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GEOLOGICAL GUIDE TO THE EXCURSION IN THE UPPER MAIRA VALLEY (WESTERN ALPS, ITALY)

Abstract - A. Petroccia, M. Bonasera, S. Nerone, F. Caso, M. Morelli, D. Bormioli, G. Moletta, *Geological guide to the excursion in the upper Maira Valley (Western Alps, Italy).*

Geological excursions are the starting point for scientific debates, acting nevertheless as a flywheel for cultural development and local economy if duly supported by geoturistic initiatives. Bearing these goals, a new two-day itinerary in the upper Maira Valley (Piedmont, Western Alps, Italy) and a related geological field guide are offered. The itinerary is divided into 5 stops each day along two transects that allow observing a geological scenario across two paleogeographical units (Acceglio Unit and Upper Piedmont Zone) in the Western Alps. The first day focuses on Acceglio Unit geology, where the siliciclastic and carbonate sequences have been recognized. The second one is mainly focused on the Gollone Landslide framework and on the Upper Piedmont Zone, where the Mesozoic oceanic sequences with ophiolitic lenses are displayed. In both polydeformed units, a polyphase brittle deformation (F_1-F_4 discontinuity systems), using geometric criteria, has been detected. The different erodibility of outcropping lithologies in relation with these systems drives landscape evolution of the upper Maira Valley and acts as predisposing factors for different gravitational phenomena, noticeable in the Gollone Landslide area. Combining lithostratigraphy and structures, this study provides the opportunity to unravel geological issues through direct outcrops and panoramic views observations.

Key words - geology, field trip, geotourism, geomorphology, Gollone Landslide, Maira Valley, Italian Western Alps

Riassunto - A. Petroccia, M. Bonasera, S. Nerone, F. Caso, M. Morelli, D. Bormioli, G. Moletta, *Guida geologica all'escursione in alta Valle Maira (Alpi Occidentali, Italia).*

Le escursioni geologiche rappresentano il punto di partenza per il dibattito scientifico, agendo peraltro come volano per lo sviluppo culturale e per l'economia locale, se opportunamente supportate da iniziative geoturistiche. Tenendo in considerazione questi obiettivi, viene proposto un itinerario articolato in due giorni in alta Valle Maira (Piemonte, Alpi Occidentali, Italia) e la relativa guida geologica all'escursione. L'itinerario è suddiviso in 5 stop ogni giorno lungo due transetti che permettono di osservare uno scenario geologico attraverso due diverse unità paleogeografiche nelle Alpi Occidentali (Unità di Acceglio e Zona Piemontese Superiore). Il primo giorno si concentra sulla geologia dell'Unità di Acceglio in cui le sequenze silicoclastiche e carbonatiche sono state riconosciute. Il secondo giorno è incentrato sulla descrizione delle caratteristiche della Frana del Gollone e della Zona Piemontese Superiore, della quale si apprezzano le sequenze oceaniche mesozoiche con all'interno lenti di rocce ofiolitiche. In entrambe le unità polideformate, è stata riconosciuta una deformazione fragile polifasica (sistemi di discontinuità F_1-F_4), utilizzando criteri geometrici. La diversa erodibilità delle litologie affioranti, associata a questi sistemi, condiziona l'evoluzione del paesaggio dell'alta Valle Maira e agisce come fattore predisponente per fenomeni gravitativi diversi, apprezzabili nell'area della Frana del Gollone. Combinando la litostratigrafia e le strutture geologiche, questo studio offre la possibilità di indagare problematiche geologiche attraverso l'osservazione diretta di affioramenti e di panorami.

Parole chiave - geologia, escursione, geoturismo, geomorfologia, Frana del Gollone, Valle Maira, Alpi Occidentali italiane

Introduction

In the last twenty years, geotourism is rapidly emerging (Dowling *et al.*, 2018). The production of a geotouristic itinerary could increase the inflow of tourists in very little advertised areas, still helping in preserving their naturalistic value (Perotti *et al.*, 2020) and encouraging scientific discussions. The geodiversity of the Alpine chain, due to its particular tectonic framework, provides an opportunity to arrange many geotouristic tours, resulting from multidisciplinary studies. The Alpine geological context is generally accompanied by suggestive landscapes and sites. With the appearance of innovative software and geo-visualizers, these tours may be developed on adequate platforms and mobile applications (*e.g.*, ARPA 3D, PROGEO-Piemonte; Ferrero *et al.*, 2012; Pelfini *et al.*, 2016; Gambino *et al.*, 2019). Both virtual and on-field trips could represent a useful tool for didactic (*e.g.*, Bollati *et al.*, 2018) and academic (*e.g.*, Simonetti *et al.*, 2017) purposes. A two-day itinerary is the result of a detailed field investigation (Petroccia *et al.*, 2020) to characterize the geological framework around the Gollone Landslide, overlooking the village of Acceglio.

Regional and local setting

The Alpine belt results from the collision between European and Apulian lithospheres following the closure of the Ligurian-Piedmont ocean by subduc-

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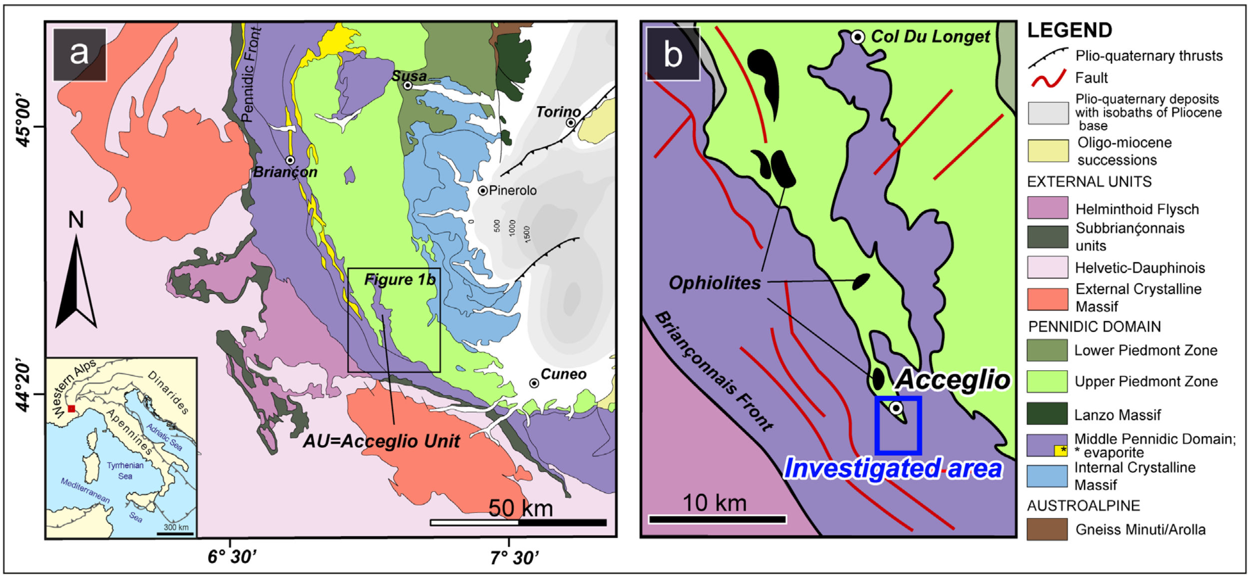

Figure 1. (a) Simplified tectonic map of the south-western part of the Western Alps (modified from Beltrando *et al.* (2010) and Piana *et al.* (2017)) with its geographical location. (b) Geological sketch of the Acceglio Unit (modified from Schwartz *et al.* (2000)).

tion (*e.g.*, Dal Piaz *et al.*, 2003). The investigated area is located in the upper Maira Valley, a deep east-west trending Alpine valley in the south-western part of the Piedmont Region (Cottian Alps, NW Italy; Fig. 1a). The Maira Valley offers an excellent opportunity to observe a complete transect from the European continental crust and the oceanic units, corresponding to the Internal Crystalline Massif (Dora Maira; Vialon, 1966) and the Piedmont Zone (Late Cretaceous-Paleocene Flysch; Upper Pennidic Domain, Debelmas & Lemoine, 1957), to the Nappe stack in the Middle Pennidic Domain with Briançonnais affinities. The Nappe stack involves the pre-, syn- and post-rift Tethyan sediments originating from a stretched margin (*e.g.*, Claudel & Dumont, 1999). The Briançonnais was originally a submerged plateau separated into high and low structural domains by normal faults inherited from the Jurassic rifting (Lemoine *et al.*, 1986). During the subduction process, the deep architecture of the Briançonnais zone was characterized by the stacking of crustal slices extracted from the European lithosphere (accretionary wedge). The excursion area is located in a structurally complex area, where the Acceglio Unit (Middle Pennidic Domain; Fig. 1b; Michard, 1967; Lefevre & Michard, 1976; Caby, 1996; Schwartz *et al.*, 2000) outcrops as a low-angle extruded unit surrounded by blueschist facies metasediments (Schistes Lustrés; Upper Piedmont Zone; Fig. 1b; Deville *et al.*, 1992; Lemoine, 2003). The Briançonnais (*sensu lato*) units or nappes can be divided into two groups (Lefèvre, 1984; Gidon *et al.*, 1994): the "classical" Briançonnais (external units) and the Ultrabriançonnais (internal units). The Ultrabriançonnais affinities units are generally characterized by a discontinuous carbonatic cover on siliciclastic rocks (Lemoine, 1957). One of the slices of European crust (Acceglio Unit) acted like tectonic extrusions within the overlying Schistes Lustrés. These derived from Mesozoic oceanic sediments (Lemoine & Tricart, 1986), strongly deformed and metamorphosed during alpine subduction. During Oligocene, the Nappes were deeply deformed and shortened. From Neogene to present-day a general shortening in the external arc, in contrast to a widespread extension in the internal zones, is present (Sue & Tricart, 1999). Extension resulted in a dense normal fault network overprinting the compressional structures (Sue & Tricart, 2003). The Quaternary succession is characterized by glacial dynamics deposits related to Upper Pleistocene and by Holocene landslides, alluvial-polygenic fans and fluvial deposits. The former are associated with the U-shaped valley evolution during ice ages; the latter to the present higher steepness slopes of an incised, narrow valley (Bonasera *et al.*, 2020). Despite the complete mapping of local geomorphological features is recent (Petroccia *et al.*, 2020) or still on-going, the complex Maira Valley morphological evolution requires further studies to be retraced. Here, absolute and relative dating is lacking, in contrast to adjacent valleys where glacial deposits interpretation provides an appropriate reconstruction of recent, Quaternary dynamics (Spagnolo *et al.*, 2007; Federici *et al.*, 2012).

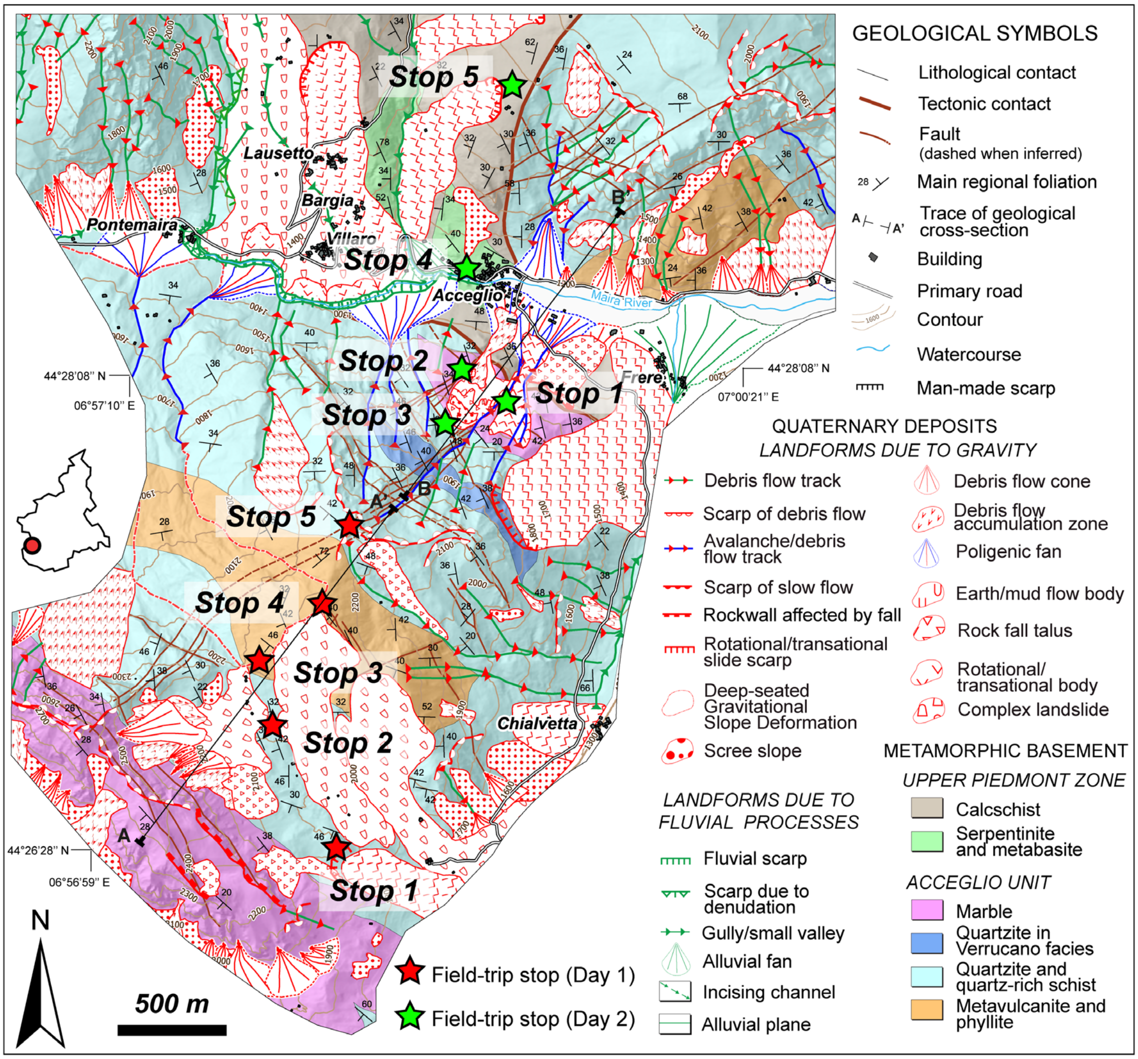

Figure 2. Structural-geomorphological map of the upper Maira Valley near Acceglio (modified from Petroccia *et al.*, 2020). Cross-sections A-A' and B-B' are reported in Figure 8 and Figure 9. Red and green stars indicate the stops of the two-day itinerary.

In the displayed area (Fig. 2), the Upper Piedmont Zone is constituted by calcschists (Schistes Lustrés) with metric to kilometric bodies of metabasites and serpentinites. This sedimentary cover has been interpreted by Lemoine *et al.* (1986) as some ophiolitic slices inside the syn-Jurassic calcschists. The Acceglio Unit is characterized by the presence of siliciclastic and carbonate sequences. The siliciclastic sequence in this area is represented by phyllites and metavolcanic rocks of Upper Carboniferous – Lower Permian ("Varicolori Facies"; Franchi, 1898) and meta-conglomeratic and arenaceous quartzites with graphite-rich and quartz-rich phyllites and lenses of conglomeratic quartzite in "Verrucano" facies during the detritic sedimentation (Middle Permian-Lower Triassic; Lefèvre, 1984). In the Alps, Verrucano facies of Permian and Early Triassic age are particularly well developed in the strongly deformed Internal Domains (Penninic, in particular Briançonnian, and Austroalpine nappes) (Perrone *et al.*, 2006), resulting from the erosion of the Hercynian Chain and its subsequent volcanoes. The carbonate sequence is represented by the Triassic grey marbles with some thin phyllitic and "cornieules" levels on siliciclastic rocks during marine transgression. The tectonic contact between the Acceglio Unit and the Upper Piedmont Zone is oriented parallel to the main foliation associated with kinematic indicators. Recent studies highlight a ductile and brittle polyphase deformation history (Petroccia *et al.*, 2020).

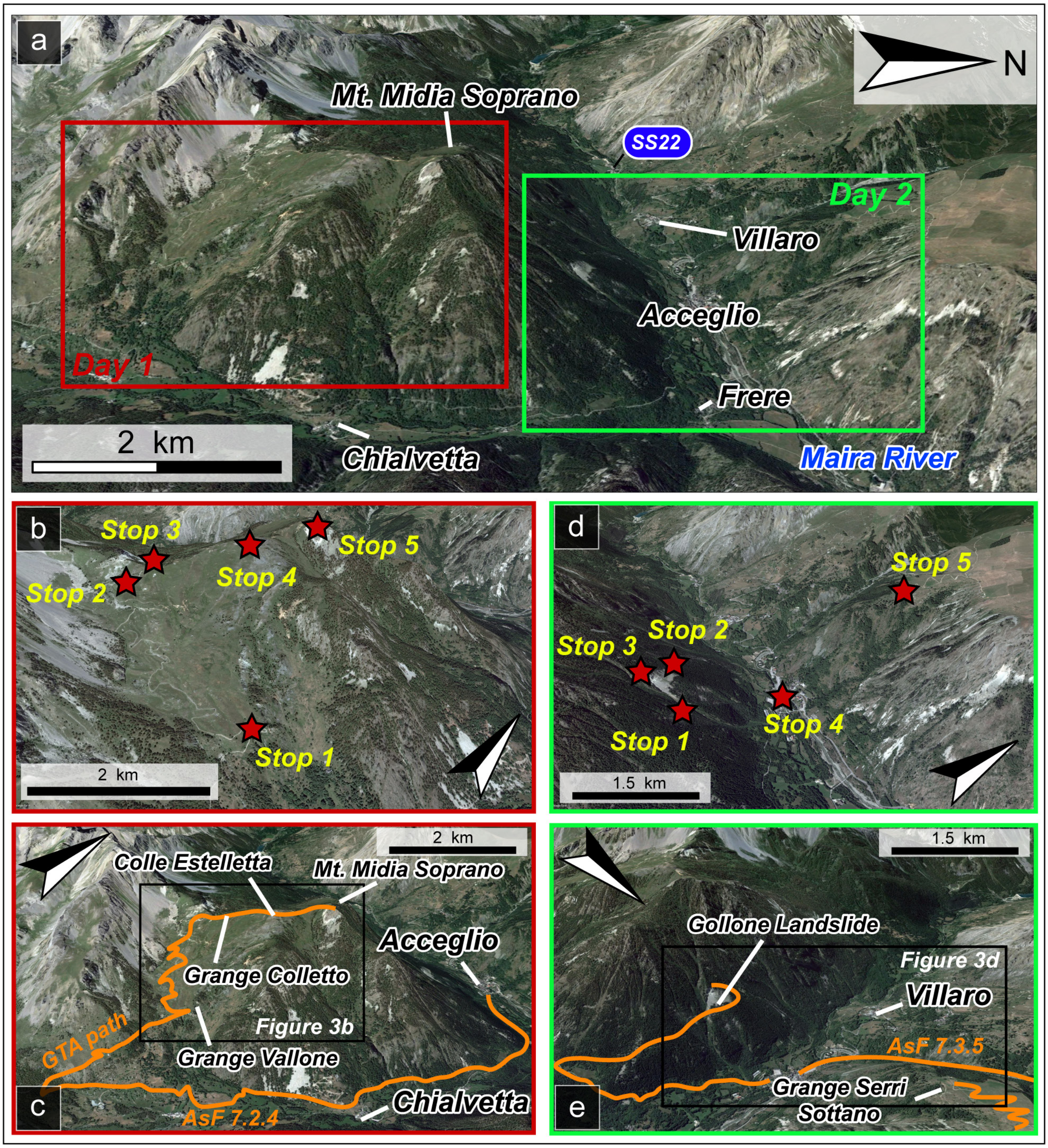

Figure 3. (a) Satellite view of the upper Maira Valley. The two itinerary areas are highlighted with red and green boxes. Stops, paths and localities have been indicated (b, c) for day 1 and (d, e) for day 2.

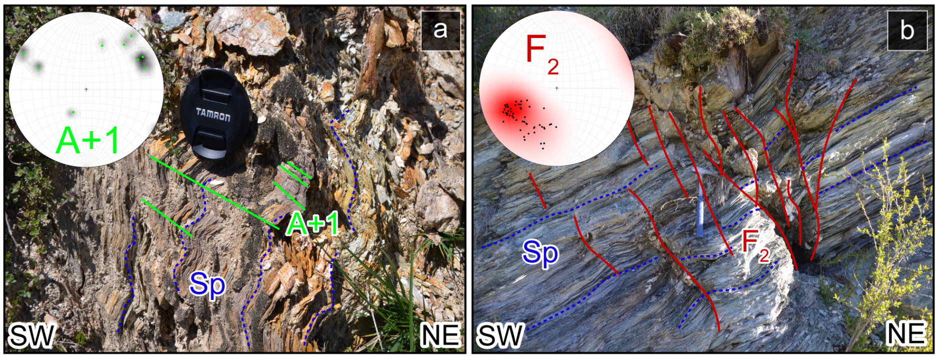

Figure 4. (a) Post-Sp folds with a crenulation lineation defined by the hinge lines A+1 plunging mainly towards the NE. (b) F_2 system dipping towards NE, opposite to the Sp foliation, crosscutting quartz-rich schist.

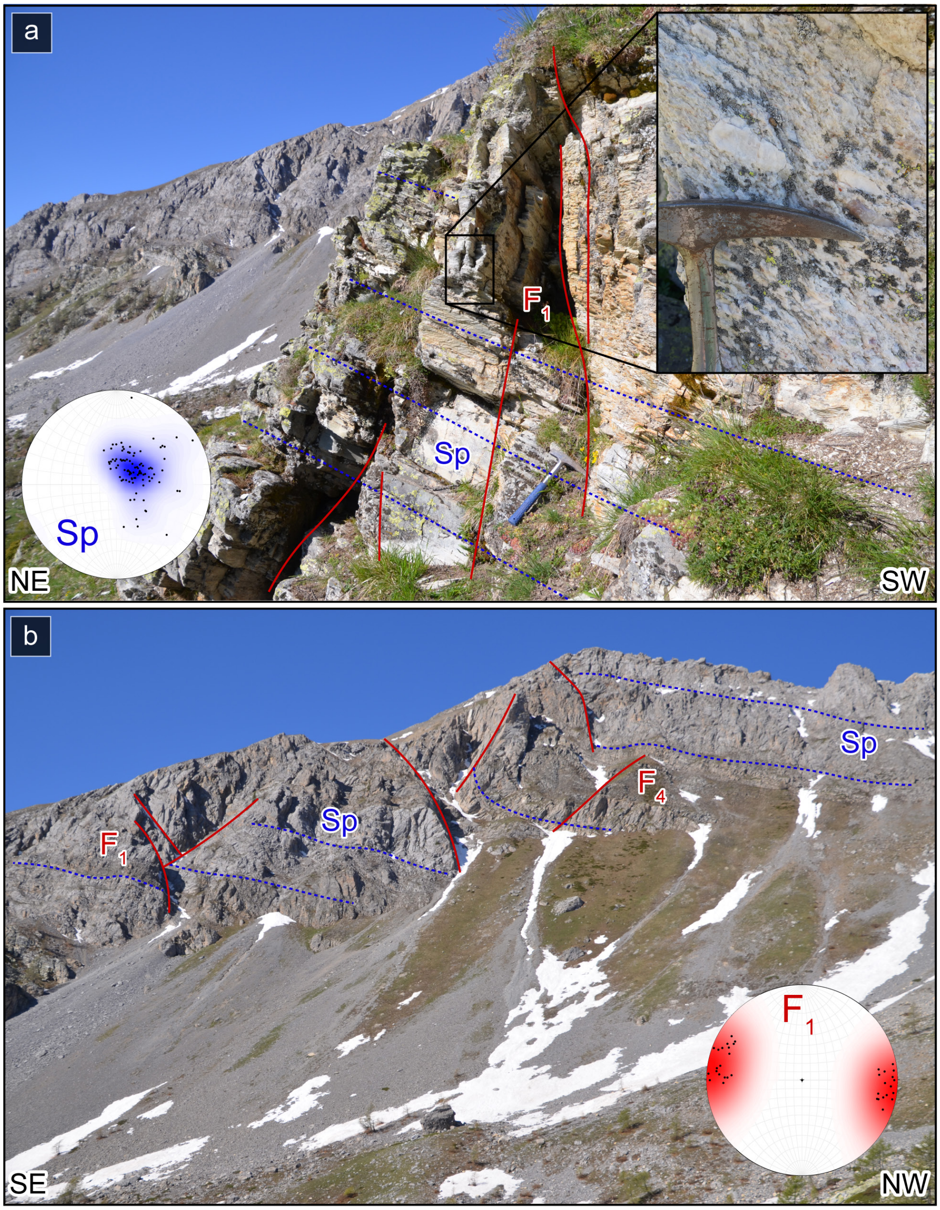

Figure 5. (a) Conglomeratic quartzite of the Acceglio Unit, with a focus on the object lineation defined by quartz clasts. F_1 sub-vertical system crosscuts the Sp foliation with high dip angles. (b) Landscape view of the southwestern slope in marble. The interaction between F_1 and F_4 systems is displayed.

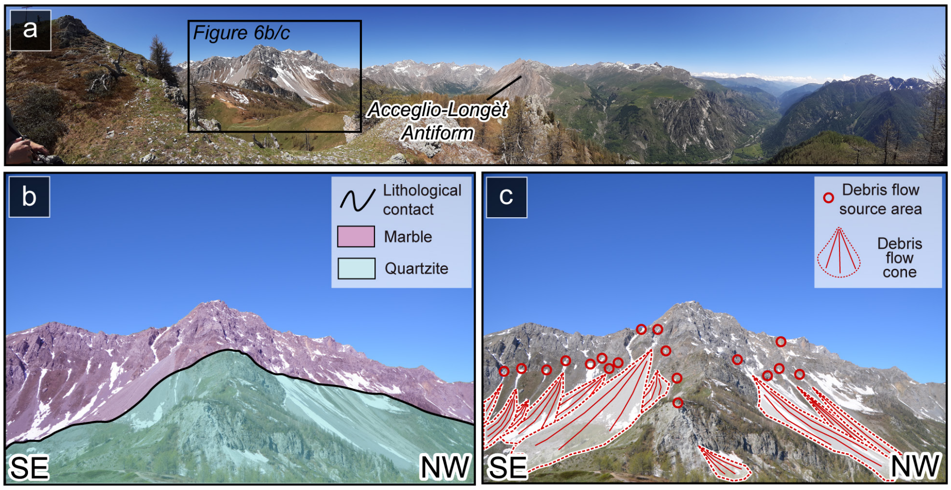

Figure 6. (a) 360° landscape view from Loc. Grange Colletto showing the Acceglio-Longèt Antiform. (b) Lithological contact between marble and quartzite of the Acceglio Unit. (c) Debris flows source areas and debris flows cones distribution along the previous lithological contact.

Fieldtrip information

The excursion itinerary develops entirely near Acceglio, reachable following the road SS22 (Fig. 3a). GPS coordinates and elevation are provided in each stop headline to facilitate the finding of the outcrops. The entire dataset is ensued from a May-July 2019 field survey, revisited at a smaller scale (Fig. 2). A geological and geomorphological map is presented to focus on local outcrops and most scenic lookout points, both interesting for the geological trip. Fieldwork data have been improved with photointerpretation of multi-temporal aerial images (1977 colour photographs at 1:15.000/1:20.000) and digital orthophotos (2005-2008, 2009-2011, 2012, 2015). The ductile deformation structures will be described using the not-numerical structural nomenclature indicating, for instance, the foliations as Sp-1, Sp and so on. Brittle structures from F_1 to F_4 have been indicated.
The fieldtrip is divided into two days:

- the first day is completely dedicated to the description of all Acceglio Unit lithologies and the main ductile and brittle structures and deformation style evidence, as well as their weathered cover and the associated debris deposits thickness. Day one is divided into five stops (Fig. 3b). Except for stop 1, which could require a car, an easy-marked GTA path can be walked. The highest peaks of the itinerary are Colle Estelletta (2316 m) and Mt. Midia Soprano (2341 m) (Fig. 3c).

- the second day has been distinguished into two parts with five stops (Fig. 3d). The first one focuses on the Gollone Landslide area in the Acceglio Unit, while the second part on lithologies and structures developed in the Upper Piedmont Zone, with a final landscape view. The tectonic contact between Acceglio Unit and Upper Piedmont Zone, parallel to the main foliation, is marked by a metric-thick mylonitic zone affecting both units. The mylonites are not explained and showed in the following stops for the lack of easy-walking paths (see the geological cross-section B-B' in Fig. 9a above). Stop 4 and stop 5 could be reached by car. The Gollone Landslide crown (1656 m) and the Loc. Grange Serri Sottano (1780 m) are the highest peaks of the day (Fig. 3e).

Day 1

Stop 1. Loc. Grange Vallone - Quartz-rich schist and quartzite of the Acceglio Unit (Alt. 1923 m; Coord. 44°26'39.51" N; 6°58'56.26" E)

From Acceglio, we follow the road AsF 7.2.4 (Guida Chambeyron - Val Maira N7, 2002) going to the Viviere locality shelter. From here, the marked trekking path (GTA path) for 1.5 km up to Loc. Grange Vallone should be taken. Here, quartz-rich schist and minor quartzite belonging to the Acceglio Unit crop out. These rocks show an Sp main foliation (spaced cleavage) generally dipping toward SW with different dip angles. The Sp is affected by post-Sp folds, with different geometries and deformation styles. In particular, kink and chevron post-Sp folds, with rounded hinges and frequent asymmetric profiles, and crenulation cleavage (Sp+1) are locally present. A crenulation lineation (*sensu* Piazolo & Passchier, 2002), defined by the hinge lines of centimetric-folds (A+1; Fig. 4a), plunging at low angles toward the NE with very high dispersion, has been observed. Also, an important brittle deformation has been detected. Here, the F_2 system (Fig. 4b), characterized by close to open fractures with centimetric to metric spacing and usually without filling, is observable. The mean direction is NW-SE, dipping NE with dip angles varying from 30° to sub-vertical, generally opposite to the main foliation.

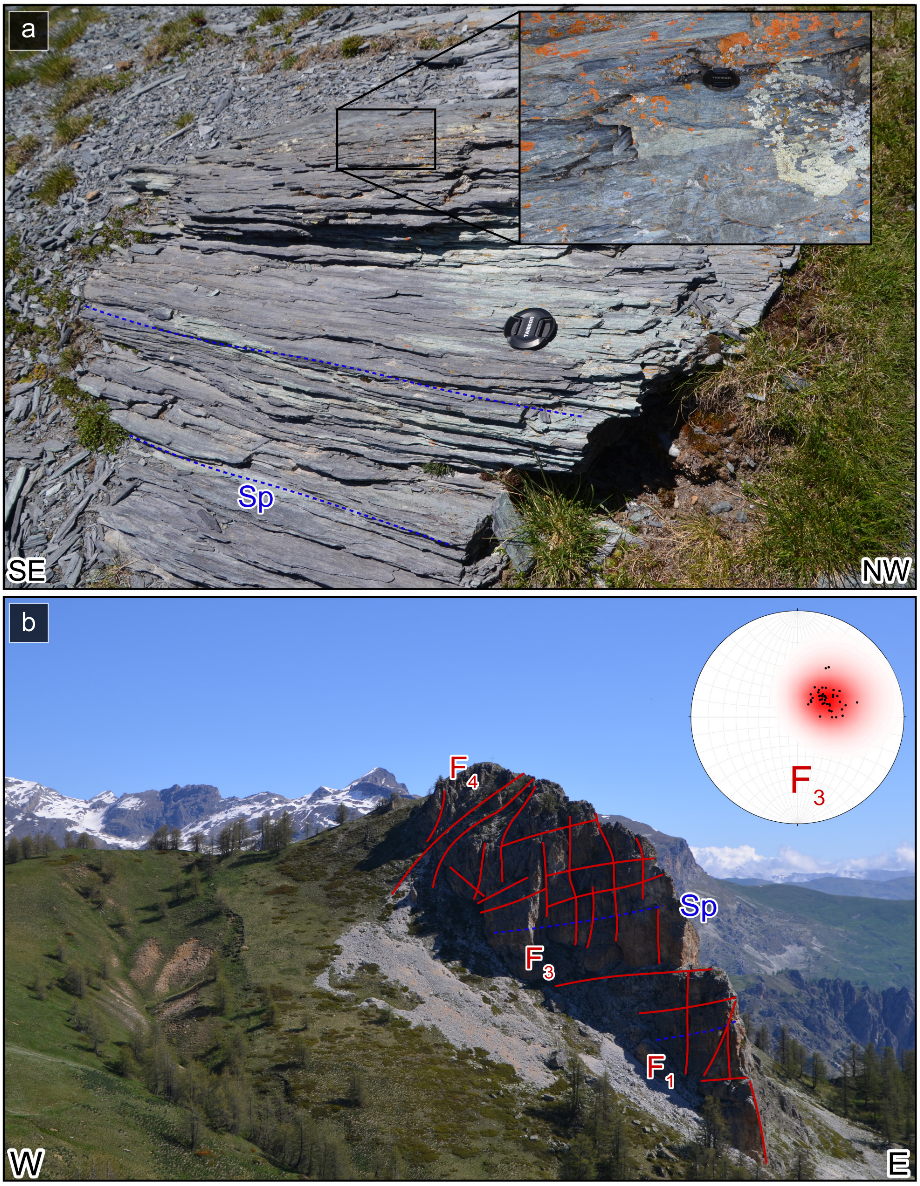

Figure 7. (a) Metavolcanic rocks outcrop with a zoom on the object lineation defined by volcanic clasts. (b) Quartzite of the Mt. Midia Soprano showing the complex interaction between F_1, F_3 and F_4 systems with the Sp foliation.

Stop 2. Quartzite and conglomeratic quartzite of the Acceglio Unit (Alt. 2191 m; Coord. 44°27'2.97" N; 6°58'13.15" E)

From Loc. Grange Vallone, we continue following the GTA path toward Loc. Grange Colletto. About 200 m downstream, quartzite and minor conglomeratic quartzite of the Acceglio Unit crop out. A very low penetrative disjunctive cleavage with smooth and anastomosing cleavage domain is present. Foliation dips at moderate to low angles toward the S-SW (Fig. 5a). In conglomeratic quartzite, the object lineation is defined by millimetric to centimetric elongated quartz clasts (Fig. 5a). Two main fracture systems (F_1 and F_4) with different features and geometry crosscut the main foliation Sp (Fig. 5b). From meso- to macro-scale, the F_1 fracture system strikes N-S and NNE-SSW (Fig. 5b), with sub-vertical dip angles.

Stop 3. Loc. Grange Colletto - Lithological and tectonic contacts on landscape view (Alt. 2206 m; Coord. 44°27'8.22" N; 6°58'15.69" E)

In Loc. Grange Colletto, a 360° panoramic view is appreciable (Fig. 6a). Starting from the south, on the left, the contact between Acceglio Unit quartzite and marble crops out (Fig. 6b). This contact is parallel to the main foliation (Sp). The great difference in erodibility between the two lithologies is confirmed by the different quantity of debris deposits in correspondence with their boundary. In particular, the higher percentage of fine materials characterizes the detrital

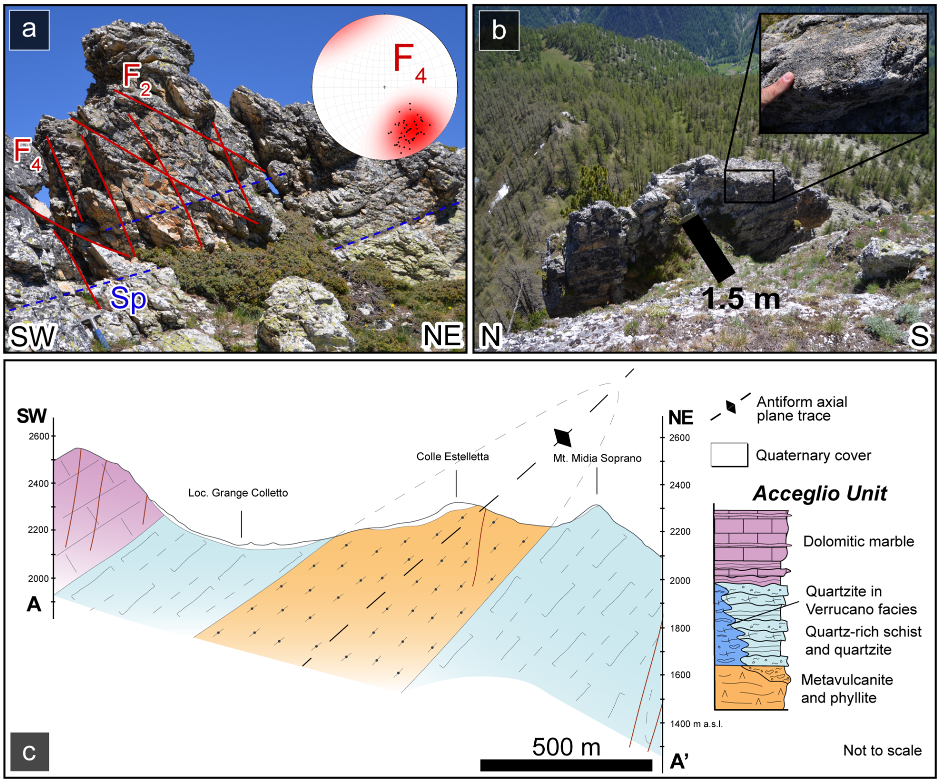

Figure 8. (a) Highly fractured quartzite of the top of Mt. Midia Soprano. (b) F_1 open fracture in quartz-microconglomerate. (c) A-A' cross-section (see Fig. 2 for the trace position). Stratigraphy and structural elements have been indicated.

cover in the carbonate lithotype, whereas it is almost absent in quartzitic one. An excessive amount of this cover could induce very fast gravitational movements if clearly triggered by heavy rainfall (not uncommon in an alpine climate). Due to these reasons, the presence in the uppermost range of debris flow source areas is noticeable, although debris flow cones are mainly emplaced on the lower quartzitic slope (Fig. 6c). Going toward the north-western sector, the Acceglio-Longèt Antiform, with a NE-SW shortening direction could be observed (Fig. 6a).

Stop 4. Colle Estelletta - Metavolcanite of the Acceglio Unit (Alt. 2316 m; Coord. 44°27'23.42" N; 6°58'37.69" E)

From Loc. Grange Colletto, we take a small path towards the north-east leading to the top of Colle Estelletta. Along its 2320 m high crest, metavolcanic and rarely volcaniclastic rocks, the oldest lithotypes of the Acceglio Unit, are present (Fig. 7a). Sometimes, centimetric volcanic clasts and elongated and stretched chloritoid crystals, defining an object lineation, have been recognized (Fig. 7a). The relationships of the F_1 and F_3 brittle structures strongly deformed quartzite, outcropping on the south-western side of the Mt. Midia Soprano. The F_3 structures are ductile with brittle reactivation shear zones that are generally parallel (Fig. 7b) to the Sp foliation. The F_1 structures generally crosscut the previous one (Fig. 7b).

Stop 5. Mt. Midia Soprano - High fractured quartzite and quartz-microconglomerate (Alt. 2341 m; Coord. 44°27'40.50" N; 6°58'48.68" E)

At the top of the Mt. Midia Soprano, high fractured massive quartzite (Fig. 8a) and quartz-microconglomerate (Fig. 8b) are present. The Sp foliation, dipping towards the SW, is poorly developed and pervasive in massive quartzite. The intersection of all different discontinuities (F_1 to F_4) is prominent. The F_4 system is characterized by close to few millimetres open fractures, with centimetric spacing, usually without filling and dipping NNW with dip angles about 35°-90° (Fig. 8a). Instead, metric to plurimetric open fractures and clefts are related to F_1 system (Fig. 8b). Combining structural and lithological data, a km-scale metavolcanic rocks anticlinal-antiform in quartzite has been recognized (see the geological cross-section A-A' in Fig. 8c).

Day 2

Stop 1. Eastern slope of the Gollone Landslide (Alt. 1527 m; Coord. 44°28'1.78" N; 6°59'27.47" E)

Starting from Acceglio, following for about 2.5 km the road toward Chialvetta, the entrance for the Gollone Landslide area is present. Proceeding for about 1

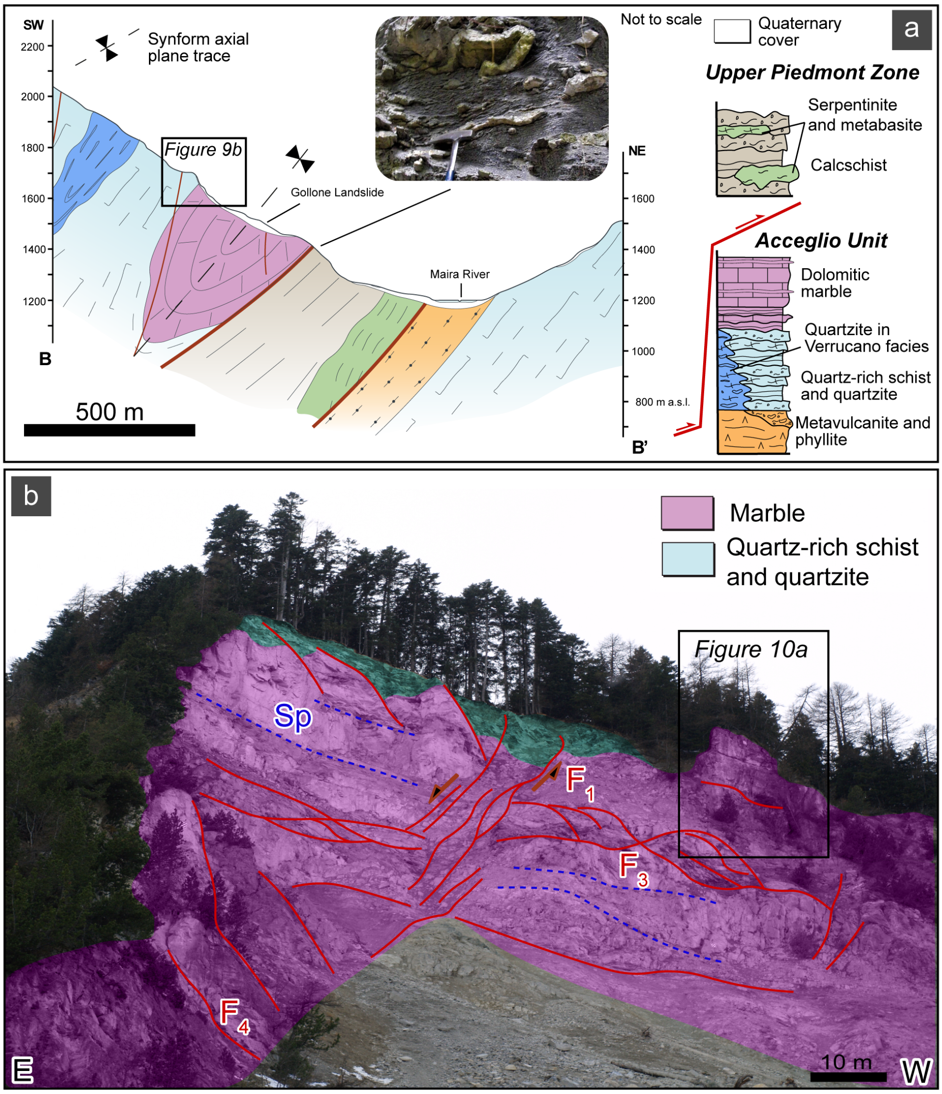

Figure 9. (a) B-B' cross-section (see Fig. 2 for the trace position) highlighting the marble synclinal-synform in quartzite. An example of the mylonitic rocks outcropping along the tectonic contact has been indicated. The simplified stratigraphy of the Acceglio Unit and Upper Piedmont Zone is displayed. (b) Mesostructural view of the sub-vertical main scarp of the Gollone Landslide.

km towards the northwest, on the left, Acceglio Unit intensely fractured marble can be observed. Locally, they present well-developed "cornieules" levels, which are parallel to the main foliation Sp and have been considered as marker levels to understand the marble synclinal-synform in quartzite, displayed in the B-B' geological cross-section (Fig. 9a). Going towards the highest part of the slope, the sub-vertical main scarp, approximately oriented NW-SE, is about 250 m long and 70 m high. Here, the interaction of all discontinuities systems (F_1 to F_4) is observable (Fig. 9b). Detailed structural analyses have been carried out concerning the relationship between geometry and areal distribution of these structural elements, combined with the kinematics and instability of the landslide. The landslide planar and wedge sliding are controlled by the F_1, F_2 and F_4 systems. Toppling could be related to the F_1 system when it dips opposite to the Gollone Landslide slope. The F_3 system, in addition to the previous ones, determines a more intense fracturing of the rock mass.

Stop 2. Western slope of the Gollone Landslide (Alt. 1600 m; Coord. 44°28'3.29" N; 6°59'13.01" E)

Going toward the west, a not well-signed path that crosscut the landslide on the base of the detrital body is present. Further up the western slope, it is possible to observe how the Gollone main scarp considerably regressed after many rock falls and topplings occurred on December 4-6, 2011 and also recorded on the night of October 28-29, 2019. Both gravitational phenomena are associated with centimetric-to-metric open fractures (F_2), as displayed in Fig. 10a, which has been taken before the last event.

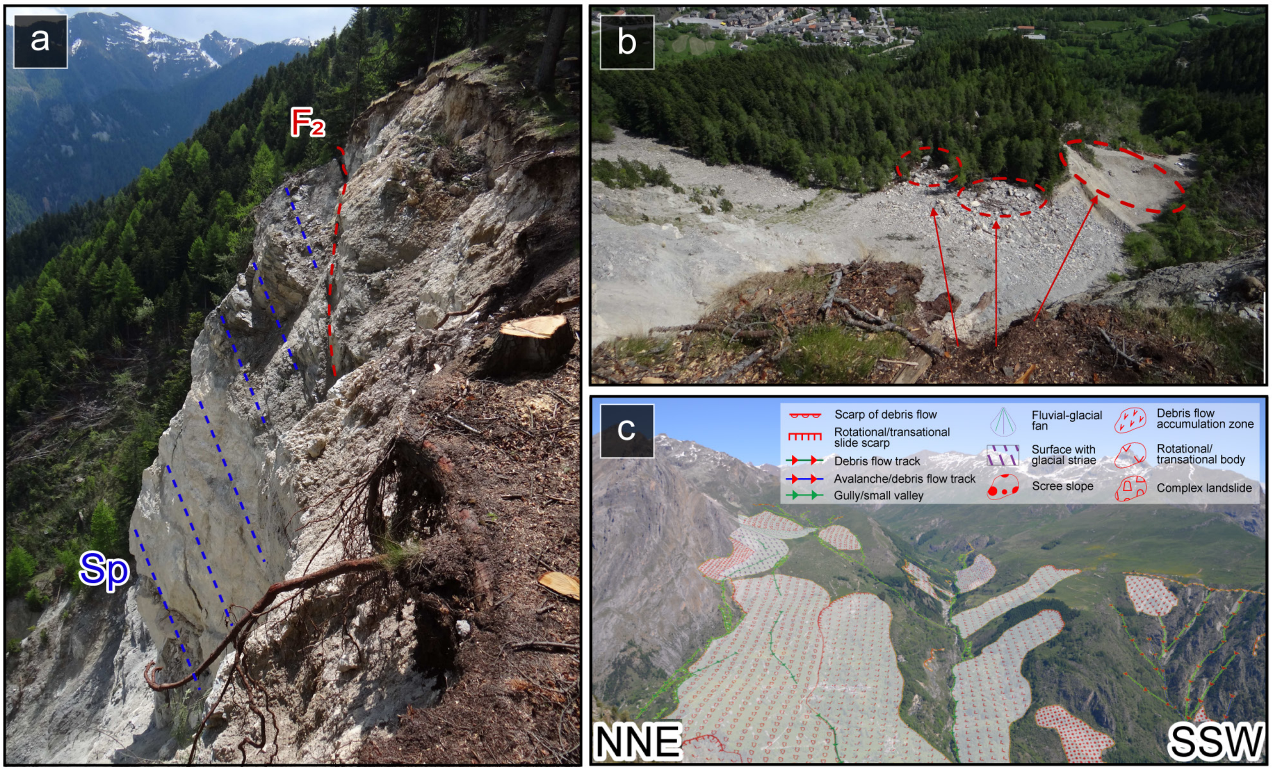

Figure 10. (a) F_2 system with centimetric to metric opening in the proximity of the Gollone Landslide crown, taken before the last rockfall in 2019. (b) The man-made, debris storage tank and the talus deposits produced by the rock falls observed from the landslide crown. (c) Panoramic view of the left orographic side of upper Maira Valley with its main geomorphological features.

Stop 3. Crown of the Gollone Landslide (Alt. 1656 m; Coord. 44°27'59.03" N; 6°59'14.64" E)

From the viewing area on the top of the landslide main scarp, the man-made trials, performed through engineering activities to mitigate potential risks, are evident. In particular, storage tanks have been built to limit the arrival of the debris quantity in the slope lowest sectors (Fig. 10b). This detrital cover is seasonally involved in debris flow and snow/debris avalanches where other triggering factors occur, as seen for Loc. Grange Colletto (cf. stop 3, day 1). Its thickness is between 18 m upstream and 32 m downstream, as estimated using the stratigraphy obtained by drillholes provided by Arpa Piemonte. On the opposite side, an overall view on the left side upper Maira Valley geomorphology is offered (Fig. 10c). The gentle slope characterizes the suspended landscape, an ancient witness of the pre-erosion morphology. In this sector, large and slow landslides affect this surface, modelled by Pleistocene glacial dynamics. Several debris flow channels and a widespread gully erosion testifies the hydrographic pattern attempt to reach a new base level, represented by the Holocene Maira riverbed.

Stop 4. Upper Piedmont Zone oceanic rocks (Alt. 1230 m; Coord. 44°28'30.84" N; 6°59'18.90" E)

Back to Acceglio, several outcrops, neighbouring the parking area on both sides of Maira River, can be observed. Massive and locally layered fine-grained metabasite, mainly composed by green amphibole, epidote and plagioclase, and massive to foliated serpentinites crop out. The rock fabric in metabasites is often crosscut by green cm-thick epidote veins (Fig. 11a). A clear intersection between Sp foliation and F_4 fracture system is present (Fig. 11b). F_1 structures associated with two types of striae, indicating dip-slip and strike-slip movements (Fig. 11c), are observable, with a prevailing strike-slip component.

Stop 5. Loc. Grange Serri Sottano - Panoramic view of the north-eastern slope of the Mt. Midia Soprano (Alt. 1780 m; Coord. 44°29'6.92" N; 6°59'27.65" E)

Continuing along the SS22 towards Villaro, we follow the signs for Lausetto skirting the Mollasco Stream. From Lausetto, we take the AsF 7.3.5 path (Guida Chambeyron - Val Maira N7, 2002) towards Grange Serri Sottano. Reaching the beginning of a dirt track, which coincides with the end of a small bridge,

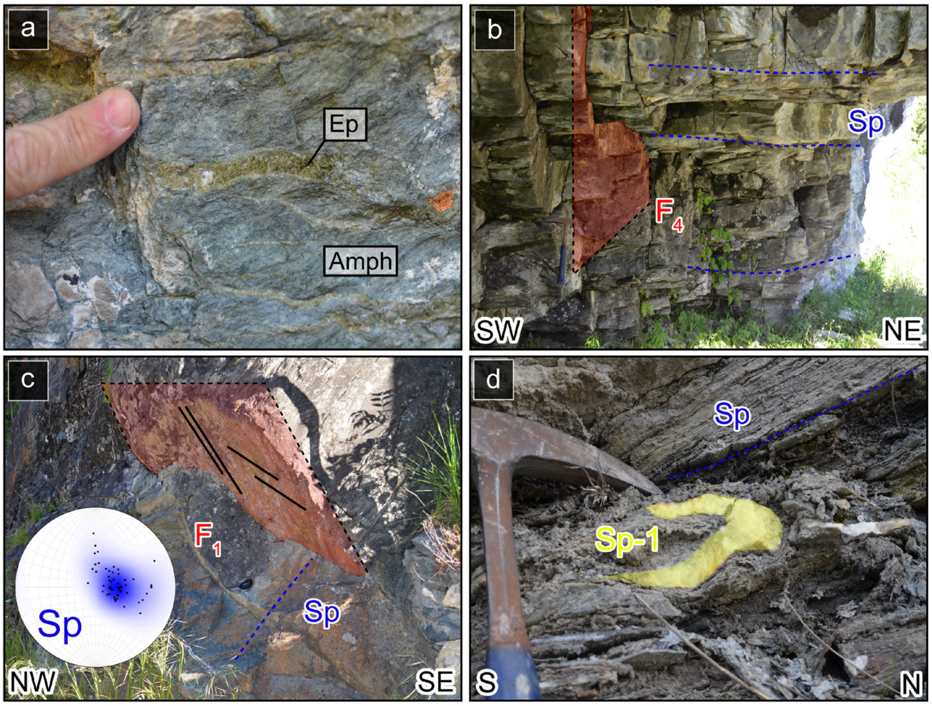

Figure 11. (a) Green cm-thick epidote vein crosscutting the metabasite fabric. (b) Perpendicular intersection between Sp foliation in metabasite and F_4 system. (c) F_1 structures associated with dip-slip and strike-slip striae. (d) Rigid quartzitic level underlining an older Sp-1 foliation, not completely transposed, in calcschist of Upper Piedmont Zone.

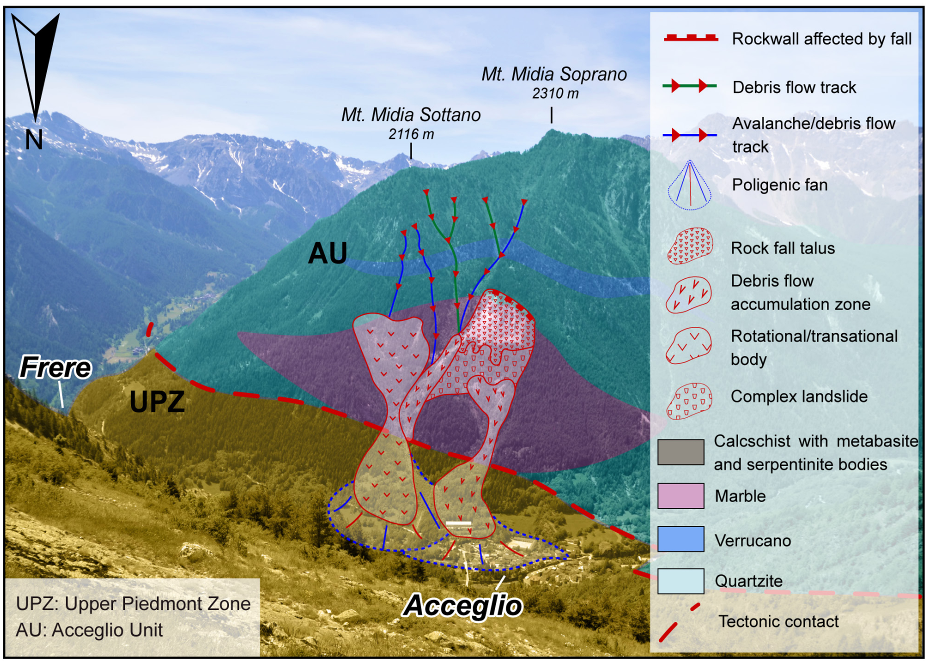

Figure 12. Panoramic overview of the right orographic side of upper Maira Valley. The manifold Gollone landslide morphological features have been over-imposed on described lithologies. The tectonic contact between Upper Piedmont Zone and Acceglio Unit has been highlighted.

calcschist of Upper Piedmont Zone crops out. This lithotype shows a spaced foliation Sp, with some rigid quartzitic levels which underline an older Sp-1, not completely transposed (Fig. 11d). After ca. 3 km from the small bridge, in Grange Serri Sottano locality, an outstanding, complete panoramic point of Mt. Midia Soprano northern slope is revealed (Fig 12). The interaction of well-described litho-structural component and the morphologies are here worthy of attention. The sudden slope gradient changes are in correspondence with the tectonic contact between calcschist and quartzite. The most of gravitational phenomena are linked to marble weathered cover in the uppermost range of the slope (cf. stop 3, day 1). On this subject, the overview of gravitational movement typologies and related effect could be provided. In particular, the rock fall talus and debris flow accumulation zones characterize the core of the above-mentioned synclinal-synform (Fig. 9a). Wide polygenic fans are emplaced on calcschist in the valley floor, here interacting with Maira River fluvial dynamics. Acceglio is founded on these active deposits, thus increasing the risk to which its inhabitants are exposed in case of rainy events with landslide triggering.

Conclusions

The proposed two-day fieldtrip, along the key outcrops, allows the observation of both Acceglio Unit and Upper Piedmont Zone lithotypes, ductile and brittle structures. The data collection of our geological guide to the excursion highlights the extraordinary geodiversity of the upper Maira Valley. In this respect, the area represents an important geological spot for a possible future geopark or geotrail applications. The valorization of far-from cities valleys would help local communities in the enhancement of tourist activities. The fulfilment of this task requires contemporaneous detailed investigations on not completely investigated themes to reach an exhaustive awareness of local geological features. Thanks to the cooperation between Università degli Studi di Torino and Arpa Piemonte, fieldtrip data could be finally uploaded in the GeoViewer 3D (Geo3D), the Gis consultation tool provided by Arpa Piemonte for granting easy access to researchers who may be interested in.

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