San Giacomo carbonates supports the aforementioned interpretation.

The exposed free face would be referable to reactivations that took place after the origin of the slope rectilinear profile occurred during the cold-arid climate stages following the Last Glacial Maximum LGM (~16-20 k.y. BP).

The late Quaternary slope deposits in the hanging wall block are variable in facies and grain size. Close to the fault scarp well sorted, poorly cemented stratified breccia and gravels prevail. The latter gradually passes downslope to matrix-supported gravels and calcareous sands interpreted by Galli et al. (2006) as climatogenic slope-deposits (cold period), in which ^{14}C radiocarbon dating provided a time interval of 16730–15900 BP.

On the fault plane, clear kinematic indicators such as mechanical slickenlines, incongruous steps, and crescentic shape markings, show a slight sinistral oblique motion (mainly 80°<pitch <70°).

The ~ 6 m offset measured by Galli et al. (2006) across the scarp profile would post-date 16 k.y. (age of the last cold climate-related slope deposits) providing a late Quaternary slip-rate of 0.3-0.4 mm/y.

Stop 2.5 - Timpe del Vento

Coordinates: Lat. 40.53908, Long. N 15.53104 E

The Mt. San Giacomo fault continues cropping out through a ~1.2 km gap at the Timpe del Vento locality. This fault section was highlighted by Cello et al., (2003), and Galli et al., (2006), and has been recently considered part of the larger CMF (Bello et al., 2022). At stop 2.5, the fault plane is particularly well-preserved due to a recent excavation along the unpaved road. Interestingly to observe is the marked striation of the fault plane, which shows slickenlines and calcite steps coherent with a dip-slip slightly right-lateral kinematics. The structure, displacing Cretaceous limestones, borders, at the Timpe del Vento locality, a series of narrow along-fault-strike elongated basins, filled with Quaternary deposits, and crops out at the northern edge of them with an eroded scarplet, still easily identifiable for several hundred meters toward south-east (Fig. 15a,b). Near the stop, paleoseismological studies have previously been carried out, which have led to the hypothesis that this portion of the fault was activated numerous times in the past. In particular, it has been associated with the 1561 Vallo di Diano earthquake (M_w 6.4) and possibly with the 1857 Basilicata earthquake (M_w 7.1; Galli et al., 2006; Castelli et al., 2008; Spina et al., 2008). Based on the results of geochemical and topographic analyses, Bello et al. (2023) hypothesise the occurrence along this fault segment of 7 to 11 earthquakes with variable slip between ~40 and ~70 cm (within post-LGM times) and estimated magnitudes between 5.5 and 7.0. The recurrence time is calculated between 1.6 k.y. and 2.3 k.y. with a slip rate ranging between 0.6 mm/y and 0.9 mm/y.

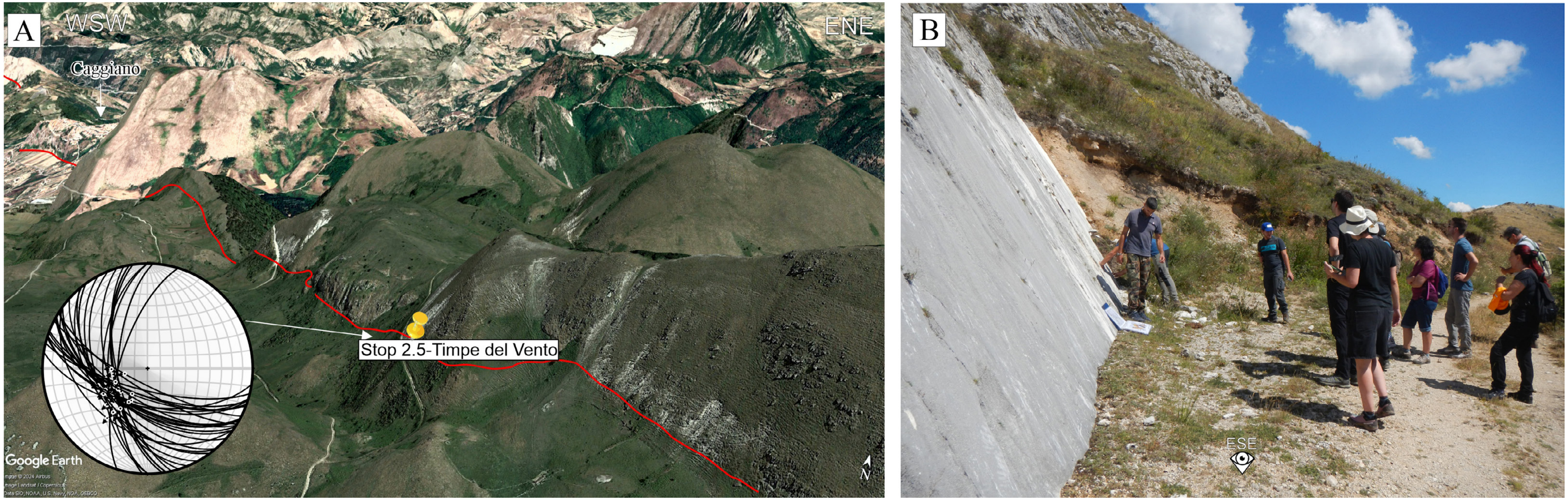
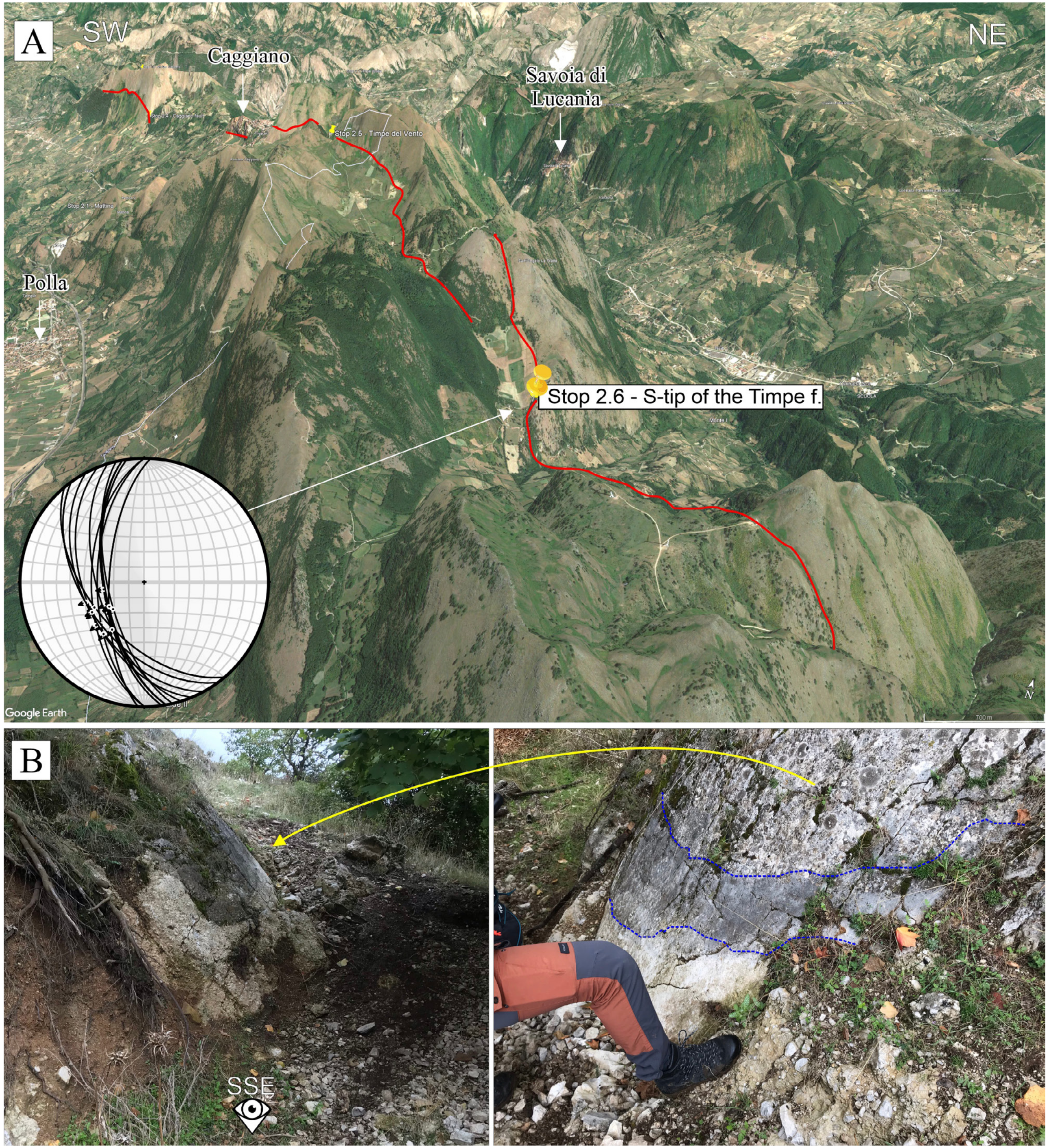


Fig. 15 - A) Location of the stop 2.5. Red lines represent the main normal faults of the area (from Bello et al., 2023). The stereoplot illustrates the structural data (fault plane and striae) measured at this stop. Google Earth image is vertically exaggerated (2x). B) Fault mirror cropping out at the Timpe del Vento locality.

Stop 2.6 - Late Quaternary evidence along the southern tip of the Caggiano-Timpe fault segment

Coordinates: Lat. 40.50447 N, Long. 15.57450 E

In this stop 2.6, we analyse the southern section of the Timpe fault (Fig. 16a,b). It develops along the western slopes of the Mt. Sierio – Mt. Gualacchio ridge, alternating NW-SE and WNW-ESE strike directions. Similarly, to the northern section, the fault trace shows a fresh morpho-structural signature and evidence of Late Quaternary activity. These latter consist in: i) the typical alignment of narrow depressions containing syn-tectonic continental deposits unconformably resting on flysch-type terms; ii) fault scarps continuously developing along the border of such Quaternary basins; iii) crest doubling phenomena, observed a few km northward, along the trace of the fault; iv) free faces showing an abrupt down-dip change in the degree of weathering suggesting repeated and recent exhumation events.
The best exposures of the fault allow determining its kinematics that, coherently with the adjacent CMF sections, varies from pure dip-slip normal, on WNW-ESE striking planes, to normal-left, on NW-SE ones. Interesting to observe at this stop are the weathered ribbons on



limestone slickensides, which, according to Bello et al. (2022), could represent tectonically exhumed portions of the fault plane possibly referred to the latest earthquakes.

Stop 2.7 - Panoramic on the Polla fault section

Coordinates: Lat. 40.46604 N, Long. 15.58682 E

This panoramic point allows a particularly wide and continuous panoramic view of the Polla fault section (PFS), representing the intermediate strand of the Caggiano-Paterno fault segment of CMF (Fig. 17a,b). This section, whose northern tip is placed just north of the Polla village, develops for ~12 km, ~2 km SW to the TFS along the slope of the Monti della Maddalena ridge. In this area, the PFS, and the synthetic TFS, are arranged approximately parallel with an extended ~11 km-long and ~2 km-wide overlap zone, in a right en-echelon setting. The PFS was firstly mapped by Spina et al. (2008) and later by Bello et al. (2022) which detailed a continuous trace characterised by a series of right en-echelon fragments in its northern and central portions, and a prosecution toward the south for further ~4.5 km overall.

Fig. 16 - A) Location of the stop 2.6. Red lines represent the main normal faults of the area (from Bello et al., 2022). The stereoplot illustrates the structural data (fault plane and striae) at this stop. Google Earth image is vertically exaggerated (2x). B) Fault plane cropping out at the stop locality. Drawing on the photograph highlights the weathered ribbon.

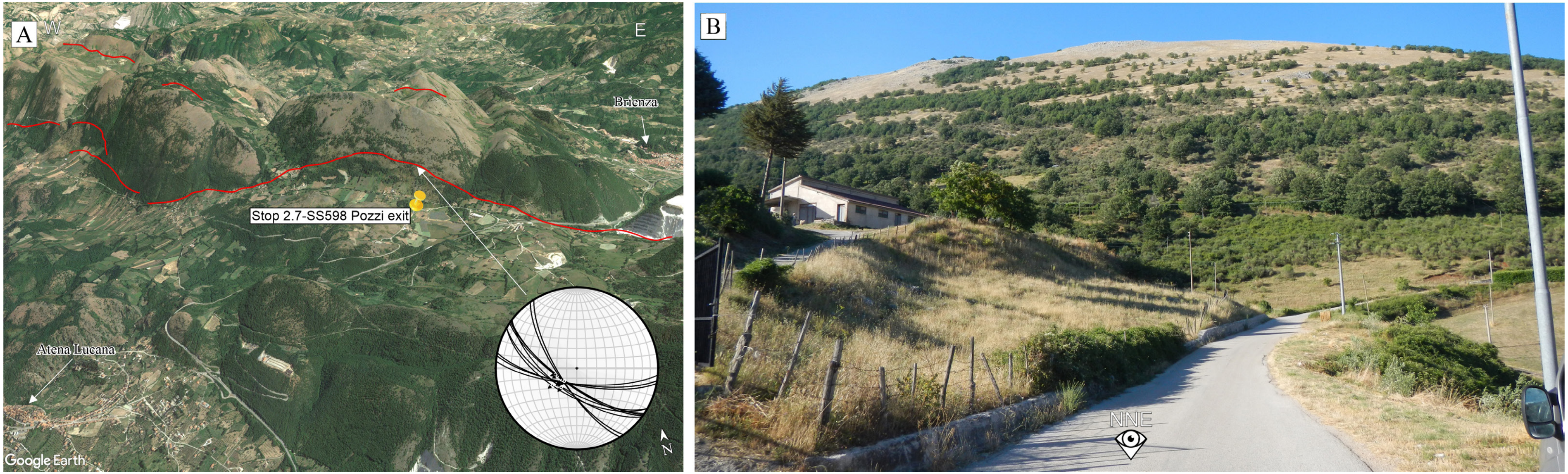


Fig. 17 - A) Location of the stop 2.7. Red lines represent the main normal faults of the area (from Bello et al., 2022). The stereoplot illustrates the structural data (fault plane and striae) at this stop. Google Earth image is vertically exaggerated (2x). B) Panoramic view on the Serra la Rapanza mount, crossed by the Polla fault section.

The PFS presents various along-strike bends (from ~EW to NNW-SSE directions), some of which are visible from this stop. The sense of motion of the structure displays a certain variability that confirms almost pure dip-slip kinematics, locally associated with a slight sinistral strike-slip component (rake –85°).

Interesting to note that, just above Massa Nigro (1.5 km NW of this stop) the PFS puts in contact the Cretaceous platform carbonate bedrock with Pleistocene slope debris. The latter are in turn covered by red soils which are displaced by the fault. The possible attribution of these soils to the end of the Middle Pleistocene (to be ascertained yet), could testify to the Late Pleistocene activity of the fault.

Stop 2.8 - Serra di Brienza

Coordinates: Lat. 40.42039 N, Long. 15.64854 E

This stop, located on the southeastern side of Tempa delle Rose, shows the southernmost evidence of the Polla fault section (PFS) and is located close to its tip line (Fig. 18a,b).

Further south the continuity of the structure is lost in flysch-type deposits, both because the latter are affected by widespread landslides, and because, after a right step-over, the CMF transfer to the Atena-Paterno fault section.

The outcrop is placed in continuity with the trace of the PFS mapped further north and is perfectly aligned with the eastern edge of a narrow intramountain depression named “Lago di Brienza”, located about 1 km NW, filled with fluvial-lacustrine late Quaternary deposits.

The localization of the outcrop was initially based on remote-sensing methodologies. As a matter of fact, the most striking local effect of the PFS, which can also be detected in aerial photos, is the displacement, with apparent right offset, of a pre-existing N010E-striking transpressive lineament that juxtaposes the Triassic dolostones of the Marzano-Maddalena Unit (to the NW) to the basinal lithotypes of the Parasicilide units (sensu Vitale et al., 2011). The attitude of this contact is not directly measurable in the field but its nearly rectilinear trace, over some km, suggests a sub-vertical geometry.

In the valley that cuts the Coste di Brienza, upslope of Masseria Ventre, numerous evidence of faulting, probably even recent, can be observed, such as straight scarps, counter slopes, and trenches, arranged transversely to the mountainside, as well as marked step in the bedrock. All these features are compatible with the presence of a SW-dipping normal fault.

In the first analysis, we do not exclude that the scarps and counter-slopes affecting the topography, given their orientation inconsistent with gravitational deformations, may represent ancient coseismic ruptures that originated along the trace of the PFS during a historical event.

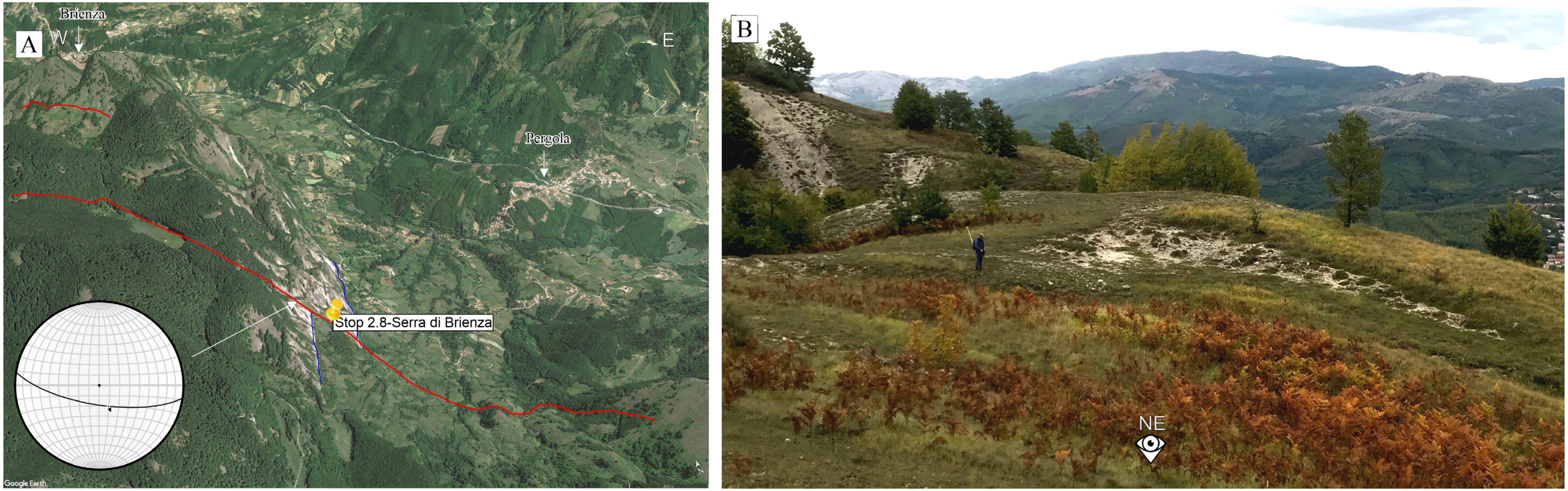


Fig. 18 - A) Location of the stop 2.8. Red lines represent the main normal faults of the area (from Bello et al., 2022) while the blue line represents the contact between Triassic dolostones of the Marzano-Maddalena Unit with the basinal lithotypes of the Parasicilide units (see stop description). The stereoplot illustrates the structural data (fault plane and striae) at this stop. Google Earth image is vertically exaggerated (2x). B) Photograph of the Polla fault trace potentially displacing recent deposits at the stop locality.

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Stop 2.9 - Atena-Paterno south tip (Optional)

Coordinates: Lat. 40.40058 N, Long. 15.68775 E

This stop is located in one of the topographically highest sectors of the Monti della Maddalena ridge, in the central portion of the Atena-Paterno section (Fig. 19a,b). This fault section, together with the Polla section, entirely cuts the Monti della Maddalena ridge, representing a "trans-ridge fault", which, differently from "ridge-bounding" faults, are quite rare (Bello et al., 2022). Here, the fault scarp and associated striated breccia crop out at the edge of a small intramountain basin, elongated along the fault-strike. While it might appear as a qualitative observation, it is interesting to note the setting and "aspect" of the Quaternary sediment-filled basin. The morphotectonic aspect of the small basins at this stop, is surprisingly similar to the stop at the Timpe del Vento locality, with the outcropping fault being like a scarplet, a few tens of meters uphill from the cultivated plain, and running along the slope for the entire length of the basin. Where the depression gradually closes, generally against a low relief that acts as a threshold, also the scarplet disappears to then re-appear after a small gap.

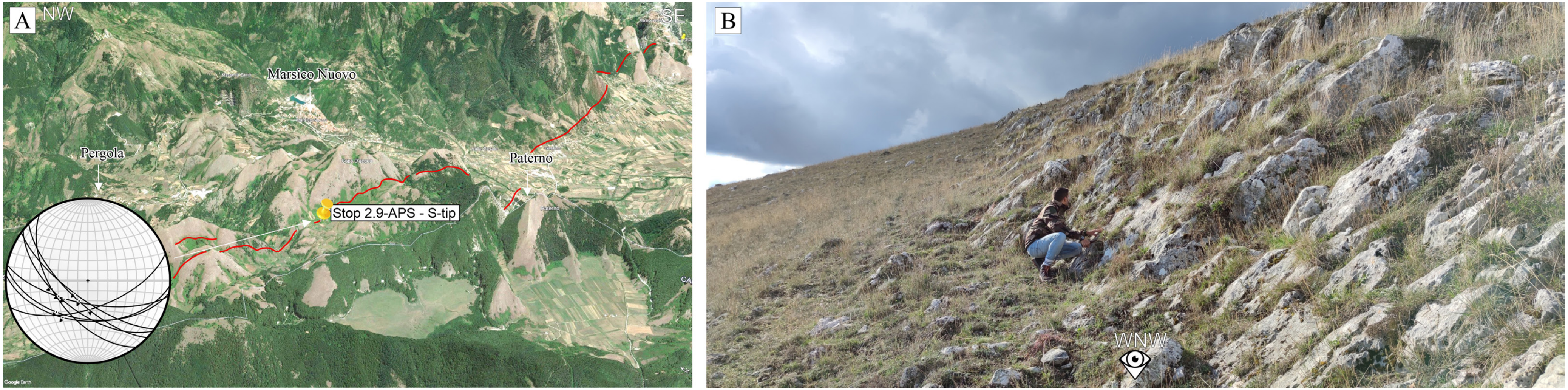

Fig. 19 - A) Location of the stop 2.9. Red lines represent the main normal faults of the area (from Bello et al., 2022). The stereoplot illustrates the structural data (fault plane and striae) at this stop. Google Earth image is vertically exaggerated (2x). B) Fault plane scarplet cropping out close to the stop locality.

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DAY 3

THE VALLO DI DIANO AND VAL D'AGRI FAULT SYSTEMS

Stop 3.1 - Atena Lucana

Coordinates: Lat. 40.45820 N, Long. 15.54456 E

At this stop, behind the yellow house, it is possible to observe one of the rare exposures of the Vallo di Diano boundary fault in contact with Quaternary deposits (Fig. 20a,b).

The fault plane is now unfortunately largely covered by vegetation, and no detailed structural observations can be made. However, literature data (Ascione et al., 1992), collected at the time of the excavation for the construction of the building, reports that it rests on lake deposits of the first sedimentation cycle recognized in the basin.

These pelitic sediments, containing gravel and sand intercalations with freshwater pelecypods (Dreissenia), are referred to an age before 700 k.y. and are raised and dragged along the fault. Above these lower deposits, a calcareous breccia in reddish matrix and red soils, not deformed by faulting, occur.

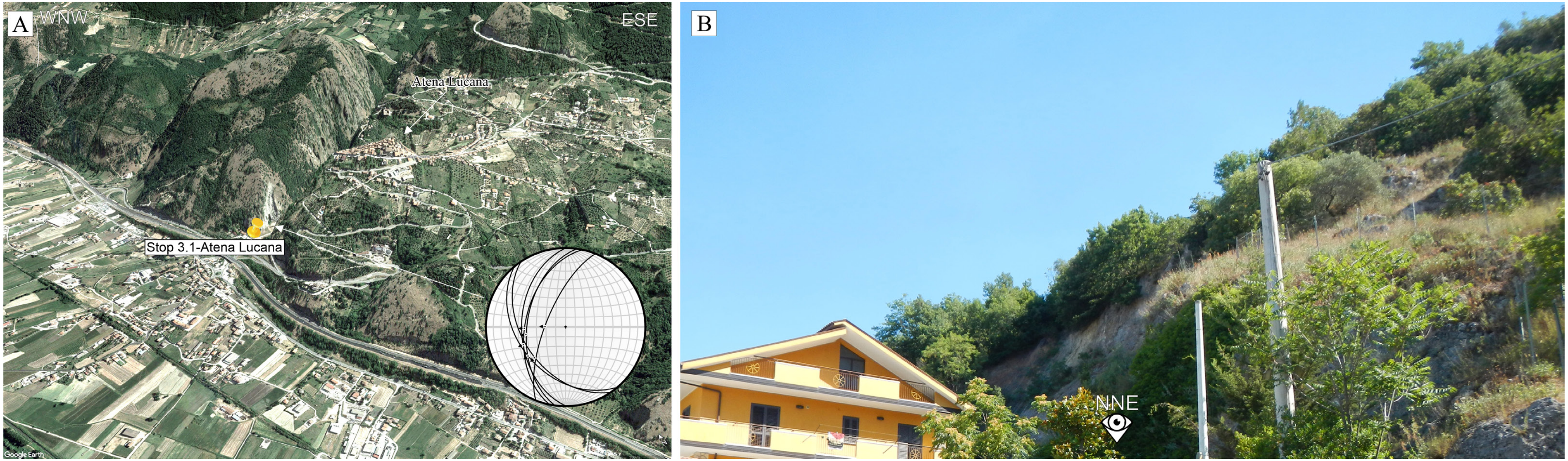

Fig. 20 - A) Location of the stop 3.1. The stereoplot illustrates the structural data (fault plane and striae) at this stop. Google Earth image is vertically exaggerated (2x). B) Panoramic view of the fault plane cropping out behind the yellow house.

Stop 3.2 - Sala Consilina Quarry

Coordinates: Lat. 40.38983 N, Long. 15.61167 E

In this stop 3.2, located east of the Sala Consilina village, in a quarry not currently in use, a spectacular fault plane crops out, several tens of meters high. This is another of the few places along the eastern edge of the Vallo di Diano basin where the border fault can be observed (Fig. 21a,b). As in the previous stop, it seems that the topography above the fault plane is quite linearised, and this would suggest not-quite-recent activity of the structure. Additionally, the strike of the fault plane, which is ~E-W, does not align well with the trend of the Vallo di Diano basin. This fault may represent a connecting segment between two strands of the main fault that bounds the basin, particularly when considering the basin's shape which widens in this area. In any case, it is interesting to note the intense and pervasive striation of the fault plane with approximately dip-slip kinematics, within the bedrock of a carbonate platform.

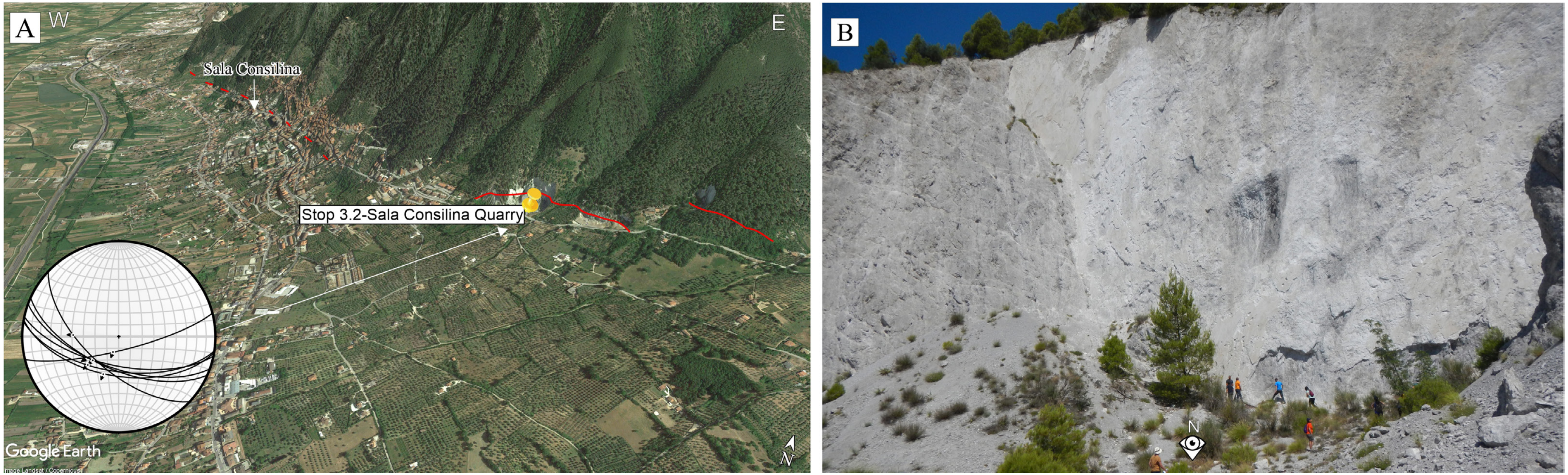

Fig. 21 - A) Location of the stop 3.2. Red lines represent the main normal faults of the area (from Bello et al., 2022). The stereoplot illustrates the structural data (fault plane and striae) at this stop. Google Earth image is vertically exaggerated (2x). B) Fault plane cropping out at the Sala Consilina Quarry.

https://doi.org/10.3301/GFT.2024.08

Stop 3.3 - Villa d'Agri

Coordinates: Lat. 40.36993 N, Long. 15.82856 E

Along the road from Villa d'Agri to Marsico Vetere, a recent excavation has highlighted the tectonic contact between the calcareous bedrock, consisting of platform carbonates of Late Jurassic-Early Cretaceous limestones, and late Quaternary slope debris (Fig. 22a,b).
Structural analyses allowed us to recognise the extensional kinematic of the fault, detectable on subsidiary planes affecting the cataclastic damage zone. The Quaternary deposits include gravelly layers and brown soils containing a volcaniclastic fraction. Despite no quantitative data are available on the age of such deposits, the aforesaid observations, suggest that, reasonably, they are not older than the upper part of the Middle Pleistocene.

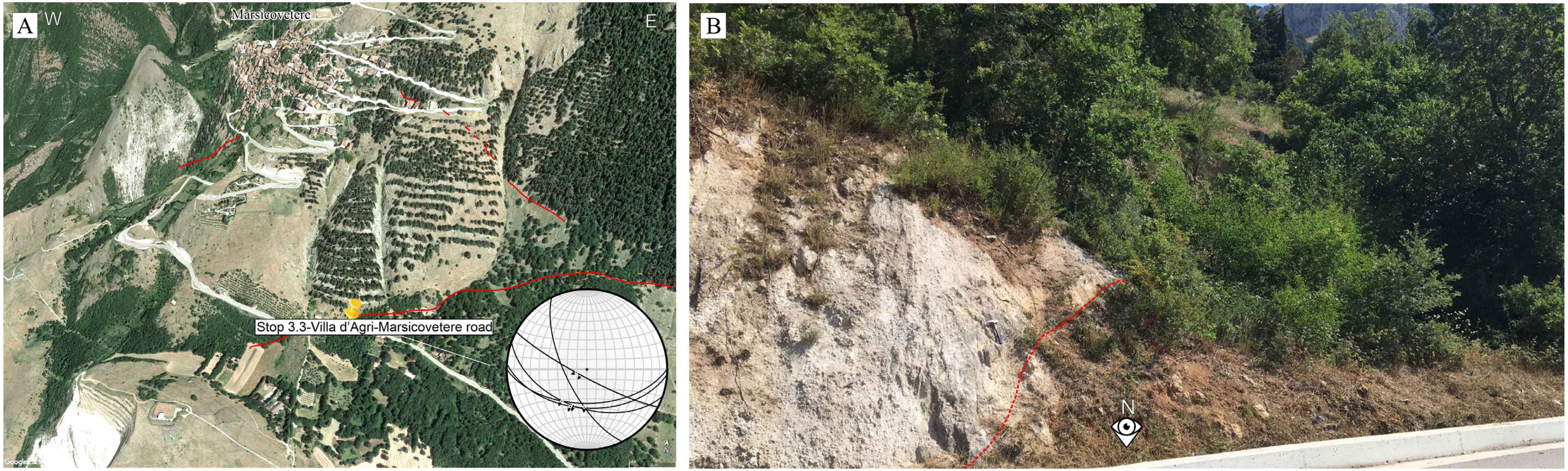

Fig. 22 - A) Location of the stop 3.3. Red lines represent the main normal faults of the area (from Bello et al., 2022). The stereoplot illustrates the structural data (fault plane and striae) at this stop. Google Earth image is vertically exaggerated (2x). B) Photograph of the tectonic contact between the calcareous bedrock and late Quaternary slope debris at the stop locality (the contact is marked with the red dashed line).

Stop 3.4 - Il Monte

Coordinates: Lat. 40.38695 N, Long. 15.83604 E

Stop 3.4 is located at a distance of a few tens of meters from the edge of the road that leads from Marsicovetere to Mt. Volturino (Fig. 23a,b). Here it is possible to observe a fault plane which, similarly to what happens to the fault plane present at stop 2.6, shows evident bands of different colours which, albeit only qualitatively, could represent several episodes of relatively recent coseismic rupture. Following the fault plane along the fault strike, after a few hundred meters, and a hundred meters in altitude, a small intra-mountain basin, elongated according to the strike of the fault is present. Also, this depression shows a marked analogy, under the morphotectonic point of view, with both the basins of the Timpe del Vento locality (stop 2.5) and the basins at the southern tip of the Caggiano-Paterno fault segment (stop 2.9), suggesting a similar development of these basins. As in the previous stop 2.6, a weathered reddish ribbon is evident on the fault plane.

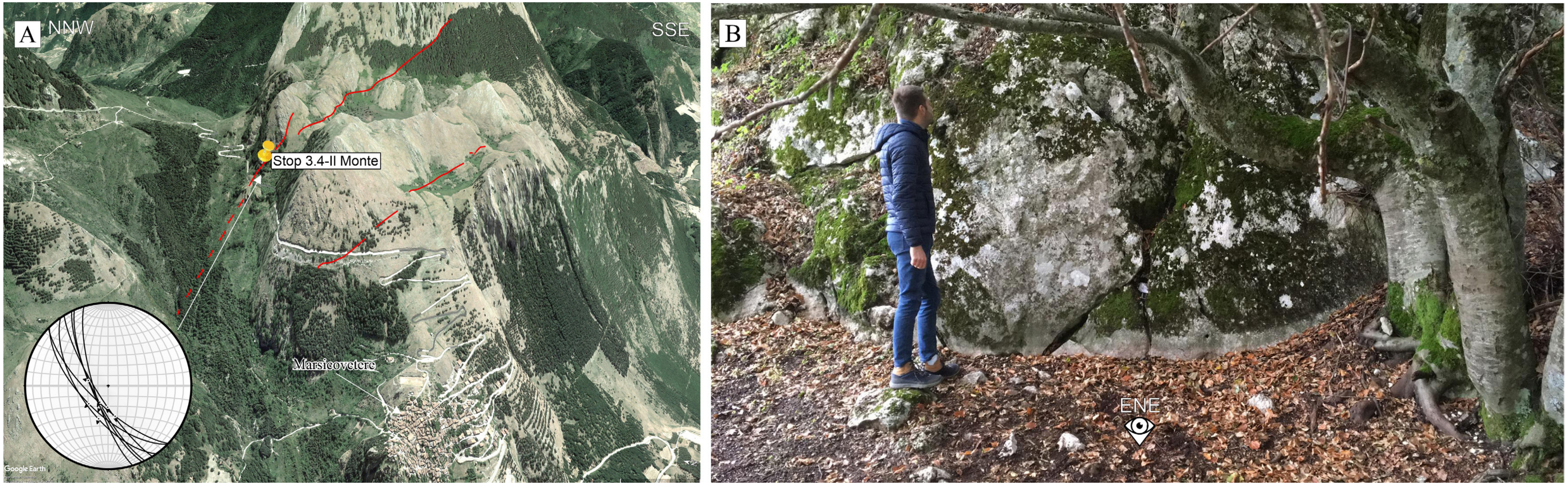

Fig. 23 - A) Location of the stop 3.4. Red lines represent the main normal faults of the area (from Bello et al., 2022). The stereoplot illustrates the structural data (fault plane and striae) at this stop. Google Earth image is vertically exaggerated (2x). B) Picture of the fault plane cropping out at the Il Monte locality.

https://doi.org/10.3301/GFT.2024.08

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