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THE GEOMORPHOSITES IN LOMBARDY

Luisa Pellegrini, Paolo Boni, Pierluigi Vercesi, Alberto Carton, Lamberto Laureti & Francesco Zucca with contribution of Stefania De Vita
Dipartimento di Scienze della Terra, Università di Pavia, Via Ferrata 1, 27100 Pavia – e-mail: lpellegr@unipv.it

ABSTRACT: L. Pellegrini *et al*., *The Geomorphosites in Lombardy*. (IT ISSN 0394-3356, 2005).
Lombardy is a region of Northern Italy with a territory whose structure includes, from the physical-geographical point of view, a very important portion of the Alps and the adjacent Po plain with a little part of the Northern Apennines.
This situation is due to the complexity of the landscape with its great diversity of historical and human aspects, frequently studied and described, but also the same physical elements which are, owing to their interest, worthy of conservation as part of the cultural heritage.
As in many other Italian regions and provinces, also in Lombardy the exigence of describing and making available sites and peculiarities of the landscape arose, together with the suggestion of specific naturalistic tours, by means of relative guidebooks, monographs and so on.
The Authors of the present work (as a part of the national research programme on 'Geosites and Italian Landscape') made a census of *geomorphosites* in Lombardy in order to their improvement, conservation and availability, both on the tourist and the scientific level.
From the operating point of view, because of the high heterogeneity of the Lombard physical landscapes, it has been necessary to differentiate three main areas: Alps, Po plain and Apennines. Then, owing to its didactic exemplariness, its rarity and its paleogeographic or evolutive evidence, the geomorphological sites having a specific value have been identified and described, and also typologically assembled.
Till now more than 150 sites have been registered. Some of them are single geomorphosites and others correspond with their areal but significant distribution. Someone of them are moreover well known as tourist sites, but many others, instead, have not had such consideration, yet.

RIASSUNTO: L. Pellegrini et al*., Geomorfositi in Lombardia. (IT ISSN 0394-3356, 2005).*
La Lombardia è una regione dell'Italia settentrionale che comprende un territorio molto articolato dal punto di vista geografico-fisico, estendendosi dalle zone alpine di alta montagna con più o meno estesi ghiacciai, alle zone prealpine di media altitudine fino alla pianura, che va, a sud, a raccordarsi con le colline e le montagne dell'Appennino settentrionale.
In questa complessità di paesaggi in cui gli aspetti storici, geopolitici ed artistici rivestono una grande importanza e, proprio per questo, sono stati da sempre oggetto di studio e fonte di numerose pubblicazioni, l'aspetto naturalistico risulta essere ugualmente interessante e determinante per la conservazione dei beni naturali.
Come per molte altre regioni o province, anche in Lombardia, già da parecchio tempo, si è sentita l'esigenza di descrivere e rendere pubblici luoghi e peculiarità paesaggistiche, itinerari naturalistici ecc. Sono infatti disponibili numerose guide, monografie e illustrazioni di vario tipo che, a causa della loro difficile reperibilità e/o per il loro carattere locale, sono difficilmente fruibili a vari livelli.
Con il presente lavoro, inserito nel programma di ricerca di rilevante interesse nazionale 'Geositi nel paesaggio Italiano: ricerca, valutazione e valorizzazione' si è effettuato un censimento dei geomorfositi lombardi, in linea con quanto è già stato fatto da altre regioni, Questa operazione rappresenta un primo passo verso l'obiettivo finale che è, oltre a quello di una completa catalogazione, la valorizzazione, la conservazione e la fruibilità a livello sia turistico che scientifico dei medesimi.
Come già precisato, essendo l'ambito regionale molto eterogeneo dal punto di vista geografico-fisico, si è deciso di suddividere l'area alpina da quella appenninica e da quella di pianura. Nell'ambito di questa suddivisione, si è proceduto all'individuazione e alla descrizione di quegli elementi che, per esemplarità didattica o rarità o per testimonianza paleogeografia o evolutiva, possiedono una particolare valenza a carattere geomorfologico. Detti elementi sono stati accorpati in base alle tipologie.
Attualmente sono stati censiti oltre 150 siti, alcuni dei quali corrispondono a forme singole, altri a una distribuzione areale di oggetti che nell'insieme soddisfano alle caratteristiche di geomorfosito. Alcuni di questi ambiti sono noti e già meta di visite turistiche; per altri, invece non sono ancora riconosciuti gli aspetti specifici e peculiari.

Keywords: Geomorphological assest, Geomorphosytes, Lombardy, Italy.

Parole chiave: Beni geomorfologici, Geomorfositi, Lombardia, Italia.

1. INTRODUCTION

Among the Italian regions, Lombardy is noteworthy because of its great variety of environments. In fact it consists of a large section of the Po plain, between the Ticino and the Mincio rivers, surrounded by the mountains and the hills. The mountains of Lombardy are formed northward mainly by the central section of the southern side of the Alps, that is the Raetian (culminating to the 4050 m of the Pizzo Bernina) and the Orobie Alps, with the lower belt of the Prealpi, and southward by a little portion of the Apennines range (culminating to the 1724 m of the M.t Lesima), limited by the Staffora and Tidone valleys.

Likewise other Italian regions, also in Lombardy one feels the exigence of recognizing, describing and making available for people sites and landscape aspects as testimony of the Earth history. By the exploitation of such situations, known and named geosites, geotopes or geomorphosites, one wants to awaken the public opinion towards a more and more correct use of the environment, showing by these 'geological monuments' the complexity and the fragility of the equilibria regulating the life of geosphere. All over

the world, many efforts have been done in order to safeguard the 'geological heritage', as it's been done in the biological and anthropological field.

Among the European and extra-European scientific initiatives, by the support of government funds, in the year 2001 has started a research programme on 'Geosites and Italian Landscape: Research, Evaluation and Exploitation'. The aim of this program is to make the first census of geomorphosites in Lombardy, according to the standards applied in other Italian regions. The choice of the sites is based on the researchers' experience and by means of wide bibliographic sources.

The recognized geomorphosites will be registered according to codified national rules and will be put in a data bank managed by the National Geological Survey as a part of the programme 'Preservation of the Italian Geological Heritage'. According to the basic standards, the choice of geomorphosites in Lombardy was steered into those landscape aspects characterized by didactic exemplariness, naturalistic rarity, paleogeographic testimony, evolutive evidence or particular geomorphological value.

Till now, more than 150 sites have been registered. Some of them are single geomorphosites and others correspond with their areal but significant distribution. Moreover some of them are well known as touristic sites, but many others, instead, have not such consideration.

2. THE GEOLOGICAL STRUCTURE AND ITS MORPHOLOGICAL IMPLICATIONS

The geological substratum of Lombardy, into which the geosites are carved out and preserved, is very complex and diversified: in fact the alpine portion includes crystalline and sedimentary rocks, members of the Sudalpine domain (Southern Alps), separated by the Insubric Line from the Pennidic and Austroalpine ones. Southwards, the Po plain, nearly entirely made by Quaternary sediments, serves as a connection between the Alps and the Apennines.

2.1 The Alps

The actual structure of the Alps, including the Lombard Prealps, is to be ascribed to the alpine orogenesis which reworked and reshaped the great crystalline 'eastern massifs' (as Ortles-Cevedale, Bernina-Disgrazia, Tambò-Suretta) placed by the Hercynian orogenesis. Then, this basement has been sectioned forming large and deep depressions (as the Basin of Collio) filled afterwards by thick piles of sediments, sideways opposed to those of the carbonatic shelf.

The morphological evolution, influenced by the Alpine orogenesis, gave rise to steep landforms, alternating with milder others, as one can see in the 'Triangolo Lariano' (the area between the two southern branches of the Como Lake). So, all over the Lombard Prealps, the old Jurassic structures (Fig. 1) that influenced the subsequent tectonic and morphological evolution, originated from Paleozoic events (Cassinis & Vercesi, 1982). On the other hand, the dissection of the large Triassic shelf caused the formation of the great Lombard trough into which were interposed some more or less resistant structural tops (of Botticino, Teglie, Monte Cavallo, etc.).

The sedimentary events developing from the lower Jurassic till Palaeogene allowed the deposition of great thicknesses of sediments into this trough (besides controlled by synsedimentary faults) and, during the Alpine orogenesis, influenced the superposition of impressive overthrust nappes.

The settlement of great thicknesses of sediments into the Jura-Cretaceous troughs and their exhumation by the following orogenetic stages (at times embricating remarkable elements in form of tectonic chips, as in the case of the Grigne mountain) led to the juxtaposition of rocks having different degree of resistance with regard to the erosion.

Consequently, it is possible to see the superposition of strong calcareous-dolomitic plates upon tender and friable Cretaceous-Eocenic sequences (i.e. the Scaglia) with the protection of these last ones from the erosion and moreover allowing their observation along deep gorges.

Then, during the alpine orogenesis, together with vertical liftings and horizontal translations, the plutonic bodies of Adamello and Val Masino-Bregaglia were placed, originating also interesting phenomena of contact metamorphism.

From the morphological point of view, it is possible to distinguish, in the alpine and prealpine region, at least three zones of influence:

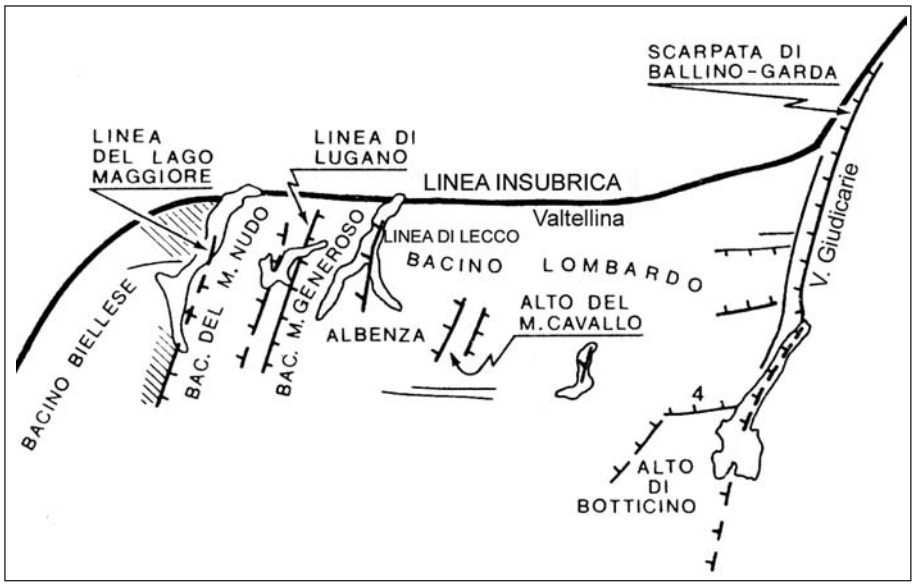


Fig. 1 - Main features of the Jurassic tectonics of the Western South Alps (Castellarin, 1982, modif.).

Principali lineamenti della tettonica giurassica del sudalpino occidentale (da Castellarin, 1982, modif.)

a) the northern zone, with prevailing igneous and metamorphic rocks, showing morphological situations mainly due to the glacial and fluvial activity; the relieves (separated by large valleys with didactic alluvial cones at the bottom of their sides, as in Valcamonica and Valtellina) have impressive forms and typical pyramidal structures;
b the southern zone with prevailing carbonatic sequences keeping regular structures with less large mountain massifs and into which the morphogenesis is mainly controlled by the water activity together with remarkable karst (as on the Cariadeghe plateau, on the Presolana, on the Grigne, etc.) and gravity phenomena;
c) as a consequence of structure and lithology, owing to the erosion, the mount tops take the shape of a cusp, a pinnacle, a tower, often very indented (as on the Grigne, the Presolana, etc.) with arches, windows and doors (as the Passo Forato, Porta di Prada, etc.) producing spectacular effects.

The structure of the Sudalpine domain goes down southwards, passing from nearly 3000 m of the highest mountain tops towards the more than 10 km in depth under the middle part of the Po plain, originating so the hard opposition between the regular flat surfaces of the plain and the overhanging sides of the prealpine relieves, characterized by the strong folding of the Jura-Cretaceous sequences as one can observe from the lake of Como to the lake of Garda, in spite of the presence, along the contact, of an hilly belt made by a remarkable morainic cover.

The prealpine lakes, on the other hand, are strictly correlated to the old Jurassic structures, being placed along faults systems which dissected the great and resistant Triassic plates. Then, the lacustrine basins was enlarged by the fluvial erosion during the Messinian and then bay the fluvio-glacial erosion during all the Quaternary.

2.2 The plain

The Po plain, formed during the Quaternary by the filling of the old Adriatic foretrough by the result of the erosion on the alpine and Apennine chains, nevertheless shows various morphological elements to be connected to buried structures. By this regard, the more significant forms are the lonely hills near the edge, both alpine and apennine, as Montorfano, Castenedolo, San Colombano, etc.

Other influences by the structural evolution of the plain landscape forms may be found in the hydrographic network changes, put in evidence by river captures, meanders, etc. Particularly the plain morphogenesis, unlike on alpine relieves, displays a great and easy ability in shaping the alluvial and loose sediments.

2.3 The Apennines

Lombardy it is possible to see, often, very diversified morpho-evolutive types, according to different lithologies. So one passes from the high tenacity of the alpine and prealpine rocks to the easy erodibility of the plain sediments, while the apennine rocks shows intermediate conditions because of the prevalence of clayey sequences and the strong tectonic stresses.

In fact, during the past orogenetic stages, the overthrust nappes covered great distances giving the contact between more or less resistant rock bodies (i.e. metamorphic rocks as serpentinites included in sedimentary sequences).

Furthermore, even if the Lombard Apennines has a little extension, within it one can observe the rotation of the structural lines which placed themselves in a longitudinal direction, because of the presence of a 'torsion knot' (Fig. 2) in relation with the alpine-ligurian and the apennine structures.

It is clear, so, that the hydrographic network configuration and all the relative forms are influenced (also from the evolutive point of view) by the geo-lithological structure, as a consequence of which the landscape shows mild aspects, from the little and diversified hills on its edge, to the not even rough and steep watershed relieves.

3. CHANGING GEOMORPHOSITES

On the basis of the previous considerations, it is indubitable that the morphogenesis in the above-mentioned three zones of Lombardy follows their complex geological and structural vicissitudes, reflecting also its strong conditioning.

And it is just by the observation of geomorphosi-

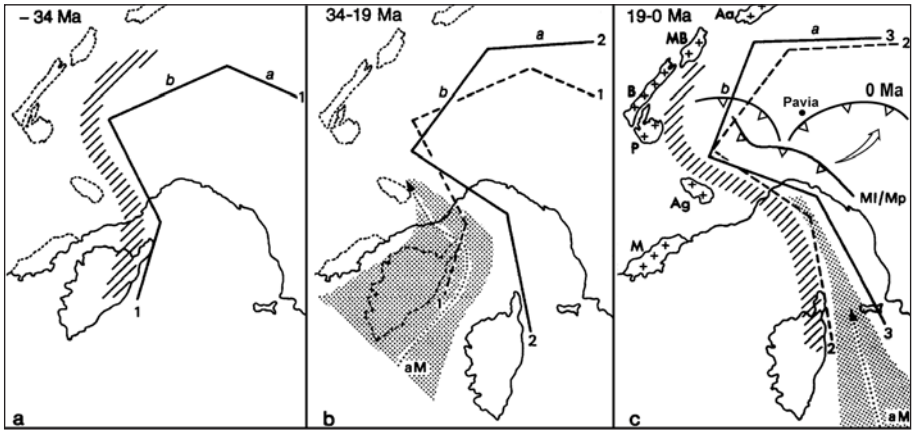


Fig. 2 - Progressive movements have touched the Adria plate from Lower Oligocene to the present one, opening out the Ligurian Ocean and the Tirrenic Basin, originating so the buried Apennine arcs (lines and triangles) and the Apennine Chain.
a – Insubric line; b – Canadese line; Ag-M Argentera-Mercantour Block; P-B – Pelvoux-Belledonne Block; MB – M.te Bianco Block; Aa – Aar-Gottardo Block; 1,2,3 – Vertical projection of the deep NW margin of Adriatic Moho (Vanossi *et al*., 1994, modif.).

Movimenti progressivi che hanno coinvolto la zolla Adria dall'Oligocene inferiore all'attuale, creando l'apertura dell'oceano ligure e del bacino tirrenico, e formando gli archi appenninici sepolti (linee con i triangolini) e la catena appenninica.
a – linea insubrica; b – linea del Canavese; Ag-M massiccio Argentera-Mercantour; P-B – massiccio Pelvoux-Belledonne; MB – massiccio del M.te Bianco; Aa – massiccio Aar-Gottardo; 1,2,3 – proiezione verticale del margine nord-ovest profondo della Moho adriatica. (da Vanossi et al*., 1994, modif.).*

tes that we can reconstruct their genetic endogenous and exogenous events and by means of them also the regional geo-morphological history.

Nevertheless, we must underline that the morphological landscapes differ also depending on the main morphogenetic agents succeded in time. In fact, the fluvial morphogenesis gives an intense mark to the Lombard landscape, even if in the alpine zones the glacial action is more evident, while in the apennine ones there are also gravity slidings causing deep disruptions on the mountain sides forming so great accumulations upon the valley floors.

This way we hope we have given a suitable key of reading for the different landscape forms that are to be observed not only from the outside, but it is necessary to explore their internal structure, their capability to resist to the erosion and weathering agents and, lastly, to evaluate their fragility or, in some case, the impossibility or the not convenience of preservation initiatives (Wimbledon, 1999).

According to the Wimbledon 1990 categories, the sites worthy of recommendation, for their stratigraphic, sedimentological and structural characteristics and for their rarity and singularity, are to be included among the 'better' and 'unique' sites.

These morphosites, normally small dimensioned but with naturalistic and scientific value, are often greatly vulnerables both for natural and anthropic impacts. It is then absolutely necessary to state their severe protection.

Among the many examples (plain rise, glacial lakes, erratic blocks, etc.) we will point out the attention towards two particular sites, showing how rapid is the change of their preservation conditions and the

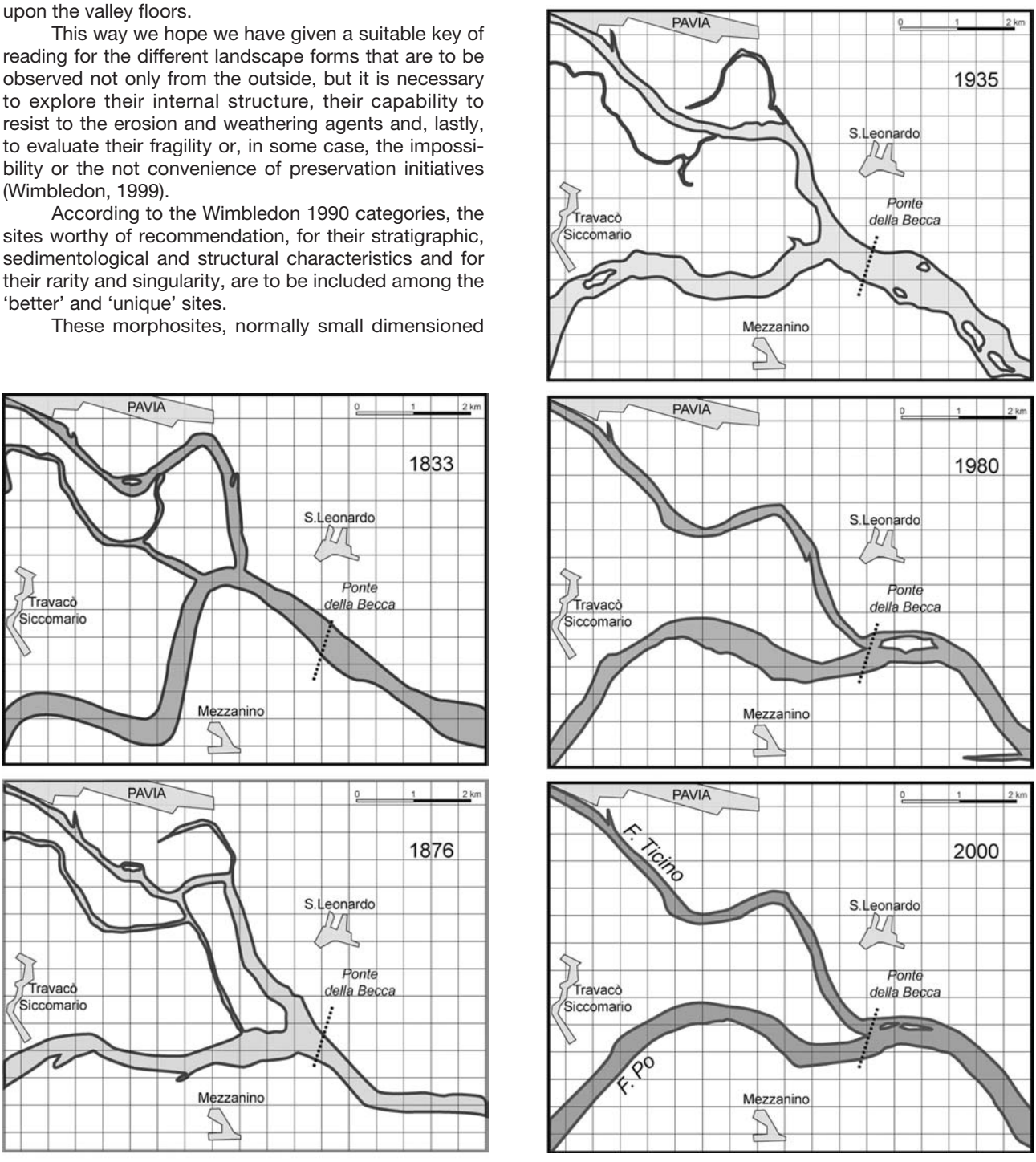


Fig. 3 - Evolution of the confluence wedge between Po and Ticino rivers.
Evoluzione della penisola di confluenza tra F. Po e F. Ticino.

Fig. 4 - Quick change of a geomorphosite: view of the earth pyramids of Zone: the picture on the left was taken in the early 70s, the one on the right in June 2003.

Modificazione rapida di un geomorfosito: panoramica delle piramidi di terra di Zone: la foto di sinistra è stata scattata nei primi anni '70, quella di destra nel giugno 2003.

morphological evolution, observable also in short times.

The first case refers to a site represented by the confluence wedge between the rivers Po and Ticino that, during the last one hundred years, have advanced overall of more than one km valleywards (Fig. 3).

The second case refers to the morainic earth pillars near Zone, a village on the east side of the Iseo lake. The pillars, made by soft and easily eroded glacial material, are normally protected by a stone or a boulder placed on their top. But the presence of a wood can danger these fragile pinnacles because of the trees roots, besides to the same rain violence (Fig. 4).

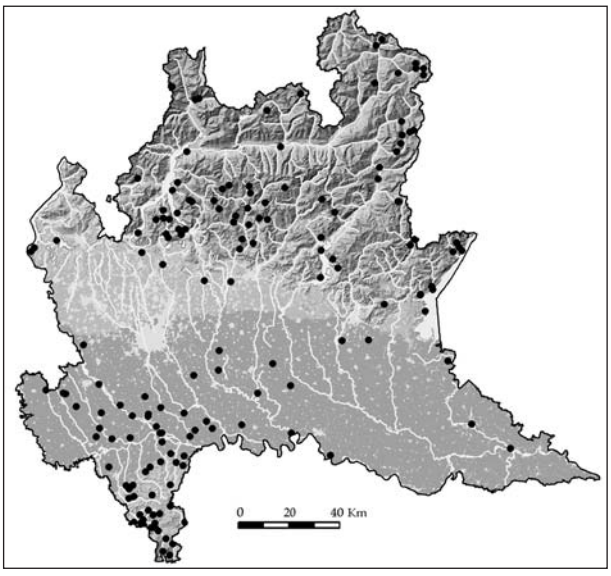


Fig. 5 - Geomorphosites position in Lombardy.

Distribuzione dei geomorfositi nel territorio lombardo.

4. THE LOMBARD GEOMORPHOSITES

Owing to the great number of geomorphosites present in Lombardy it's been agreed to make two lists.

In the first one (Tab. A) are listed the most representative geosites for which a specific survey was made. Such geosites have been listed in a GIS and can be seen in the general map (Fig. 5), while the maps of figures 6a and 6b can be easily located thanks to a quoted progressive identity code.

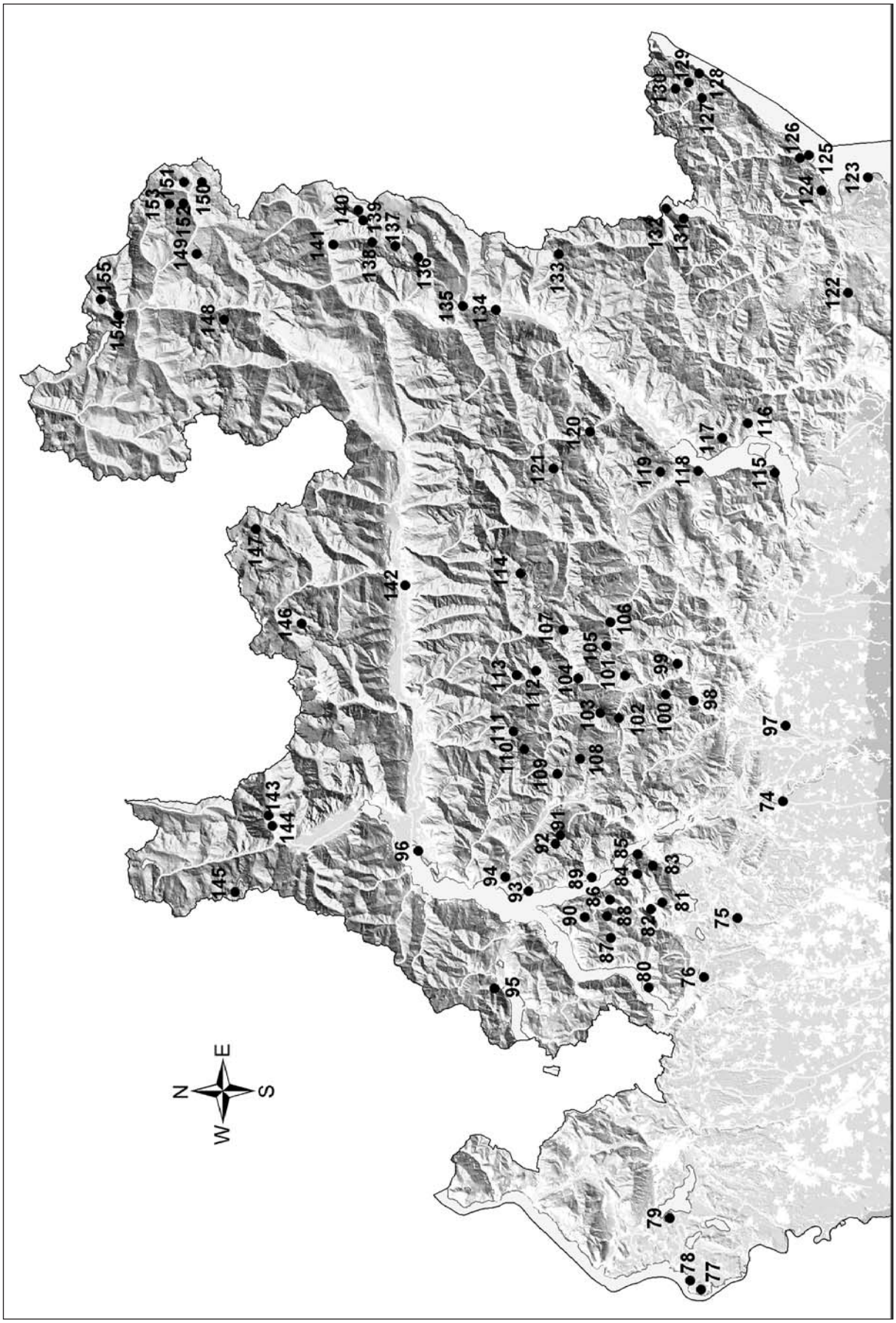
In this list, for each geomorphosite is quoted its identity code (COD) referring to the general map, its name (toponym or placename), its province (PROV), the motivations (MOTIV) of the choice made by researchers and a short description. In this list, the sites are grouped according to their geographic pertinence (the Apennines, the Po Plain, the Alps).

A second list (Tab. B) includes those geomorphosites which, though having similar characteristics to the ones of the first group, are either considered as less significant (a) or have been deduced by the scientific and popular literature, and for this reason need further analysis for their classification (*b*).

4.1 Some examples

Here is, furthermore, the description of some significant geomorphological sites (as the 'Ghiacciaio dei Forni', a glacier situated in the Ortles-Cevedale massif, the '*Peduncolo di Sommo*', a residual meander lobe along the river Po, the regularized hill sides [in Italian: '*faccette triangolari*'] near Broni in the apenninic region of the Oltrepo Pavese, and the serpentinite 'monadnocks' near Pregola in the high Apennin) with their evolution history, the choice motivation and the possible fruition.

Such descriptions will be, therefore, made, in the near future, also for the other geomorphosites of the list A.



6a)

6b)

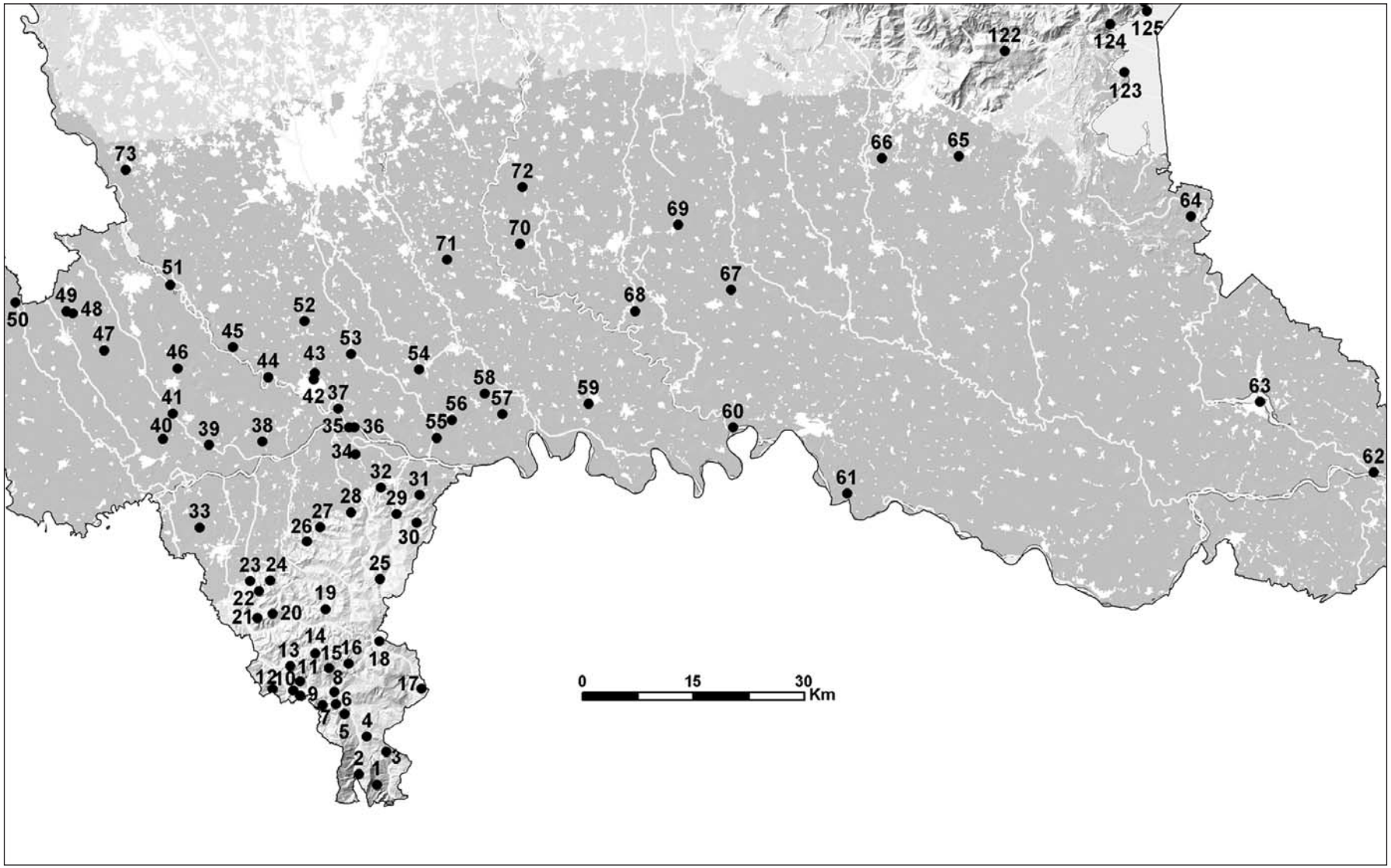


Fig. 6 - Index maps of Lombard geomorphosites: a- northern Lombardy; b- southern Lombardy.
Carta indice dei geomorfositi lombardi. a- Lombardia settentrionale; b –. Lombardia meridionale.

TAB. A - LIST OF THE MOST REPRESENTATIVE GEOMORPHOSITES IN LOMBARDY

Key: DE - Didactic example; EV - Ecological value; ME - Model of evolution; NR - Natural rarity; PE - Paleoenvironmental evidence

COD	NOME GEOSITO APPENNINO SETTENTRIONALE	NAME NORTHERN APENNINE	PROV	MOTIV	NOTES
1	Scarpata di faglia di Corbesassi	Fault scarp of Corbesassi	PV	DE, ME	Impressive interruption of the slope (owed to the fault in object) with evident superficial lacerations and flowing from the dominating 'Calcari di M. Antola'.
2	Terrazzo orografico di Cencerate	Bedrock terrace of Cencerate	PV	DE	Carved in the 'Calcari di M.te Antola', here lies the village of Cencerate; it is delimited by a steep scarp about 100m high, leading to the 'Fosso della Biva'.
3	Monadnoks di Pregola	Monadnoks of Pregola	PV	DE	Rolling hill coinciding with an ophiolitic mass included in the softer clays called 'Argille a palombini di Barberino'.
4	Rilievo morfoselettivo di S. Margherita Staffora	Morphoselective relief of S. Margherita Staffora	PV	DE	The relief of S. Margherita Staffora is carved into ophiolitic rocks included in softer clays called 'Argille a palombini'.
5	Forme di tipo calanchivo di Bosmenso	Badland shapes of Bosmenso	PV	DE	These formations, very similar to badlands, lie in the marly and marly -clay soil, they infer a wild look to the slopes and contrast the growth of plants.
6	Forme di tipo calanchivo di Monteforte	Badland shapes of Monteforte	PV	DE	Formations owed to the quick erosion of the marly-clay slopes (Marne di Rigoroso), very similar to ravins. Erosion causes the abruptness of the landscape and prevents the plants from growing.
7	Forme di tipo calanchivo di Fontana di Nivione	Badland shapes of Fontana di Nivione	PV	DE	Greyish steep slopes moulded in the 'Marne di Rigoroso'. There are narrow little valleys and top laminated interfluves.
8	Deviazione fluviale del T. Staffora (Varzi)	T. Staffora deviation (Varzi)	PV	ME	Deviation elbow, near Varzi, connected to the presence of an important tectonic line (Villalvernia-Varzi line).
9	Faccette trapezoidali presso Varzi	Trapezoidal facets by Varzi	PV	DE	Trapezoidal wide surfaces along the left slope of the Valle Staffora. Its origin is structural (formations coincident with faults plain).
10	Deviazione fluviale del T. Staffora (Bagnaria)	T. Staffora deviation (Bagnaria)	PV	ME	Deviation elbow, near Bagnaria, connected to the presence of the tectonic line of the Staffora.
11	Calanchi di Varzi	Badlands by Varzi	PV	DE	Typical close valley system and laminoid ridges, in constant development, owed to the intense washing away waters removing the clay parts of the bedrock ('Complesso Caotico'), disgregating it by persistent dryness.
12	Grotta di San Ponzo	San Ponzo cave	PV	DE	Located between the 'Marne di Antognola' and the 'Arenarie del Monte Vallassa' caused by quite heavy dissolution.
13	Superficie sommitale di Pizzocorno	Top surface of Pizzocorno	PV	ME	Subplain forms often coinciding with the strata surfaces of the Arenarie of Mt. Vallassa. Mainly delimited by lateral incisions forming small valleys exposed radially to the rectangular sandstone rock.
14	Paleofrana di Poggioferrato	Poggioferrato palaeolandslide	PV	DE	Representative example of lateral spreads landslide; it is witnessed also by the presence of big sandstone blocks fallen down from the 'Placca di Pizzocorno – Pietragavina' conveyed by the movement of the extrusion clays underneath and rolled downhill for the pressure made by the formation above.
15	Rilievo morfoselettivo di Oramala	Morphoselective relief of Oramala	PV	DE	Stronghold on the relief moulded on the 'Arenarie of Mt. Vallassa', surrounded by the soft 'Marne of Mt. Lumello'.
16	Valle in formazione del Rio Mola	Developing valley of Rio Mola	PV	DE	Valley head characterized by a steep and marked slope dynamic and an intense rill erosion.
17	Rilievo morfoselettivo di Pietra Corva	Morphoselective relief of Pietra Corva	PV	DE, EV	Major ophiolitic outcrop of the Oltrepo Pavese with arsh formatios and steep slopes. Its characteristic lithology makes it particularly resistent to the weather erosion compared with the basic complexes covering it.
18	Forme di tipo calanchivo di Zavattarello	Badland shapes of Zavattarello	PV	DE	Badlands located in the 'Marne di Monte Piano' along the right bank of the Rio Marchese.
19	Rilievo morfoselettivo di Fortunago	Morphoselective relief of Fortunago	PV	DE	The village of Fortunago is settled on the more resistant 'Arenarie di Serravalle', dominating over the near 'Mare di Monte Piano'. The church of Fortunago lies at the top.
20	Orrido di Rocca Susella	Rocca Susella gorge	PV	DE	Vertical crags carved in the 'Conglomerati di Cassano Spinola'

Segue TAB. A - LIST OF THE MOST REPRESENTATIVE GEOMORPHOSITES IN LOMBARDY

Key: DE - Didactic example; EV - Ecological value; ME - Model of evolution; NR - Natural rarity; PE - Paleoenvironmental evidence

21	Rilievo morfoselettivo di Gomo	Morphoselective relief of Gomo	PV	DE, ME	Relief connected to the presence of the more resistant 'Conglomerati di Cassano Spinola' and to the less resistant 'Marne di M. Lumello'. It is particularly important because it is coincident with a perched syncline.
22	Forme di erosione e dissoluzione di Mondondone	Erosion and dissolution shapes of Mondondone	PV	DE	The steep wall overlooking on the T. Luria clearly shows the tracks of washing away waters, the disgregation gypsum and decayed limestone of the 'Formazione gessoso-solfifera'.
23	Orrido del T. Luria	Luria stream gorge	PV	DE	Deep cut of the T. Luria in the 'Conglomerati di Cassano Spinola'. It reaches the underneath 'formazione gessoso-solfifera' which gives sulphur characteristics to the spring waters on the river-bed.
24	Orrido di S. Antonino	S. Antonino gorge	PV	DE	Impressive vertical walls carved into the 'Arenarie di M. Vallassa'; at their foot there is a detritus layer which conveys them to the torrential valleyfloor.
25	Frana di Colombato (Montecalvo)	Colombato landslide (Montecalvo)	PV	DE	Typical, didactic example of mud flow.
26	Grotta di Camarà (Casteggio)	Camarà cave	PV	DE	Cave at the bottom of an enclosed basin, open in Messinian gipsy rocks and formerly crossed by a little stream whose entrances are now obstructed.
27	Rilievo morfoselettivo di Torricella Verzate	Morphoselective relief of Torricella Verzate	PV	DE	Moulded in the 'Arenarie di M. Arzolo'; a sanctuary was built on the top of this relief.
28	Faccette triangolari di Broni-Redavalle	Triangular facets of Broni – Redavalle	PV	DE	Triangular shaped four hill spurs at the foot of the Apennines slope overlooking the plain. They are connected to tectonics.
29	Paleofrana di Montù	Montù palaeolandslide	PV	DE	In the lower Valle Versa, on the right bank of the river, this palaeolandslide (originally a slide), presents an impressive edge of the slide that, very rare in the valley, holds a very strong acclivity because it is carved in the rather resistant 'Formazione di Montù Beccaria' (sandstones).
30	Crinale arcuato di San Damiano	San Damiano arched ridge	PV	DE	Impressive winding top surface surrounding the watershed of a small stream, left affluent of the T. Marsinola. The development of the San Damiano, Buffalora and Villa Marone areas underlines this shape.
31	Morfosculture di Sparano	Morfosculpture of Sparano	PV	NR	Hills moulded in clay successions, quite articulated in short spaces.
	PIANURA PADANA	**PO PLAIN**			
32	Rilievo morfoselettivo di Poggio Mozzecane	Morphoselective relief of Poggio Mozzecane	PV	DE	Carved in the 'Arenarie di M. Arzolo' . Here lies a stronghold (Rocca Ticozzi).
33	Fontanile di Cascina del Conte	Cascina del Conte spring	PV	DE	Emergence ground water table owed to a permeability decrease in a certain point of the depressed country.
34	Bodrio di Albaredo	'Bodrio' of Albaredo	PV	DE	Hollow characterised by slightly brackish waters; it is originated by the evorsion of the Po river (it is similar to the 'bodrio delle Gerre Ugolani').
35	Penisola di confluenza Ticino-Po	Confluence wedge of Ticino-Po rivers	PV	DE	Tipical confluence wedge, here it's crossed by the Becca Bridge. It has prolonged of about 1 km over the last 100 years.
36	Isole fluviali del Po	Po river fluvial islands	PV	DE	Many fluvial islands arise all along the Po river, mainly sedimental. Being hold in a fast development system, they are touched by very quick changes.
37	Confluenza Vernavola-Ticino	Vernavola-Ticino confluence	PV	DE, PE	The confluence is coincident with the end of an oxbow lake of the Ticino river crossed by the Roggia Vernavola.
38	Peduncolo di Sommo	Peduncle of Sommo	PV	DE, PE	The cut of the main surface of the plain by the Po river, the heavy lateral erosion and an evident meandering have originated a sort of peduncle composed of a small lobe connected by a very thin neck to the surface of the plain.
39	Terrazzi divergenti del T. Terdoppio	Divergent terraces of T. Terdoppio	PV	DE	Just like the Olona, the valley of the T. Terdoppio is characterised by terraces whose slopes fade away downhill.
40	Dosso di Scaldasole	Scaldasole ridge	PV	PE, EV	Local relief (3-4 m high) of the old level of the plain rising from the 'main surface of the plain' (these relieves often present a thin layer of decayed loess).

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41	Meandri del T. Terdoppio	T. Terdoppio meanders	PV	DE	Well defined meanders, showing different evolution phases particularly interesting thanks to their small size.
42	Terrazzi alluvionali divergenti del T. Vernavola	Divergent alluvial terraces of Vernavola stream	PV	DE	Slopes carved by the stream Vernavola. The more downhill the higher they are. Originate by a hollow of the Ticino River.
43	Meandri della Vernavola	Vernavola meanders	PV	DE	Meanders at different phases of evolution in the Vernavola Park.
44	Cuspide di terrazzo di S. Sofia	Terrace cusp of S. Sofia	PV	DE	Typical example of fusion of two scarps: the low terrace, by Cascina Santa Sofia, was completely eroded by the shifting of the Ticino river, related to a wide meandric bight.
45	Lanca del Boscaccio	Boscaccio ox-bow lake	PV	DE, EV	The occurred cut of the meander is witnessed here by the presence of a a big and articulated lake and by a shortening of the river course which caused a remarkable current increase.
46	Dosso fluviale di Madonna delle Bozzole	Fluvial ridge of Madonna delle Bozzole	PV	DE	One of the plain rise of Lomellina (Scaldasole, Remondò etc.); here a sanctuary was built.
47	Dosso di Remondò	Remondò ridge	PV	PE	Local rise (3-4 m high) of the old level of the plain emerging from the 'main level of the plain' (these relieves often present a thin layer of decayed loess). Now forbidden to visitors.
48	Dosso di Parona	Parona ridge	PV	PE	Little rise plain, similar the ones of Scaldasole, Remondò etc, which represents a top of the old plain surface then covered with deposits from the 'main surface of the plain'.
49	Fontanile di Parona	Parona spring	PV	NR	It is one of the few springs which can be found today in the mid plain in the Pavia area.
50	Lanca dell'Agogna Morta	Agogna Morta ox-bow lake	PV	DE, EV	Ox-bow lake after human attempt to straighten river-bed (between Nicorvo and Borgolavezzaro).
51	Alveo pluricursale del Ticino	Multi-channel river-bed of Ticino	PV	DE	Didactic example of braided channels age-old river-bed showing a depositing action of the water course (Vigevano area).
52	Meandri di Roggia Barona	Roggia Barona meanders	PV	PE	Small actual meanders inside big palaeomeanders (belonging to a palaeo-Ticino?).
53	Terrazzi alluvionali divergenti del F. Olona	Divergent alluvial terraces of Olona river	PV	DE	Over a few km scarp fades away downhill characterising the divergent flood terraces originated by the recessive erosion happened after the lowering of the base level of the Po.
54	Deviazione del F. Lambro Meridionale	Diversion of Lambro meridionale river	PV	DE,ME	Near Villanterio, in the open plain, the almost 90° deviation of the river, is connected to the recent tectonic raising action of the San Colombano Hill and, in last analysis, to the marginal thrusts by the buried front of Pavia Apennine.
55	Penisola di Costa dei Nobili	Costa dei Nobili peninsula	PV	DE, PE	Thin strip of the 'main surface of the plain', similar to the 'Penisola di S. Cristina'; it is delimited westward by the cut of the Olona river.
56	Penisola di S. Cristina	S. Cristina peninsula	PV	DE, PE	From 500 to 800 m wide, it spreads over the lower post-giacial plain to the Po over 3 km. Its origin is similar to those of the 'Peduncolo di Sommo'.
57	Rilievo isolato di Chignolo Po	Chignolo Po isolated relief	PV	PE	Lonely strip of the 'main surface of the plain'; its isolation is due to carving by the Po and by a river corresponding to the old Lambro Meridionale, before its divertion northwards.
58	Rilievo isolato del Colle di San Colombano	Colle di San Colombano isolated relief	MI	DE	Rising relief (in open plain, north of the Po) of the Apennine Chain, coincident with the Pavia compression front.
59	Rilievo isolato Casalpusterlengo	Casalpusterlengo isolated relief	LO	DE	Lonely relief moulded in the old level of the plain, standing isolated because of the water erosion occurred in the cataglacial stage before the 'main surface of the plain'. It's similar to the one in Romanengo.
60	Confluenza del F. Adda nel F. Po	Adda river confluence in Po river	LO	DE	The Adda waters keep active the mander of the Po by Isola Serafine. Just up the confluence one made a meander cut and a dam to exploit the fast fluvial currents to produce electric energy.
61	Bodrio delle Gerre Ugolani (Stagno Lombardo)	'Bodrio' of Gerre Ugolani (Stagno Lombardo)	CR	DE	Hollow filled with water owed to the evorsion made by diverted waters after breaks or siphoning. The edges are spreaded all along the Po, mainly out of the main bank (their maximum concentration is in the Cremona area).

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62	Confluenza del F. Mincio nel F. Po	Mincio river confluence in Po river	MN	DE	Though similar to the confluence Po-Ticino, the tendency to increasing of the fluvial peninsula is less evident.
63	Laghi di Mantova	Lakes of Mantua	MN	DE	These lakes are originated by a natural tendency to fluvial digression of the Mincio River whose waters, near Mantua, have been artificially controlled by hydraulics engineering works made at the end of XII century.
64	Collina morenica di Monzambano	Monzambano morainic hill	MN	DE	Hill carved on an ancient terminal moraine of the Garda; here is a Medieval Castle.
65	Rilievo isolato di Castenedolo	Castenedolo isolated relief	BS	DE	Lonely hill of the plain, genetically similar to the Monte Netto di Capriano; it differentiates from it because supported by a clay-sandy fossiliferous substratum.
66	Rilievo isolato di Monte Netto di Capriano	Monte Netto di Capriano isolated relief	BS	DE	Isolated strip of the old plain (rising from 12 to 32 m on the main surface of the plain) moulded in glacio-fluvial grounds dating back to the oldest quaternary glaciations and to loess covered areas.
67	Valle dei Navigli	Valle dei Navigli	CR	PE	Great Late-Pleistocenic palaeo river-bed on the main surface of the plain.
68	Alvei abbandonati del F. Serio	Abandoned river-bedss of Serio	CR	PE	Important palaeogeographic of the progressive shifting westwards of the river Serio, from the Upper-Pleistocene till today , with the abandon of deep river-beds eroded in the main surface of the plain. Such deviations could have been caused by the recent movement of buried forms, together with local over floods owed to climatic changes.
69	Rilievo isolato di Romanengo	Romanengo isolated relief	PV	DE, PE	It is a remain of the main surface of the plain, isolated during the cataglacial stage occurred before the deposition of the main level of the plain, over which it rises of about 13 m. A very interesting aspect is the loess covering the terrace surface.
70	Fontanile di Dovéra	Dovéra spring	CR	NR	Water rising in open plain owed to the rising of the ground water table caused by the decreasing texture of sediments, it reaches the topographic surface without effort. The spring gives birth to a small water course that erodes the surface of the plain.
71	Meandri del Cavo Sillaro	Cavo Sillaro meanders	LO	PE	The Cavo Sillaro covers big meanders witnessing the presence of an old much bigger water course.
72	Fontanile di Pandino	Pandino spring	CR	NR	Water table rising in open plain. Similar to the Dovéra spring, it has four heads.
73	Terrazzi del F. Ticino	Ticino river terraces	MI	DE	Very well defined scarps dividing the main surface of the plain from the post-glacial flood terraces. These scarps decrease in height going downhill (Morimondo-Pavia): convergent terraces.
74	Orrido di Paderno d'Adda	Paderno d'Adda gorge	LC	DE	Impressive deep cut of the Adda river (around 100 m) in lake silty-clays, the 'Ceppo dell'Adda', gravel with 'ferretto', loess gravel, and glaciofluvial würmian gravels.
75	Orrido di Inverigo	Inverigo gorge	CO	DE	Moulded by the Lambro River in the 'Ceppo' of Brianza.
76	Lago di Montorfano (Brianza)	Montorfano Lake (Brianza)	CO	DE	Intermorainic depression filled by a small lake (394 m), between the Montorfano hill (554 m) and the Croce Mount (524 m).
	ALPI	**ALPS**			
77	Roccia montonata di Angera (Lago Maggiore)	Roche moutonnée by Angera (Lake Maggiore)	VA	DE	It wides from Ranco to Angera; it is moulded in the Varese porphiry and its southern edge (where is the homonymous Castle) in 'Dolomia principale'.
78	Masso erratico 'Sasso Cavallaccio' (Lago Maggiore)	'Sasso Cavallaccio' erratic boulder (Lake Maggiore)	VA	DE	Table shaped erratic rock composed by schistose gneiss from the upper basin of the Ticino river.
79	Lago di Biandronno	Lake Biandronno	VA	PE	Lake depression, at 239 m of altitude, moulded in limestone-marleys lithotypes of Upper Cretaceou-sand partially delimited by morainic deposits. Probably connected to the near Lake of Varese (230 m) when its level was higher than at present.
80	Masso erratico 'Pietra Pendula'	'Pietra Pendula' erratic boulder	CO	DE	Erratic block made of 'ghiandone' granite originating from Val Masino, situated at 650 m of altitude on the east shore of the western branch of the Lake of Como and lying on a limestone basement.

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81	Lago Segrino	Lake Segrino	CO	DE	Small and narrow lake, it has only one emissary, it is fed through resurgences along the lake shore and under them, visible thanks to the pullulation they produce.
82	Cattura del F. Lambro	Lambro river capture	CO	DE, ME	The capture should have been caused by the regressive erosion made by a tributary of T. Bistona and could have caused the abandon of the course through the Lake of Segrino and the emptying of the hollow of Canzo.
83	Masso erratico 'Sass Nègher'	'Sass Nègher' erratic boulder	LC	DE	A serpentinite erratic block placed on a calcareous rock nearby the village of San Martino in Valmadrera.
84	Corni di Canzo (Triangolo lariano)	Corni di Canzo (Como-Lecco area)	CO	DE	Rocky towers shaped by the morpho-structural erosion on the upper Trias 'Dolomia a Conchodon' culminating at 1371 m of altitude and dominating the north west side of the Valmadrera.
85	Masso erratico 'Sasso di Preguda' (L. di Lecco-M. Moregallo)	'Sasso di Preguda' erratic boulder (Lake Lecco-M. Moregallo)	LC	DE	A 'ghiandone' granite erratic block coming from the Val Masino, well-known for a short poem by the Abbé Stoppani.
86	Masso erratico di Lasnigo (Conche di Crezzo)	Lasnigo erratic boulder (Conche di Crezzo)	LC	DE	Very big remain of a serpentinite erratic block divided by a joint in which a birch has grown.
87	Paesaggio carsico del Piano del Tivano (Triangolo lariano)	Karst morphology in Piano del Tivano (Como-Lecco area)	CO	DE	Enclosed karst basin at about 975 m of altitude, dominated by the Monte San Primo (1686 m), Monte Cippei (1236 m) and Monte Croce (1351 m). In this basin open some caves as the Bus della Colma Squarada and the Buco della Niccolina, the main swallow hole.
88	Grotta di Lasnigo	Lasnigo cave	CO	DE	It is the so called 'grotta del Budrac', set along the right side of the Lambro valley, by a fault surface. The udergrund water solution activity progressively enlarged this fissure which became a 'cave'.
89	Conoide lacuale di Mandello	Mandello alluvial fan shoreline	CO	DE	The typical convex form of this alluvial cone of the T. Meria gradually becomes a small flat lacustrine delta by its mouth (Lake Como).
90	Masso erratico 'Pietra Luna'	'Pietra Luna' erratic boulder	CO	DE	A granitic-gneiss erratic block coming from the upper Valtellina and placed at 950 m of altitude on the small plateau called Piano Rancio.
91	Circo di Moncodeno (Grigne)	Glacial cirque of Moncodeno (Grigne)	LC	DE	Glacial cirque with many karst landforms, both subaerial (dolines, karren, bogaz, etc.) and underground (shafts and galleries), together with glacial landforms and depositions (roches moutonnées surfaces, erratic blocks, moraines).
92	Arco naturale 'Porta di Prada' (Grigne)	'Porta di Prada' natural arch Grigne)	LC	DE	Natural arch, 15 m high and 8 m large, open on a calcareous rock (the 'Calcare di Esino') at the head of the Prada valley at 1700 m of altitude.
93	Risorgenza del T. Fiumelatte (Lago di Como)	Rising of T. Fiumelatte (Lake Como)	LC	NR	Short stream (active between March and November) coming from a karst emergence (the Grotta di Fiumelatte, with the entrance at 325 m of altitude in the Ladinic unit of the 'Calcare di Perledo-Varenna') and flowing into the lake of Como (199 m on sea level).
94	Orrido di Bellano (Lago di Como)	Bellano gorge (Lake Como)	LC	DE	Deep and narrow gorge carved by the stream Pioverna (Valsassina) in the metamorphic rocks of the del Orobic basement with formatiom of typical pot-holes ('marmitte').
95	Orrido di Carlazzo	Carlazzo gorge	CO	DE	Very deep (about 50-60 m) and narrow gorge carved in calcareous-dolomitic rocks.
96	Conoidi di Colico	Colico alluvial fans	CO	DE	These are two typical juxtaposed alluvial cones joining to the shore of the lake of Como the small moutonnées reliefes of Montecchio nord and Montecchio sud, at the outlet of Valtellina.
97	Orrido del F. Brembo	Brembo river gorge	BG	DE	By the Ponti di Sedrina, the valley shows subvertical rockwalls shaped on the Triassic and Lower Jurassic calcareous-dolomitic rocks.
98	Grotta delle meraviglie	Grotta delle meraviglie - 'wondercave'	BG	DE	The only example of a great cave, carved in limestones and well equiped for tourist visits.
99	Orrido di Bracca	Bracca gorge	BG	DE	Short stretch (less than one km) of the stream Ambria valley carved in Triassic limestones with a resulting of a very deep gorge.

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100	Pinnacoli di S. Pellegrino	S. Pellegrino pinnacles	BG	DE	Very spectacular rocky pinnacles resulting from erosion and solution of limestones and dolomitic limestones belonging to the 'Dolomia principale'.
101	Paesaggio carsico di Dossena	Karst morphology in Dossena	BG	DE	Karst landforms and caves (dolines, swallow-holes, microkarren, etc.) originated by the solution of evaporitic layers of the 'Formazione di San Giovanni Bianco', mainly near the village of Paglio.
102	Orrido del T. Enna (Alta Val Taleggio)	T. Enna gorge (upper Val Taleggio)	BG	DE	Typical gorge with rock-walls high till 50-70 m, carved by the stream Enna.
103	Paesaggio carsico del Piano di M. Cancervo	Karst morphology in Piano of Mt. Cancervo	BG	DE	Karst landscape with dolines, swallow-holes, karren, etc. as the deep 'buca della neve' (a hole filled by snow) in which the snow keep also all the year in spite of the moderate altitude.
104	Masso erratico 'Còrna dèl Màsa'	'Còrna dèl Màsa' erratic boulder	BG	DE	Erratic block (15-20 m_) made of the Middle Permian 'verrucano lombardo' (a reddish formation with conglomerates, sandstones, siltsones, etc.) placed on the Triassic limestones 100 m upon the bed of the Brembo stream. Nearby there are also some morainic remains of the last glaciation.
105	Orrido della Val Parina	Val Parina gorge	BG	DE	A deep and narrow (2-4 m) gorge with very high roch-walls carved in Ladinic limestones. Nearby there are also some small caves open in quaternary sediments.
106	Torrione di Oltre il Colle	Oltre il Colle pinnacle	BG	DE	A very strange pinnacle, with a bottle shape and 30 m high, moulded on the Norian dolomite. It is utilized as climbing exercise.
107	Paesaggio carsico ipogeo del Piano di Capovalle di Roncobello	Underground karst morphology in Piano of Capovalle di Roncobello	BG	DE	A very important underground karst area in the upper est side of the Val Brembana with the great cave system of the Cornabuca carved in quaternary cemented sediments.
108	Paesaggio carsico dei Piani di Artavaggio (Valsassina)	Karst morphology in Piani of Artavaggio (Valsassina)	LC	DE	Typical flat or undulating surfaces moulded on Triassic dolomitic rocks with a morainic cover and noteworthy karst landforms as dolines, swallow-holes and characteristic micro-karren.
109	Paesaggio carsico dei Piani di Bobbio (Valsassina)	Karst morphology in Piani of Bobbio (Valsassina)	LC	DE	Other typical karst area moulded on Triassic dolomitic rocks, with morainic remains and many subaerial karst and glacial landforms.
110	Torrione della Sfinge (Ornica-Val d'Inferno)	Tower of Sphinx (Ornica-Val d'Inferno)	BG	DE	A very strange tower, 70-80 m high and carved on a Palaeozoic conglomerate, fractured in great blocks and so having a singular aspect as the shape of an ancient Egyptian sphinx, mainly if seen from the upper Valle dell'Inferno.
111	Conche glaciali M. Avaro	Mt. Avaro glacial hollows	BG	DE	Wide and well carved glacial depressions, sometimes filled by small lakes, with roches moutonnées and moraines.
112	Paleosuperficie di Piazzatorre	Piazzatorre palaeosurface	BG	DE	Wide terrace characterized by the mild forms of morainic and glaciofluvial deposits.
113	Arco naturale della Val Pegherolo	Val Pegherolo natural arch	BG	DE, NR	Calcareous tower, 30 m high, with a window, perhaps due to the karst erosion.
114	Forme glaciali di M. Cabianca	Mt. Cabianca glacial landforms	BG	DE	Glacial landforms mainly constituted by cirques with small lakes, thick debris slope and remains of morainic deposits.
115	Hogbaks Razor back del L. d'Iseo	Hogbaks Razor back of Lake Iseo	BG	DE	Erosive landforms due to the particular bedding of the relative rocks.
116	Morena laterale del sistema camuno	Lateral moraine of the Camuno system	BS	PE	Morainic remain on the east side of the Iseo lake, northerly of village of Sale Marasino, showing the highest level reached by the glacier descending along the Val Camònica during its maximum expansion.
117	Piramidi di terra di Zone (Cislano, lago d'Iseo)	Earth pyramids of Zone (Cislano, Lake Iseo)	BS	NR, DE	Typical landforms carved in a Rissian till deposited by a lateral tongue of the great glacier descending along the Val Camònica.
118	Orrido 'Bogn' di Zorzino (Lago d'Iseo)	'Bogn' (gorge) of Zorzino (Lake Iseo)	BG	DE	A rocky spur of the 'Calcare [limestone] di Zu' formation whose vertical layers show a discordant contact with the adiacent 'Norian Dolomite of the Monte Clemo-San Defentente'.
119	Paesaggio carsico dell'Altopiano di Bossico	Karst morphology in Bossico upland	BG	DE	Prealps plateau moulded in Norian Dolomite and characterized by karst (dolines, uvalas, caves, karren, etc.) and glacial (moraines and erratc blocks) landforms.

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120	Orrido del T. Dezzo (Val Camonica)	T. Dezzo gorge (Val Camonica)	BS	DE	A very deep gorge cutting theTriassic calcareous-dolomitic formations in the lower course of the stream Dezzo, with many source on the fissured calcareous rock-walls. In this valley passes the ancient road 'Via Mala'.
121	Paesaggio carsico della Presolana: 'Mare in burrasca'	Karst morphology in Presolana: 'Mare in burrasca'	BG	DE	Very characteristic karst area (with dolines, karren, etc.) moulded on the Triassic calcareous Gorno formation out cropping on the northeastern side of the Monte Ferrante in the Presolana massif.
122	Paesaggio carsico dell'Altopiano di Cariadeghe	Karst morphology in Cariadeghe upland	BS	DE	Wide karst area moulded in the 'Calcari [limestones] di Zu' and in the 'Corna' formations, with many dolines, swallow-holes and karren.
123	Solchi di battente relitti del L. di Garda	Relictic wave-cut notch of Lake Garda	BS	PE	Morphological and sedimentological traces on the west coast of Garda lake, referring to Upper Pleistocene and Holocene lacustrine levels.
124	Orrido di Barbarano	Barbarano gorge	BS	DE	A small gorge with steep rock-walls, carved in the Mesozoic 'Scaglia Rossa' [red chip] formation, near the western coast of the Garda lake.
125	Conoide lacuale di Maderno	Alluvial fan shortline of Maderno	BS	DE	Alluvial cone changing the west coast profile of the Garda lake by the mouth of the stream Rio Toscolano.
126	Orrido di Toscolano Maderno	Toscolano Maderno gorge	BS	DE	Deep gorge carved by the stream Rio Toscolano in the Mesozoic 'Scaglia Rossa' [red chip] formation, showing on the steep rock-walls noteworthy folded structures.
127	Orrido del T. S. Michele	T. S. Michele gorge	BS	DE	Karst canyon, on the western coast of Garda lake, with a spectacular entrance road from which it is possible to see the 'flatirons' of the Monte Baldo (on the eastern coast of the same lake).
128	Orrido di Tremosine	Tremosine gorge	BS	DE	Deep gorge, 200 m long, known als as the 'Orrido' [gorge] of the stream Brasa.
129	Morena di Vesio	Vesio moraine	BS	PE	Short strip of a terminal moraine relative to a lateral lobe of the great Würmian Garda glacier flowing into the Tremosine valley up to the village of Vesio.
130	Lago relitto di Bondo (Lago di Garda)	Relictic Bondo Lake (Lake Garda)	BS	PE	Small lacustrine depression, filled by water until the first half of the XX century and today reclaimed. The lake was originated by a morainic barrage of a valley tributary of the Garde lake.
131	Masso erratico 'Sant'Antonio' (Lago d'Idro)	'Sant'Antonio' erratic boulder (Lake Idro)	BS	DE	Erratic block made of Permian sandstone and placed along the western coast of the Idro lake (Val Sabbia).
132	Masso erratico di Ponte Caffaro	Ponte Caffaro erratic boulder	BS	DE	Erratic block carved on the Permian 'Verrucano' calcareous conglomerates, near the village of Ponte Càffaro in the upper Val Sabbia.
133	Paesaggio carsico del Lago Nero di Cadino	Karst morphology in Nero Lake of Cadino	BS	DE	Area with many karst landforms (ex Lake Vacca-2357 m).
134	Rocce montonate della Val Camonica (Capodiponte) UNESCO	Roches moutonnées of Val Camonica (Capodiponte) UNESCO	BS	PE	Typical glacial landforms (moutonée rocks) belonging to the great Pleistocene glacier flowing along the Val Vamònica and which, mainly near the village of Capo di Ponte, in the 'Parco Nazionale delle incisioni rupestri', show characteristic rock graffiti ('incisioni rupestri') made during the Bronze Age.
135	Conoide di Cedegolo	Cedegolo alluvial fan	BS		Alluvial cone in the Val Camònica typically shaped as a fan.
136	Valle glaciale sospesa (Val Miller)	Glacial hanging valley: Val Miller	BS	DE	Hanging glacial through on the western side of the Adamello massif.
137	Rock glacier inattivo della Valle dell'Avio (Adamello)	Inactive rock glacier of Valle dell'Avio (Adamello)	BS	PE	Typical rock-glacier in a periglacial environment and no more active, probably because of its altitude and morphology.
138	Valle glaciale a gradini (Alta Valle dell'Avio)	Stepped glacial valley: upper Valle dell'Avio	BS	DE, PE	Typical glacial stairway, on the northern side of the Adamello massif, with many rocky steps alternating with glacially escavated rock basins often infilled with lakes.
139	Ghiacciaio 'La Calotta'	'La Calotta' glacier	BS	DE	Typical small-sized ice cover [in italialian: 'ghiacciaio di calotta'] on the Adamello massif.
140	Morene della Piccola Età Glaciale (Pisgana)	Little Ice Age moraines (Pisgana)	BS	PE, DE	Steep lateral moraines of the Pisgana glacier (northern side of the Adamello massif) marking the level reached during its maximum expansion at the half of the XIX century (Little Ice Age).

Segue TAB. A - LIST OF THE MOST REPRESENTATIVE GEOMORPHOSITES IN LOMBARDY

Key: DE - Didactic example; EV - Ecological value; ME - Model of evolution; NR - Natural rarity; PE - Paleoenvironmental evidence

141	Morene stadiali di Temù	Moraines stadial of Temù	BS	PE	Terminal but stadial moraines, placed by the village of Temù in the upper Val Camònica, marking the maximum expansion reached, during the Upper Pleistocene, by the glacier flowing along the Avio valley, on the northern side of the Adamello massif.
142	Conoide del T.Torchione	T. Torchione alluvial fan	SO	DE	Alluvial cone, spectacularly fan-shaped, on the south side of the Valtellina.
143	Frana di Piuro (Val Bregaglia)	Piuro landslide (Val Bregaglia)	SO	DE	Historic landslide due to a great rock fall that completely destroyed the village of Piuro, upstream of Chiavenna (Bregaglia valley), the Sept. 4th 1618.
144	Marmitte dei Giganti (Chiavenna)	Chiavenna potholes	SO	DE	Great pot-holes or shafts [named also 'glacier mills'] resulting by the glaciofluvial evorsion on the ophiolitic rock outcropping on the southern side of the Bregaglia valley, upstream of Chiavenna.
145	Arco naturale 'Passo Forato' (Val San Giacomo)	'Passo Forato' natural arch (Val San Giacomo)	SO	DE	Great natural arch (8 m high and 5 m large), locally known as 'Porton del Pombi', carved in the metamorphic rocks (gneiss and micaschists) and placed on the watershed between the Italian Spluga Valley and the Swiss Mesolcina Valley.
146	Ghiacciaio del Ventina (Sentiero glaciologico 'Vittorio Sella')	Ventina glacier (Glaceologic track 'Vittorio Sella')	SO	DE	Valley glacier in the upper west branch of Val Malenco, northward of Sondrio. The glacier can be reached by the well-known 'glaciological path [in italian: sentiero] Vittorio Sella', along which it is possible to estimate its areal and volumetric changes by the observation of the morainic deposits.
147	Ghiacciaio del Fellaria (Sentiero glaciologico 'Luigi Marson')	Fellaria glacier (Glaceologic track 'Luigi Marson')	SO	DE	Valley glacier in the upper east branch of Val Malenco (constituted by two separate basins), that can be reached by a special path ('Sentiero glaciologico Luigi Marson') along which it is possible to estimate its areal and volumetric changes by the observation of the morainic deposits.
148	Frana della Val Pola	Val Pola landslide	SO	DE	Spectacular and destructive landslide due to the rock fall in the northern side of the Upper Valtellina, happened in the July 1987, which made a barrage accross the Adda valley with the formation of a temporary lake. Its volume was estimated in nearly 40 million of cubic metres.
149	Sachung di Santa Caterina Valfurva	Santa Caterina Valfurva sachung	SO	DE, NR	Typical structures composed of long and deep trenches, placed along the valley sides and showing the presence of Olocenic deep-seated gravitational slope deformations.
150	Ghiacciaio dei Forni	Forni glacier	SO	DE	Typical valley glacier originated by the confluence of three separate basins, with an area of nearly 13 square km. So it is the greatest Italian valley glacier.
151	Lago di Rosole (Ghiacciaio dei Forni)	Rosole Lake (Forni glacier)	SO	DE, PE	Typical glacial lake placed between the right lateral moraine of the Forni glacier (Mount Cevedale massif) and its side.
152	Blocchi lavoratori (Alta Valtellina)	Working blocks (upper Valtellina)	SO	NR	Rock blocks, in the Upper Valtellina, flowing along the slope because of gelifluction or cryoturbation.
153	Rock glacier attivo della Val Pisella	Active rock glacier of Val Pisella	SO	DE, PE	Typical rock glacier in the periglacial environment of the Val Pisella, with probably ice into its interior, placed on the northern side of the upper Forni valley (Ortles-Cevedale massif).
154	Orrido della Valle di Fraele (Alta Valtellina)	Valle di Fraele gorge (upper Valtellina)	SO	DE	Very deep gorge carved by the river Adda in the Norian Dolomite, northward of Bormio (Upper Valtellina).
155	Paesaggio carsico dei Piani di Pedenolo (Valle del Braulio)	Karst morphology in Piani of Pedenolo (Valle del Braulio)	SO	DE	Flat or undulated surfaces, at nearly 2600 m of altitude, moulded on the Umbrail nappe metamorphic rocks and the Carnian Dolomites (with some evaporitic outcrops) belonging to the 'Punta di Rims' formation, placed between the Forcola and Braulio valleys. Karst (dolines) and periglacial (polygons and stripes) landforms are also present.

TAB. B - OTHER LOMBARD SITES

Key: a - geomorfosites identified but less significant; b: geomorfosites deduced from literature

NOME	NAME	PROV	a	b
Altopiano di Monte Castello	Monte Castello upperland	BS		X
Altopiano di Tremòsine	Tremòsine upperland	BS		X
Anfiteatro morenico del Lago d' Iseo	Morainic amphitheatre of Iseo Lake	BS		X
Anfiteatro morenico del Lago di Garda	Morainic amphitheatre of Garda Lake	BS		X
Arco carsico Valle dell'Arco	Valle dell'Arco karst arch	BG		X
Arco naturale 'Le Porte'	'Le Porte' natural arch	LC	X	
Bodrio della Ca' dei Gatti	'Bodrio' of Ca' dei Gatti	CR		X
Bodrio della Cascina S. Margherita	'Bodrio' of Cascina S. Margherita	CR		X
Campi solcati del M. Budellone	Mt. Budellone karrenfeld	BS		X
Cascata dell'Acquafraggia	Acquafraggia waterfall	SO		X
Circo glaciale del Barbellino	Glacial cirque of Barbellino	BG		X
Morene di Castellaro Lagusello	Castellaro Lagusello moraines	MN		X
Conoidi confluenti delle valli di Dombastone e Raltana, Scala, Rezzallo	Confluent alluvial fans of Dombastone and Raltana, Scala, Rezzallo valleys	SO		X
Cuscinetti erbosi Alpe di Val Poschivina	Alpe of Val Poschivina thufur	SO		X
Cuscinetti erbosi di Campagneda	Campagneda thufur	SO		X
Dosso Boschetto	Boschetto ridge	PV		X
Dosso di Borgarello	Borgarello ridge	PV		X
Dosso di Cergnago-Tromello	Cergnago-Tromello ridge	PV	X	X
Fontanile di Orzinuovi	Orzinuovi spring	BS	X	
Fontanile Nuovo di Bareggio	Bareggio spring	MI		X
Frana di Salò	Salò landslide	BS	X	
Frana torrioni centrali cima M. Cornagera	Mt. Cornagera landslide	BG		X
Fratture 'Laghe' di Lovere	'Laghe' of Lovere (fractures)	BG		X
Fratture del M. Cala	Mt. Cala fractures	BG		X
Grotta del 'Doss Pitigla'	'Doss Pitigla' cave	BG		X
Grotta 'Bus del Quai' (Iseo)	'Bus del Quai' cave (Iseo)	BS		X
Grotta 'Bus del Remeron'	'Bus del Remeron' cave	VA		X
Grotta 'Bus di Tàcoi' (Gromo-Val Seriana)	'Bus di Tàcoi' cave (Gromo-Val Seriana)	BG		X
Grotta 'Busa de l'Andrea' (Val Brembana)	'Busa de l'Andrea' cave (Val Brembana)	BG		X
Grotta 'Busa de l'Edera' (Val Brembana)	'Busa de l'Edera' cave (Val Brembana)	BG		X
Grotta 'Busa del Pusù' (Val Brembana)	'Busa de Pusù' cave (Val Brembana)	BG		X
Grotta 'Lacca del Roccolino' (Crosnello-Valle Brembana)	'Lacca del Roccolino' cave (Crosnello-Valle Brembana)	BG		X
Grotta 'Pairolo' (Sella Pairolo)	'Pairolo' cave (Sella Pairolo)	CO		X
Grotta carsica 'Buco del Frate'	'Buco del Frate' karst cave	BS		X
Grotta carsica 'Buco del nido'	'Buco del nido' karst cave	SO		X
Grotta carsica 'Buco del Piombo' (Erba)	'Buco del Piombo' karst cave (Erba)	LC		X
Grotta carsica 'Buco della Volpe' (Grigne)	'Buco della Volpe' karst cave (Grigne)	LC		X
Grotta carsica 'Corno Buco' (Pasturo-Grigne)	'Corno Buco' karst cave (Pasturo-Grigne)	LC		X
Grotta del 'Màrsol'	'Màrsol' cave	SO		X
Grotta del 'Veronica'	'Veronica' cave	SO		X
Grotta del T. Fiumelatte	T. Fiumelatte cave	LC		X
Grotta del Forgnone (Resegone)	Forgnone cave (Resegone)	LC		X
Grotta di Ponte Nativo	Ponte Nativo cave	VA		X
Grotta 'La Ghiacciaia'	'La Ghiacciaia' cave	LC		X
Grotta Scondurava	'Scondurava' cave	VA		X
Grotte per fratturazione del M. Cala (Alto Sebino)	Mt. Cala caves (Alto Sebino)	BG		X
Grotte carsiche del Dente (Grigne)	'Dente' karst caves (Grigne)	LC		X
Grotte di Rescia (Porlezza)	Rescia caves (Porlezza)	CO		X
Grotte di Valganna	Valganna caves	VA		X
Isola fluviale Boscone (F. Po presso Carbonara)	Fluvial island of Boscone (Po river by Carbonara)	MN		X
Lago di Bondo	Lake Bondo	BS		X
Lago Darengo (Alto Lario)	Lake Darengo (upper Lario)	CO		X
Lago delle Scale (Val Fraéle-Valtellina)	Lake Scale (Val Fraéle-Valtellina)	SO		X
Lago di Annone	Lake Annone	LC		X

Segue TAB. B - OTHER LOMBARD SITES

Key: a - geomorfosites identified but less significant; b: geomorfosites deduced from literature

Lago Lagazzuolo (Val Orsera)	Lake Lagazzuolo (Val Orsera)	SO		X
Lago di Ganna	Lake Ganna	VA		X
Lago di Piano (Val Menaggio)	Lake Piano (Val Menaggio)	CO		X
Lago di Sartirana (Brianza)	Lake Sartirana (Brianza)	LC	X	X
Lago Emet (Valchiavenna)	Lake Emet (Valchiavenna)	SO		X
Lago Palù (Valtellina)	Lake Palù (Valtellina)	SO		X
Lago delle Valli di Bondo (Tremosine)	Lake Valli di Bondo (Tremosine)	BS		X
Lago Pirola (Val Malenco)	Lake Pirola (Val Malenco)	SO		X
Lanca del F. Oglio 'Le Bine'	'Le Bine' Oglio river ox-bow lake	CR		X
Lanca del F. Ticino a Bernate Ticino	Ticino river ox-bow lake by Bernate Ticino	MI		X
Lanca della Rotta (Adda Sud)	Rotta ox-bow lake (southern Adda river)	LC		X
Lanca di Azzanello (F. Oglio)	Azzanello ox-bow lake (Oglio river)	CR		X
Lanca di Gabbioneta (F. Oglio)	Gabbioneta ox-bow lake (Oglio river)	CR		X
Lanca di Gerole (F. Po, presso Torricella del Pizzo e Motta Baluffi)	Gerole ox-bow lake (Po river by Torricella del Pizzo and Motta Baluffi)	CR		X
Lanca di Torricella del Pizzo (F. Po)	Torricella del Pizzo ox-bow lake (Po river)	CR		X
Lanca del F. Ticino a Besate	Ticino river ox-bow lake by Besate	PV		X
Lanca del F. Ticino a Motta Visconti	Ticino river ox-bow lake by Motta Visconti	PV		X
Marmitte dei giganti (T. Fiumenero)	T. Fiumenero potholes	BG		X
Marmitte dei giganti in Val di Lemma (Valtellina)	Val di Lemma potholes (Valtellina)	SO		X
Marmitte dei giganti Val Fabiòlo (Valtellina)	Val Fabiòlo potholes (Valtellina)	SO		X
Marmitte dei giganti Val Vertova (Val Seriana)	Val Vertova potholes (Val Seriana)	BG		X
Marmitte del T. Meria (Grigne)	T. Meria potholes (Grigne)	LC	X	
Marmitte del T. Poschiavina	T. Poschiavina potholes	SO		X
Marmitte della Valle dei Molini (Grigne)	Valle dei Molini potholes (Grigne)	LC	X	
Marmitte della Valle di Ancogno	Valle di Ancogno potholes	BG	X	X
Marmitte della Val Parina	Val Parina potholes	BG		X
Masso erratico di Bavera (Brianza)	'Bavera' erratic boulder (Brianza)	LC	X	
Masso erratico 'Corna di Scalvino' (Scalvino)	'Corna di Scalvino' erratic boulder (Scalvino)	BG		X
Masso erratico 'Pietra Lentina' (Piano Rancio, Triangolo lariano)	'Pietra Lentina' erratic boulder (Piano Rancio-Como and Lecco area)	CO	X	X
Masso erratico 'Pietra Nairola' (Blevio, Triangolo lariano)	'Pietra Nairola' erratic boulder (Blevio-Como and Lecco area)	CO	X	X
Masso erratico 'Preia Buia' (Sesto Calende)	'Preia Buia' erratic boulder (Sesto Calende)	VA	X	X
Masso erratico 'Sasso da Prada' (Val Fraéle-Valtellina)	'Sasso da Prada' erratic boulder (Val Fraéle-Valtellina)	SO		X
Masso erratico 'Sasso delle coppelle' (M. Barro)	'Sasso delle coppelle' erratic boulder (Mt. Barro)	LC		X
Masso erratico 'Sasso di Guidino'	'Sasso di Guidino' erratic boulder	MI		X
Masso erratico 'Sasso Malascarpa' (Corni di Canzo, Triangolo lariano)	'Sasso Malascarpa' erratic boulder (Corni di Canzo-Como and Lecco area)	CO	X	X
Masso erratico 'Sasso Remenno' (Val Masino)	'Sasso Remenno' erratic boulder (Val Masino)	SO	X	X
Masso erratico 'Stele di S. Fortunato' (menhir di Pian di Gembro-Aprica)	'Stele di S. Fortunato' erratic boulder (menhir by Pian di Gembro-Aprica)	SO		X
Masso erratico di Arenaria rossa del Permico	Erratic boulder of Permian red sandstone	BS		X
Masso erratico di Bodio	Bodio erratic boulder	VA		X
Meandri del Rio Fontanone	Rio Fontanone meanders	PV	X	
Morena 'ramificata' di Pizzo Scalino	Pizzo Scalino branched moraine	SO		X
Morene laterali della conca di Sulzano-Sale Marasino	Lateral moraines of Sulzano-Sale Marasino hollow	BS		X
Morene Mindel di Carpenedolo (sic-sito di interesse comunitario)	Carpenedolo Mindel moraines (sic)	BS	X	
Morene rissiane di Bossico	Rissian moraines of Bossico	BG		X
Nicchia di distacco frana di Cene	Edge of landslide of Cene	BG		X
Orrido 'Bogn' di Castro (Lago d'Iseo)	'Bogn' (gorge) di Castro (Lago d'Iseo)	BG	X	X
Orrido d'Arquino (Sondrio)	Arquino gorge (Sondrio)	SO	X	
Orrido della Val Frodolfo	Val Frodolfo gorge	BG	X	
Orrido della Valle di Ancogno	Valle di Ancogno gorge	BG	X	X
Orrido delle Cassandre (Val Malenco)	Cassandre gorge (Val Malenco)	SO	X	
Orrido del T. Armisa (Val d'Arigna)	T. Armisa gorge (Val d'Arigna)	SO		X
Orrido del T. Boggia (Valchiavenna)	T. Boggia gorge (Valchiavenna)	SO		X

Segue TAB. B - OTHER LOMBARD SITES

Key: a - geomorfosites identified but less significant; b: geomorfosites deduced from literature

Orrido del T. Crezza (Valchiavenna)	T. Crezza gorge (Valchiavenna)	SO		X
Orrido del T. Esino	T. Esino gorge	LC		X
Orrido del T. Venina (Valtellina)	T. Venina gorge (Valtellina)	SO		X
Orrido della Val Muggiasca	Val Muggiasca gorge	LC		X
Orrido di Nesso (Lago di Como, Triangolo lariano)	Nesso gorge (Lake Como-Como and Lecco area)	CO	X	
Orrido di Piovere (Tignale, Lago di Garda)	Piovere gorge (Tignale, Lake Garda)	BS	X	
Orrido 'La Pescara' (Osteno, Lago di Lugano)	'La Pescara' gorge (Osteno, Lake Lugano)	CO	X	
Paesaggio carsico M.ga Aguina -Alto Sebino bresciano	Karst morphology by Malga Aguina - upper Sebino	BS		X
Paesaggio carsico: dolina di Bani	Karst morphology: Bani sink-ole	BG		X
Paleofrana (Valle d'Arigna-Orobie)	Palaeolandslide (Valle d'Arigna-Orobie)	BG		X
Paleosuperfici in alta Val Staffora	Palaeosurfaces by upper Val Staffora	PV	X	X
Pianalto terrazzato nell'area di Rivanazzano-Retorbido-Torrazza Coste	High terrace by Rivanazzano-Retorbido-Torrazza Coste	PV		X
Pianalto terrazzato nell'area di Stradella-Cardazzo	High terrace by Stradella-Cardazzo	PV		X
Piramidi di Postalesio (Valtellina)	Earth pyramids of Postalesio (Valtellina)	SO	X	X
Rilievi in gonfolite della Spina Verde	Reliefs in 'gonfolite' of Spina Verde	CO		X
Rilievo isolato di Ciliverghe	Ciliverghe isolated relief	BS		X
Rocce montonate fra S.Cristina e l'Alpe Acquanera (Val Poschiavina)	Roches moutonnées between S. Cristina and Alpe Acquanera (Val Poschiavina)	SO		X
Rocce montonate di Darfo	Roches moutonnées by Darfo	BS		X
Rocce montonate della Alpe di Val Poschivina	Roches mountonnées by Alpe of Val Poschivina	SO		X
Rocce montonate di Campagneda	Roches moutonnées by Campagneda	SO		X
Rocce montonate di Gromo S. Martino	Roches moutonnées by Gromo S. Martino	BG		X
Roccia montonata fra Montegrino e Pineta Alta	Roche moutonnée between Montegrino and Pineta Alta	VA		X
Rock Glaciers del Foscagno	Foscagno rock glaciers	SO		X
Rock Glaciers della Foppa	Foppa rock glaciers	SO		X
Rupe dolomitica di Cornalba	Cornalba dolomitic cliff	BG		X
Soglia di Arena Po	Arena Po threshold	PV	X	
Soliflussi del M. Vago (Valle della Forcola)	Mt. Vago solifluctions (Valle della Forcola)	SO		X
Suoli poligonali (fra P.sso Canciano e il ghiacciaio del Pizzo Scalino)	Polygonal soils (between Canciano pass and Pizzo Scalino glacier)	SO		X
Superficie montonata di Ceppo di Greno	Moutonnée surface of Ceppo di Greno	BG		X
Terrazzi della conca di Sale Marasino	Terraces of Sale Marasino hollow	BS		X
Terrazzo fluvioglaciale di Piario (Val Seriana)	Fluvioglacial terrace of Piario (Val Seriana)	BG		X
Terrazzo fluvio-glaciale di Grosio	Fluvioglacial terrace of Grosio	SO		X
Valle del Freddo	Valle del Freddo	BG		X
Valle glaciale a gradinata Val Carisole (Val Brembana)	Stepped glacial valley: Val Carisole (Val Brembana)	BS	X	
Valle glaciale ad 'U': Val da Fain	'U' shaped glacial valley: Val da Fain	SO		X
Valle glaciale ad 'U': Val Federia	'U' shaped glacial valley: Val Federia	SO		X
Valle glaciale ad 'U': Val Vallaccia	'U' shaped glacial valley: Val Vallaccia	SO		X
Valle sospesa: Val Fonteno (Sebino)	Hanging valley: Val Fonteno (Sebino)	BG		X
Valle sospesa: Val Parzanica (Sebino)	Hanging valley: Val Parzanica (Sebino)	BG		X
Valle sospesa: Val Predore (Sebino)	Hanging valley: Val Predore (Sebino)	BG		X
Valle sospesa: Val Belviso (Valtellina)	Hanging valley: Val Belviso (Valtellina)	SO		X
Valle sospesa: Val Canale (laterale Val Seriana)	Hanging valley: Val Canale (Val Seriana)	BG		X
Valle sospesa: Val Caronella	Hanging valley: Val Caronella	SO		X
Valle sospesa: Val Poschivina	Hanging valley: Val Poschivina	SO		X
Valle sospesa: Val Sanguigno	Hanging valley: Val Sanguigno	BG		X
Valle sospesa: Valle di Fiumenero	Hanging valley: Valle di Fiumenero	BG		X
Valle strutturale: Valle Marsiola	Structural valley: Valle Marsiola	PV	X	
Valle strutturale: Valle Scizzola	Structural valley: Valle Scizzola	PV	X	
Valle strutturale: Valle Scuropasso	Structural valley: Valle Scuropasso	PV	X	
Valle strutturale: Valle Versa	Structural valley: Valle Versa	PV	X	
Versante strutturale M. Creò	Structural slope: Mt. Creò	BG		X

4.1.1 The Forni Glacier: Ghiacciaio dei Forni

It is one of the best known glaciers in Lombardy and of the whole versant of the Italian Alps, a beautiful example of composed valley glacier (Lombard Glaciological Service, 1992), originated by the confluence of basins and various glacial flows forming an only great tongue.

Located in upper Valfurva (Valtellina) and easy to reach from Bormio and Santa Caterina, its surface is about 13 km^2 (the largest valley glacier of the Italian Alps), flowing Northward and its average gradient is 15°. The traditional track to visit it passes through the 'Albergo dei Forni' and the 'Rifugio Branca', but many other tracks allow to observe it at close.

According to history, the glacier seems to be known since the XVIII century; the first scientific observations were made in the mid of the XIX century and became regular at the beginning of the XX century and last till today.

In 1873, Antonio Stoppani, in his book '*Il Bel Paese*' ('The Beautiful Country'), that someway can be considered one of the first works on geosites, wrote as follows about the Ghiacciaio dei Forni:

'If you want to visit an Italian glacier, without much trouble and even without renouncing to the all the comforts, go to S. Caterina Valfurva of Bormio. The sight of the Ghiacciaio del Forno, that we can call a model of glacier, will be a true pleasure, and ladies can take part to the trip, too, without stressing their muscles too much and without spoiling their hairstyle.' The reason of the choice of this glacier as geomorphosite is explained by Stoppani's words when he refers to it as 'model of glacier'.

The first aspect that makes the *Ghiacciaio dei Forni* a geomorphosite is the *didactic exemplariness*. On the glacier itself and on its side we can observe a whole range of shapes which are typical of the glacial morphoclimatic environment.

The accumulation zones generate three glacial flows that, at about 2700 meters height, join up into a vast plain area from which an only tongue derives.

Near the area called '*Le Guglie*' this glacial flow generates an impressive fall of seracs that are some meters high. The tongue flows down covered with overgiacial detritus, it enlarges and thus loses its peculiarity. On its sides, sharp lateral moraines, on which airy paths are tracked, show which were the border of the tongue in a recent past and their thickness. The one on the right is particularly evident and it supports a small lake, too (Fig. 7). Two superficial banks floating, better known as 'medial moraine' (Fig. 8), were originated by crioclastic taking down of the rocky spurs dividing the three accumulation basins, and delineate two long relieves rising out of the glacier at the beginning developing parallelly to each other and then fan out in the final part of the tongue. The melting waters, coming into a big door hollowed out of the ice, give rise to a drainage channel.

A second aspect of the '*Ghiacciaio dei Forni*' is its feature of *palaeogeographic testimony*; the tracks marked on the ground and the historical information allow to reconstruct the palaeogeography of the Valley of the Forni. The glacier has been widely described and reproduced in the last two centuries thanks to its appealing size and because it was easy to reach. We have, then, a wide documentation which reproduce its shape and its size. All the lateral and frontal banks still present in the area allow to well reconstruct the Olocenic and morainic apparatus and to draw its position. Moreover, some stages of expansion have been dated thanks to special techniques (lichenometry, dendrochronology, ^{14}C); the oldest documented one happened between 930-710 B.C.

The third aspect that makes the *Ghiacciaio dei Forni* a geomorphosite is its being an *example of availability*. In 1995, on the occasion of the celebration of the 100 years of the *Comitato Glaciologico Italiano*, a 8 Km

Fig. 7 - The Rosole Lake is located on the right bank of the Ghiacciaio dei Forni, and is a good example of didactic exemplariness, in fact its origin is evident. It belongs to the group of the glacial-origin lakes because its side down the plain is supported by the right lateral moraine of the Ghiacciaio dei Forni.

Il lago delle Rosole, ubicato in destra idrografica del Ghiacciaio dei Forni, costituisce un bell'esempio di esemplarità didattica, in quanto è assai evidente la sua genesi. Rientra nella categoria dei laghi di origine glaciale, poiché risulta sorretto nel suo lato a valle dalla morena laterale destra del Ghiacciaio dei Forni.

Fig. 8 - The 'floating' medial of the Ghiacciaio dei Forni delineates the three basins which feed the glacier; the one on the back shows its origin through the rocky outcrop at the centre of the picture.

Le morene mediane o 'galleggianti' del Ghiacciaio dei Forni individuano i tre bacini alimentatori del Ghiacciaio; quella in secondo piano mostra la sua origine a partire dallo spuntone di roccia al centro dell'immagine.

path (Smiraglia, 1995) was tracked and it can be covered in three-four hours time. The route is very respectful to the environment (there are few signals for instance) and shows the traces of the past, recent and present life of the glacier, and it winds along glacial and geomorphologic phenomena. The text written by Smiraglia is a precious support to the hiker, but also an essential guide for those who want to give a lecture about the glacier.

It is enriched with beautiful photos and with a map of the track divided in ten stops, there is also a more strictly scientific section about the most recent researches and the recent changes of the glacier. At the moment, the track is harder to climb because of the intense ablation to which all glacier have undergone.

4.1.2 The Peduncle of Sommo - Il peduncolo di Sommo

It is a sort of peninsula whose shape recalls a peduncle spreading from the main surface of the plain to the river-bed of the Po.

In the terraced flood plain, along the Po River, in the Pavia area, on the left bank, we can see very well the terraces witnessing the phases of the fluvial deposition and erosion (Fig. 9). These phases are Quaternary dated. In detail, the middle and low plain are related to the Last Glaciation and to the later post-glacial.

The village of Sommo and its surroundings settle down on a surface belonging to the the main surface of the plain interpreted as the product of fluvial aggradation phases as a consequence of the Last Glaciation; we can see here the carvings of some rivers and streams and the formation of high scarps (Castiglioni & Pellegrini, 2001).

Note worthy is the planimetric course of these slopes, both up and downriver of the confluence of the Po and the Ticino rivers (Fig. 10).

In particular, eastward and westward of Sommo, this slope delineates big concave sides southwards and the village of Sommo seems to stretch out on a sort of small peninsula (its maximum width is less than 250 m), belonging to the main surface of the plain. It rises above 15 – 18 m (the farthest SW ramification of the village reaches 80, 7 m of altitude) on the plain of the lowest post-glacial floods (between 62.5 and 64 m). On these terraces rice is cultivated thanks to the characteristics of the ground and the big amount of water available in the area.

At present, the bed of the Po river is at 57 m of altitude and it is about 2 km away from the peduncle itself.

Owing to the quite distinct concavo-convex shape of the slope and its closeness to the Po river, its morphology is connected to the presence of former meanders of the river itself where the strong lateral erosion (on the concave bank) has moulded the slope that determines the limit of the main surface of the plain through the formation of a small spur and of a narrow meander: the 'peduncle' of Sommo. (Fig. 11). The village lies exactly on the spur of this former meander and can be reached from the north, going longitudinally along the 'neck' of the meander itself. In the centre of this narrow 'neck' there is a deep hollow (a saddle) which may witness the attempt (not successful) made

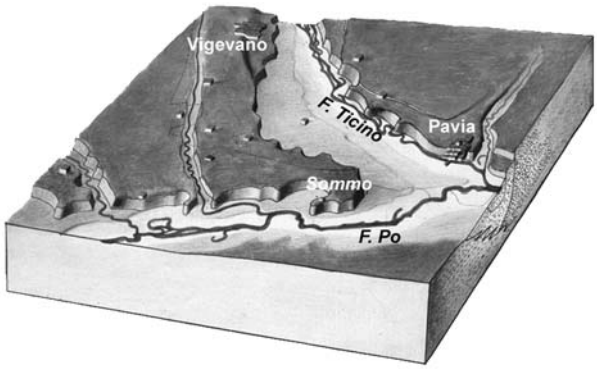

Fig. 9 - Schematic picture of the Pavia plain which shows how the main surface of the plain is deeply carved by the Po and the Ticino and how the 'peduncle' of Sommo is a marked apophysis delimited by a scarp whose longitudinal development is characterized by a remarkable winding.

Illustrazione schematica della pianura pavese che mette in evidenza come il 'livello fondamentale della pianura' sia profondamente inciso dal Po e dal Ticino e come il 'peduncolo' di Sommo rappresenti una marcata apofisi delimitata da una scarpata il cui sviluppo longitudinale è caratterizzato da una notevole sinuosità.

Fig. 10 - Oblique aerial photo of the Sommo-Sairano area taken from the East. The picture shows the perfect geometry of the meander bends by the sides of the peduncle of Sommo. (Tozzi, 1999).

Fotografia aerea obliqua dell'area di Sommo – Sairano (in secondo piano) da oriente. L'immagine mostra la perfetta geometria delle anse meandriche a monte e a valle del 'peduncolo' di Sommo (Tozzi, 1999).

by the Po river to 'jump the meander', when the river was flowing on the main surface of the plain.

The presence of this peduncle, generated by the meandering course of the river, witnesses a remarkable inclination to step away and the subsequent abandonment of the meanders.

This tendency can be checked even today in many tracts of the active river-bed.

Moreover, the old meander have been studied and analysed through the finding and the reconstruction of the tracks left on the ground and this has permitted to date back the age of the bed-rivers drifted apart by the evolution of the river itself.

Some tracks, in fact, are cut off by presumably more recent ones and these ones prove the river progressive shift southwards.

A bank was built near the active river-bed of the Po to oppose its floods, and it fixes an artificial limit to the high water beds area. The top of the bank is used also as road to connect the villages and the farms.

The morphology of the area can be better appreciated through zenithal and oblique photographs; these last ones allow an immediate three-dimensional view. The bow course of the slope can be seen quite clearly on the map, too, but, given its size, it is difficult to place a viewpoint from which you can appreciate its features: it is necessary to go down to the lower terrace, some meters away from the slope, going round the Sommo peninsula and it will be possible to catch all its characteristics.

This site is very important both on the naturalistic and didactic point of view because it shows an exemplifying model of evolution. In fact it is a part of the morphology of the Po river and it is useful to date the different terraces and the transformations of the river-bed all along the river's life.

It is easy to reach even without driving and it may be a track for bikers and hikers just like the one that soon is going to connect Milan to the Oltrepo Pavese.

4.1.3 The triangular facets of Broni – Redavalle

Between Broni and Redavalle (Pavia), at the foot of the Appennines in the Oltrepo Pavese, four flat sides hill dominates the edge of the plain along 4 km with a difference in height from 120 to 150 m. These relieves are separated by short but well defined small valleys and present some triangular shaped slopes set in a row, facing the plain.

These slopes seem to be steadily settled owing to the secular vine yards but, on the other side, the deep ploughing for the new ones aid the taking off of the little superficial layer of the substratum, causing creeping.

These shapes are very well visible even from the plain and of course on the map (Fig. 12) and analysing the photos from the plane, too.

Their origin is usually due to recent tectonics. Any part of a hill touched by recent faults (Pellegrini & Vercesi, 1995), may be subject to erosion, and this would stop its evolution near the tectonic surface.

Morphosculpture is definitely controlled by tectonic elements and this is demonstrated by finding out in the plain subsoil near Broni and Stradella sediments similar to the ones characterising the tops of the hills.

This is confirmed also by the sub-horizontal attitude of the stratification which does not neither shows any deforming phenomena nor plicate ones within close bending radius.

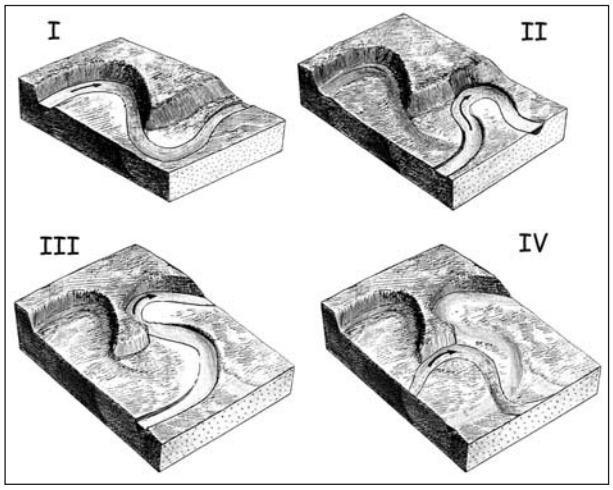

Fig. 11 - Scheme of the formation of a peduncle originated by a meandering river, in different times (from I to IV).

Schema della formazione di un peduncolo ad opera di un corso d'acqua meandreggiante, in tempi successivi (da I a IV).

The tectonic interpretation can be explained through structural model characterised by accretion wedges containing overthrust surfaces and backthrust faults (Fig. 13).

These morphologies are interrupted eastward by faults which make the 'Spur of Stradella' step ahead northward.

These spectacular shapes are softened and then disappear by the Santa Giulietta hills where the slopes have been damaged by heavy and spread landslides.

That is because it is possible to speak of the didactic exemplariness of the 'triangular facets' which characterise the slope between Broni and Redavalle, as far as the tectonic aspects are concerned. Moreover, its good availability and its good state permit to fully observe its characteristics, and this is particularly important if we consider the rarity of this kind of formation in the Lombard Apennines.

This geomorphosite can be observed from high points eastward such as the San Contardo hill and from others rolling hills overhanging Broni and Redavalle and even from the highway 10, also known as 'Padana Inferiore'.

4.1.4 The 'monadnock of Pregola' (Brallo - Pavia)

It is a representative example of a morphoselective relief in ophiolitic rocks in the Pavia Apennine.

The history of these rocks dates back to the opening of the Ligurian Sphenocasm, when the formation of deep furrows caused the placing of magmas rising in the ridge line. By the same time, the thickness of the oceanic crust grew thinner and thinner because of the incomplete rising of the rocks of the mantle.

Beside the ridge, deep basins were originating and here very thin clay and calcilutute substances sedimented.

After the development of the Ligurian orogenetic age, the obduction phenomena have risen some levels of the mantle up to the surface making possible their

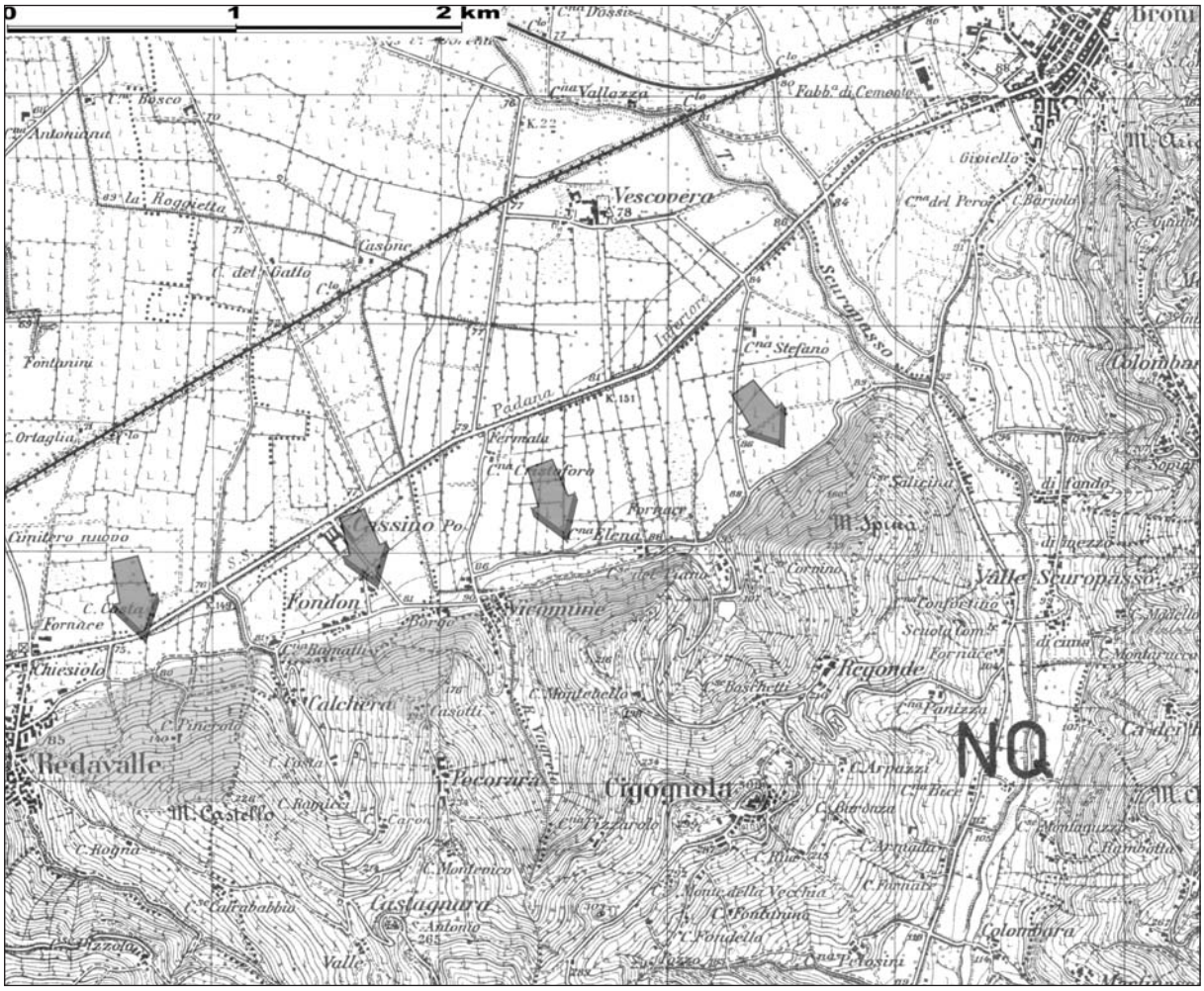

Fig. 12 - Topographic map by the Italian Istituto Geografico Militare (sheet 59 II SO-Stradella) showing the contour lines marking the shape of the four triangles on the slopes overlooking the plain (with gradient between the 20 and the 40%).

Stralcio della 'tavoletta' Stradella dell'Istituto Geografico Militare (59 II SO) in cui l'andamento delle isoipse rimarca la forma di quattro triangoli (faccette triangolari) sui versanti che si affacciano verso la pianura (con pendenze comprese tra il 20 e il 40%).

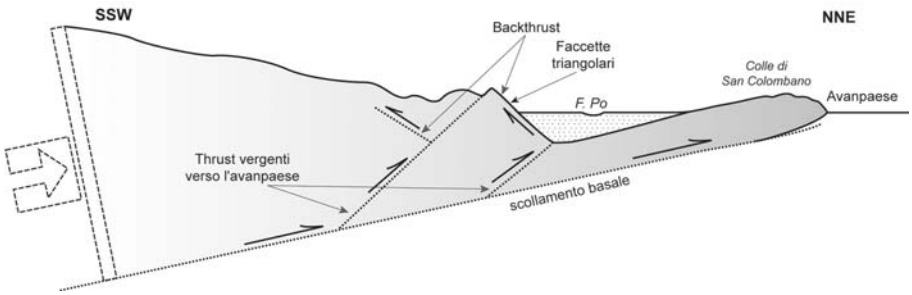

Fig. 13 - Scheme of the accretion wedges (shaded grey area) across the section 'Sperone' di Stradella (Stradella Spur) - San Colombano Hill.

Schema del prisma di accrezione (area in grigio sfumato) nella zona 'sperone' di Stradella –– Colle di San Colombano.

inclusion in the tectonic *mélanges* originated after the shortening of the rocks.

It is easy, then, to find big masses, even many kilometres long, included in the chaotic succession composed by clays, limestones, and calcilutites ('palombini clays' *auctorum*).

In the geological literature these masses are known also as 'cahotic compounds' or 'basic compounds' of the Ligurian sedimentary units. Afterwards they have been relocated some hundreds kilometres away and piled in a top geometric and structural position as regards the other tectonic units.

The selective morphogenetics action has caused the falling down of the more fragile lithological part, giving rise to a rocky spur composed of lherzolithic peridots and later has moulded it, rounding off and softening all the more rocky parts.

The impression to the eye looking at this pile emerging from a morphologic context characterised by softened forms of the surrounding view is impressive, also from a chromatic point of view (the natives call these ophiolitic masses 'black stones' owing to their

dark colours). The colours in fact display a strong contrast with the white flyshoid relieves of the Limestones at Helmintoida, Mount Lesima and Cima di Colletta on the back.

Moreover, its presence itself witnesses the existence of an oceanic bottom and is another scientific element adding to the morphoselection processes.

Such area belongs to a protected area considered particularly interesting from a panoramic point of view, due not only to the morphology of the place, but also for the naturalistic-didactic importance that the outcrops represent.

In fact many tourist routes consider this place one of the most exclusive in the in the Pavia Apennines.

The site of Pergola and the ophiolitic relief (Fig. 14) can be reached by car and can be interesting hiking routes to observe at close the lithological peculiarities while the reliefs around can offer pleasant viewpoints.

Fig. 14 - Close up, the ophiolitic relief overhanging the site of Pregola, it displays its chromatic and vegetation characteristics. In the background, it is visible on the left the Passo del Brallo and, nearly in the middle, Cima della Colletta.

In primo piano, il rilievo ofiolitico che sovrasta l'abitato di Pregola mostra le sue caratteristiche cromatiche e vegetazionali. Sullo sfondo, a sinistra, si distingue il Passo del Brallo e, circa al centro, Cima della Colletta.

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