BOLOGNAPPENNINO

GAL Appennino Bolognese

EMILIA ROMAGNA APENNINE
GEOPARK PROJECT

APPLICATION DOSSIER OF THE EMILIA ROMAGNA APENNINE FOR MEMBERSHIP IN THE EUROPEAN AND GLOBAL GEOPARKS NETWORK UNDER THE AUSPICES OF UNESCO

BOLOGNA – OCTOBER 2012

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A. Definition of the European Geopark Territory

A. 1 - Name of the proposed Geopark

The name of the area for nomination as a European and Global Geopark is: EMILIA-ROMAGNA APENNINE GEOPARK PROJECT. The regional framework is Emilia-Romagna Region, whereas the territory examined concerns only a portion of it: it includes all the Bologna district and part of the Ravenna Province. It can be considered representative of Emilia-Romagna's geological characteristics. In the following file it will be designated as ERAGP.

A. 2 - Surface area, physical and human geography characteristics of the proposed Geopark

A. 2.1 - *Administrative size and extent*

ERAGP covers an administrative area of 1950 km² in between two districts: the Province of Bologna and the Province of Ravenna with a total of 32 municipalities. 29 of them belong to Bologna Province and are, from SW to NW: Lizzano in Belvedere, Porretta Terme, Granaglione, Gaggio Montano, Castel di Casio, Castiglione dei Pepoli, Castel d'Aiano, Vergato, Grizzana, San Benedetto Val di Sambro, Savigno, Marzabotto, Monzuno, Loiano, Monghidoro, Monteveglio, Castello di Serravalle, Monte San Pietro, Sasso Marconi, Pianoro, Bologna (including the "Gessi bolognesi e calanchi dell'Abadessa" Park) San Lazzaro di Savena, Ozzano dell'Emilia, Imola, Monterenzio, Casalfiumanese, Castel del Rio, Fontanelice, Borgo Tossignano. Three municipalities belong to Ravenna Province, along the border with Bologna province; they are, from west to east: Casola Val Senio, Riolo Terme and Brisighella.

A. 2.2 - *Physical characteristic of the area*

The Emilia-Romagna Apennines, where ERAGP is located, are the mountain chain of centre-northern Italy with a NW-SE direction: it is bounded to the W by Mt. Carmo (1640 m), Mt. Penice (1460 m) and Lake Molato; to SSW by the watershed separating Liguria from Tuscany; to the SE by Mt. Fumaiolo (1407 m) and the Republic of San Marino alignment; to the NE by the hills running parallel to Via Emilia from the province of Piacenza to Rimini on the Adriatic coast.

The physical characteristics of ERAGP reflect those of the mountain chain. In particular, they are strictly controlled by geological-structural factors, such as the outcrops of the Tuscan Units (Oligo-Miocene arenaceous Flysch), overlying the mostly clayey Ligurian Formations.

The upper Apennine area, close to the watershed between Mt. Corno alle Scale and the village of Castiglione de' Pepoli, shows considerable landform homogeneity compared with the surrounding areas (provinces of Parma and Piacenza to the NW and Romagna to the SE). The valleys descending from the mountain crest sometimes have the shape of dug-in grooves, with bare steep slopes, such as the valley of the Torrent Dardagna. Another vast area characterized by landform homogeneity makes up the second geomorphological unit of ERAGP and corresponds to the zone where the so-called «*Argille Scagliose*» (historical name) crop out. The prevalence of pelitic formations has favoured erosional processes along the valley floors and on the slopes, with a widespread mass wasting processes and «*calanchi*» (badlands). The third geomorphological unit corresponds to the outcrop area of the Plio-Pleistocene sands and silty clays, showing badland erosion landforms between sandy-arenaceous bluffs. Along the border between the Bologna and Ravenna provinces the «Vena del Gesso» crops out, with its spectacular epigean and hypogean karst morphology.

A. 2.3 - *Land use*

The landscape is a mosaic characterized by highly heterogeneous land uses, resulting from a thousand years of human impact. At lower altitudes, up to 300 m a.s.l. the landscape is dominated by farmland, whereas woods and shrub lands are small and scattered. Badlands, gypsum and sandstone rocks offer habitats to stress-tolerant plants as well as an ecological refuge to some Mediterranean plants. From 300 to about 800-1000 m a.s.l., the natural vegetation is composed of mixed deciduous oak woods, in ecological conditions ranging from xeric to mesic. The landscape includes prevalently semi-natural land covers, with meadows and shrub lands. Ancient cultivated chestnut woods are frequent near the highest altitude of this belt. From 800-1000 m up to 1700-1800 m a.s.l. beech woods and meadows prevalently cover the mountain slopes. The altitudinal limit of beech woods corresponds locally to the natural timberline. Small areas above the timberline can be seen on Mt. Corno alle Scale: ericaceous dwarf shrub lands and semi-natural grasslands including pastures and *Nardus stricta* grasslands characterize this small subalpine vegetation belt.

A. 2.4 - ***Population***

Approximately 150,400 inhabitants live in the ERAGP area; the average is app. 60 inh/km², the total population of the two provinces is app. 991,000 inhabitants, with an average of 267 inh/km². The average age can be resumed as follows: 21.7% of inhabitants are younger than 25 years old, 30% are between 25-40 years old and 47.6% inhabitants are over 45 years old. The majority of the population is composed of adult persons: since the 1950s mountain areas have been abandoned by young people seeking better opportunities in the industrialised plain areas.

A. 2.5 - ***Holistic Geopark philosophy***

In a broad sense, the values of the ERAGP landscape are quoted as geodiversity, biodiversity, spectacularity, cultural heritage etc. All these values should be considered as inter-related and inter-dependent elements within a holistic conception, including also social components. These are not fixed or immutable values but rather dynamic ones, in agreement with the evolution of society itself. Indeed, even in the presence of the most untouchable values, conservation actions and protection measures should challenge the changing of the environmental and landscape physical data or even the manner in which these data are perceived and interpreted by the irrepressible topicality of the present. The holistic view should be intended as a united strategy among the criteria of assessment, which show typical objectivity characteristics of the extrinsic type and the local criteria of the European Landscape Convention, which show typical subjectivity characteristics of the intrinsic type and recognise the specific identity of a landscape (an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors). Therefore, the knowledge of the landscape is achieved by searching for all the causes that in space and time have contributed to its formation. All the landscape features should be analysed from various standpoints related to different cultural and disciplinary backgrounds in order to obtain many sensitive landscapes which, eventually, in the integration and synthesis phase will make up the cultural landscape (PANIZZA & PIACENTE, 2003). The landscape is increasingly becoming a basis for research and comparison, challenging the culture of a given territory and claiming new answers to sometimes ancient questions.

A. 2.6 - ***Industry***

During the last 30 years several mountain areas have been affected by industrial development due to the general spread and improvement of transport links that contribute to ease the movement of people and goods. People tend to move to the plain areas in order to find better jobs and improve their level of education. Several medium and small-size manufacturing industries were established. Diverse expressions of local handicrafts still bear witness to the rural way of living. At the moment the handicraft industry is increasingly connected with the local agricultural food chain for producing typical goods for the market and building up extra value. The factory division is also a very important industrial sector in ERAGP.

A. 2.7 - ***Tourism***

From the tourism viewpoint, the ERAGP area is linked to the city of Bologna as regards fairs and other important events, the Alma Mater University and various cultural initiatives. In addition, another important tourism opportunities are offered by the practice of winter sports (mainly skiing) in the mountain district of Mt. Corno alle Scale. Accommodation and facilities are located in Pianoro and Sasso Marconi, whereas Lizzano and Porretta Terme attract tourists for their spa centres. In ERAGP there are several accommodation facilities, especially bed & breakfast and farm holidays.

As regards the municipalities of the Romagna Apennines, they are less linked to the fluctuations resulting from tourist flows compared with coastal areas. The increase of tourist flow towards the inland areas of Romagna has been favoured by projects aiming at the appraisal of ancient traditions, local food and wine, and the expansion of health farm tourism and bed & breakfast accommodation.

Generally speaking the ERAGP area is characterized by some main attraction centres, such as the areas surrounding Bologna, Porretta, Lizzano and Brisighella and by a series of smaller centres which are nevertheless interesting owing to their cultural and scientific heritage. We believe that ERGAP would be the right key through which the numerous excellences of this territory could be discovered and appreciated, becoming part of a common appraisal system. For this purpose a close partnership was activated with the Emilia-Romagna Destination Company.

A. 3 - Organization in charge and Management structure (description, function and organigram) of the proposed Geopark

A. 3.1 - *The "Gal Appennino Bolognese" s.c.a.r.l. and its role*

Gal (Local Action Groups) are public and private Associations for the development of rural areas in the Leader Programme, by means of the Local Action Plan following the Rural Development Plan 2007-13 and 2013- 2017 ,managed by the Emilia-Romagna Region. Five Gal have been constituted in Emilia-Romagna, two of them have been involved since the onset of ERAGP: "Gal Appennino Bolognese" and "Gal Altra Romagna" have set up a common project following the Leader guide lines thanks to a cooperation project.

"Gal Appennino Bolognese" represents the organization in charge for the management of ERAGP from the preliminary actions to enjoy the Network to the actions development in the selected area.The organization that aims to became an indipendent developing agency inside "Gal Appennino Bolognese" is composed of a five-person internal staff, one Director, two project managers one accountant and a geographer in charge of the data bank.In particular, the ERAGP staff is composed of: the Gal Director (working 30% only for ERAGP, the accountant working 15% for ERAGP, one geographer working 30% for ERAGP, two project managers employed by Gal for the management of ERAGP: oneGeopark specialist working 100% for ERAGP and one specialist in Regional development working 30% for ERAGP).The staff members are payed by the Leader programme and by the ERAGP for the percent they are involved in. The scientific committee, coordinated by professor emeritus M. Panizza, a geologist from Modena and Reggio Emilia University, is composed of several professors and researchers from the Universities of Modena and Reggio Emilia and Bologna led by Gal on behalf of ERAGP. The public/private composition combines the most important political institutions and the category associations. The choices made through the Local Action Plan are a direct expression of a bottom-up effective process recently approved by the European Commission and ERAGP is the clearest expression of this programme.

ERAGP planned actions carried out through the Local Action Plan, aim to appraise and improve the geological, cultural and natural heritage, linked to the European and Global Geopark Network. Gal, represented by the project manager of ERAGP Sara Gentilini, attended several national, European, and international meetings with the aim to create a strong, effective project integrated with EGN-GGN strategy and define a holistic approach to Geoparks.

A. 3.2 - *Partnerships*

The project partners (meaning the subjects involved in the activities plan in the Local Action Plan and other subjects just interested in the project) will be public and private boards: the Emilia-Romagna Region, Bologna and Ravenna Province, the Science Departments of Bologna and Modena and Reggio Emilia Universities, the Geological Museum: "G..Capellini", the APT Destination Company,the Regional Speleological Federation and the Geological and Soil Survey Service of the Emilia Romagna Region.

A. 3.2.1 - Region, Provinces, Municipalities

The Emilia-Romagna Region, the Bologna and Ravenna Provinces, especially the Agricultural and Tourism Departments, would support the initiative by the approval of the Local Action Plan and the cooperation project.

A. 3.2.2 - Universities and Geological Departments

The "Gal Appennino Bolognese" has started cooperation with the Modena-Reggio Emilia and Bologna Universities, the Geological Museum: "G. Capellini" and the Regional Speleological Federation thanks to a special agreement. All these boards have guaranteed scientific support to the project from its first steps.

A. 4 - GeoparkApplication contact person (name, position, tel./fax, e-mail)

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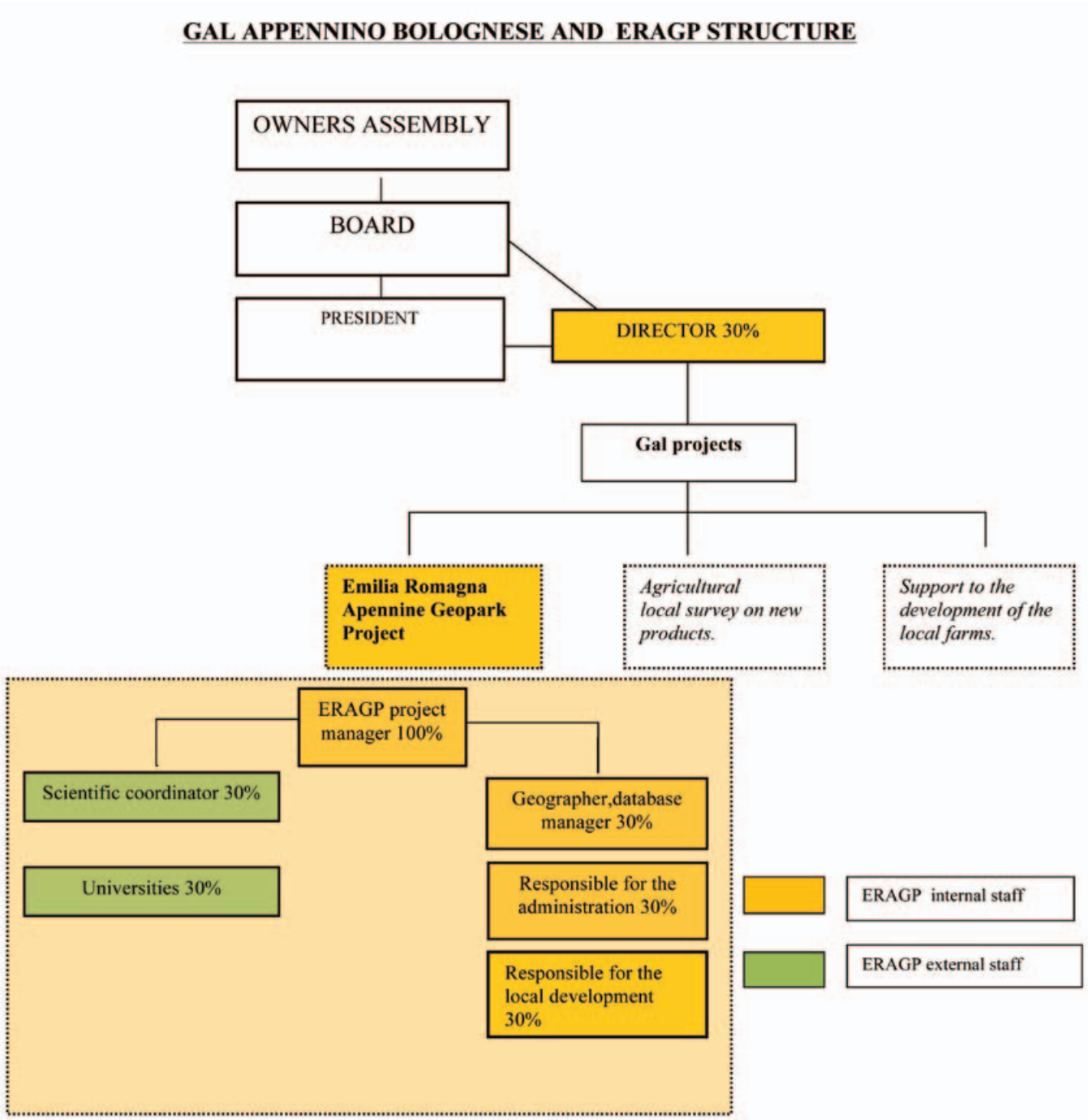

GAL APPENNINO BOLOGNESE AND ERAGP STRUCTURE
OWNERS ASSEMBLY
BOARD
PRESIDENT
DIRECTOR 30%
Gal projects
Emilia Romagna Apennine Geopark Project
Agricultural local survey on new products.
Support to the development of the local farms.
ERAGP project manager 100%
Scientific coordinator 30%
Universities 30%
Geographer,database manager 30%
Responsible for the administration 30%
Responsible for the local development 30%
ERAGP internal staff
ERAGP external staff

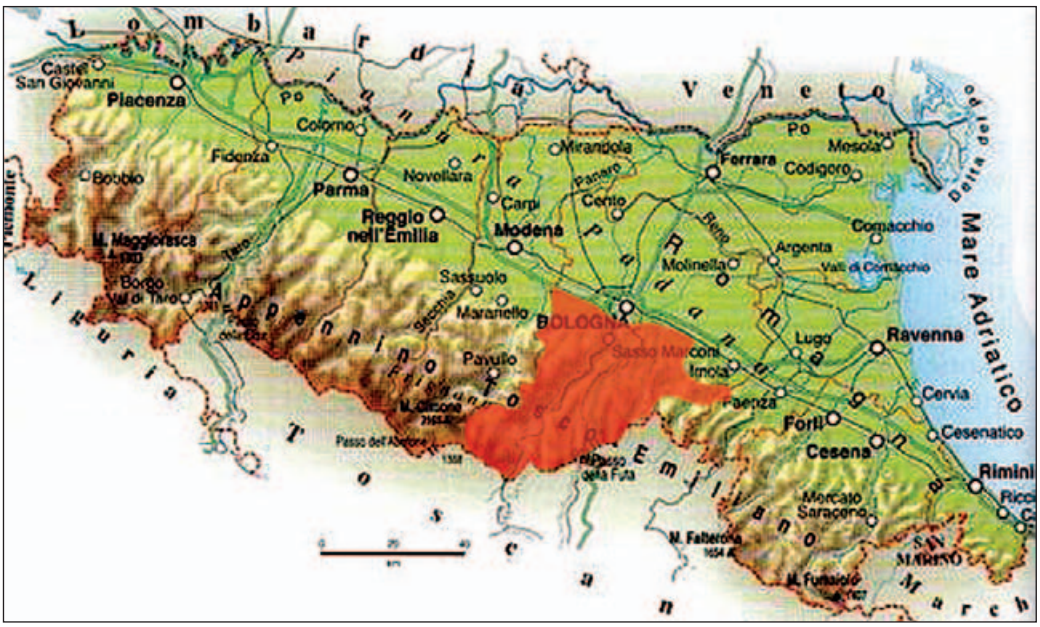
B. Geological Heritage

B. 1 - Definition of the geographic region in which the territory is located.

ERAGP is located in the centre-north part of Italy, in the Emilia-Romagna Region, mainly in the Bologna district. The south border of ERAGP is 100 km away from Florence and coincides with the province border. The north border is 10 km south of Bologna. The western and eastern borders correspond to the Bologna province border; the eastern border includes three extra municipalities belonging to the province of Ravenna.

The ERAGP territory can be easily reached by plane: a workable system of trains and buses connects Bologna's Marconi airport with the Geopark area. This system allows tourists to visit the Geopark locations also without the use of cars. However, if tourists arrive by car it is possible to make use of a very well organized network of local, provincial and regional roads that cross the ERAGP area from west to east and from south to north.

Location of the ERAGP area in Italy.



Location of the ERAGP area in the Emilia Romagna Region.

B. 2 - General geological description of the proposed Geopark

B. 2.1 - *History of geological research*

The Bolognese primacy in geology dates back to the introduction of the very name of the discipline which occurred for the first time in 1603 in Bologna through Ulisse Aldrovandi. For over a century the word *Giologia* labelled the room of the Aldrovandi Museum in the city palace, where fossils, minerals, and rocks were exhibited, which had been used by Aldrovandi to teach natural history to students coming from every part of Europe since 1551.

Before Aldrovandi, Leonardo da Vinci described the succession of strata he encountered by crossing the Romagna Apennine (Leicester Codex, 1506-1510). Inspecting the steep slopes of the valleys and rivers flowing down from the Apennines to the Adriatic Sea, he realized that (1) in the mountain range strata are made by hard stone, than (2) before reaching the Po Plain to the N the strata consist of blue marine terrain, full of shells, used for making pottery; both groups of strata are plunging toward and beneath the flat lying terrain of the plain, "as shown in the Lamone Valley". A synthetic view of Leonardo's fluvial geomorphologic knowledge in the *Imola Map* drawn by Leonardo in 1503.

Aldrovandi knew well the Bolognese gypsum with its diverse clear crystals and concretion-rich caves, the Romagna gypsum and the laminated darker shales beneath it, quarried in Tossignano for their decolouring properties. Aldrovandi's Museum of Natural History, the first ever established in the world since 1547, was increased in the 17th century by addition of Ferdinando Cospi's Museum.

Several top players of European science development, such as Geminiano Montanari, Domenico Guglielmini, Giandomenico Cassini, Marcello Malpighi teacher of Luigi Ferdinando Marsili, representing a milestone in the Earth sciences, were an output of Aldrovandi's experimental school. Marsili was the founding father of oceanography and marine geology, and an original forerunner in stratigraphy, structural geology, and geologic mapping. With the aim to improve the teaching quality in the Bologna university, he founded in 1711 the Bologna Istituto della Scienze e delle Arti, the institution where for the first time in the world skilled brains were gathered and payed for doing experimental research only. Among them were many Earth scientists, such as Antonio Vallisneri (origin of the springs), Johann Jakob Scheuchzer (structure of the Alps), Jacopo Bartolomeo Beccari (discovery of fossil and living foraminifera), Giuseppe Monti (founder of the first Museum of Paleontology, when he was in charge of adding Aldrovandi's and Cospi's museums to Marsili's collections).

Marsili's name is bounded to his homeland by the early studies about the *Pietra illuminabile Bolognese* (barite or Bologna Stone), and the *Linea dei Gessi e dei Solfi* from Northern Apennine to Sicily. Thus, even the name of *Vena del Gesso* dates back to Marsili. Wolfgang Goethe decided to stop in Bologna during his *Reise in Italien* based on Marsili's booklet on the Bologna Stone published in Leipzig in 1698. On October 20, 1786, once arrived, Goethe did not reach his hotel but asked to be immediately accompanied to the Mt. Paderno bad lands (a few km from the city centre), where he "climbed over the steep slopes of the mountain, all fragmented in blocks washed by recent heavy rain". To his great satisfaction he "did find a plenty of the heavy spath he was looking for". Then, he visited the Mt. Donato gypsum quarry collecting lot of crystals. The recent recurrent celebration of the Senckenberg Museum in Frankfurth gave the opportunity to his Director Fritz Steininger to ask the Bologna Capellini Museum to enrich Goethe's collection of Bolognese gypsum crystals with new samples from the recently studied *Vena del Gesso Romagnola*.

At the end of the 18th century, Lazzaro Spallanzani's collections in Reggio Emilia increased the importance of geological museum in the Emilia-Romagna region. Slightly later, Giuseppe Cortesi's collections and Giambattista Brocchi's genius studying them contributed to the origin of stratigraphic paleontology. The most renown collections remained those stored in the Bologna Istituto delle Scienze, and especially the Aldrovandi Museum for the credit expressed by George-Louis Buffon, at the point that Napoleon, following a suggestion by Georges Cuvier, his scientific counsellor during the Italian campaign, soon after having occupied Bologna in 1796, decreed to transfer to Paris all Aldrovandi's collections for the benefit and the *grandeur* of France. Aldrovandi's collections eventually were sent back to Bologna a few years later strongly reduced in number of samples and badly preserved. The Bologna Istituto was left only with its past fame. Cuvier, however, having remained in contact with the Bolognese Camillo Ranzani, continued to appreciate and study the fossils of the ancient Bologna collections, which were exhibited in a new Museum of Natural History by Gian Giuseppe Bianconi in 1852.

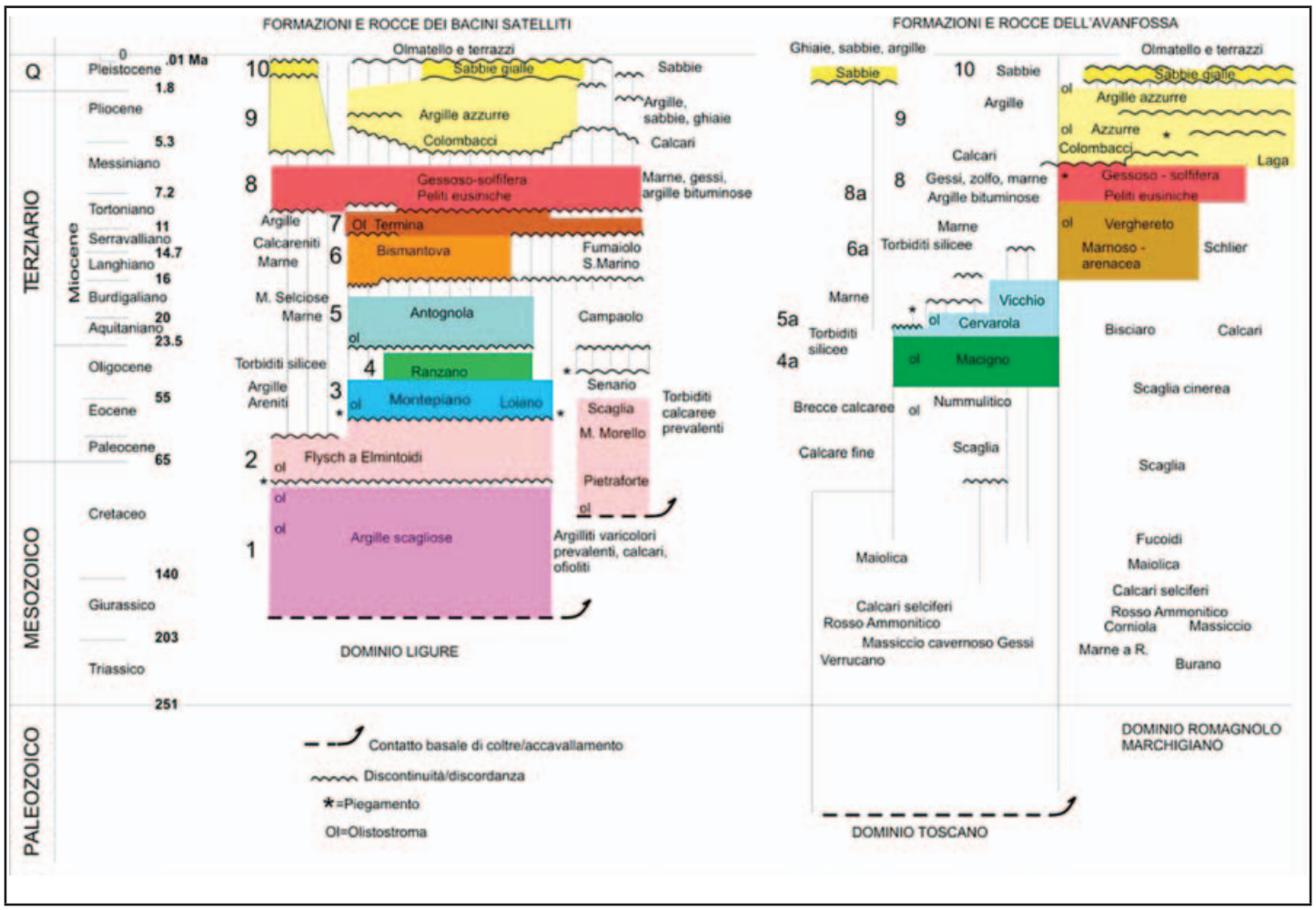
Bianconi was the most distinguished Bolognese geologist in the early 19th century, having discovered and first interpreted the *Argille Scagliose* in 1840. Before him, processes related to "will-o'-the-wisp" or "foolish fire" and natural outpouring of gas and oil very common in the Apennine were studied by Beccari and Alessandro Volta. Volta discovered the methane as a gas now forming in lake and marsh environments, and was able to extract a s a fossil fuel at the Raticosa Pass divide between Bologna and Florence.

Bianconi's pupil Giuseppe Scarabelli was a prominent scientific player in geology and pre-historical archaeology in the second half of the 19th century. He established in Imola the first geological and archaeological museum in Europe since 1857. In the same time, a leading Earth science organizer was Giovanni Capellini, who was given the first chair of geology, sponsored to Bologna by the new Italian government in 1860, when he was only 27 years old. Capellini's legacy is the geological museum bearing his name since 1911. It is the most important in Italy and a major one in Europe, acting today as a mean of scientific, historical, and cultural interaction in geologic risk mitigation, land use and protection, geosites and geoparks promotion.
Italian science and geology were disrupted by Napoleon's tornado over Europe, lost most of their international role that was saved by some leading individuals only (as for geology in this region were worth mentioning Pietro Doderlein, Carlo Fornasini, Michele Gortani, Franco Anelli). Geology was turning provincial until after the II World War, facing later a bloom in numbers, skillness, originality and international competition. Emerging scientists were Raimondo Selli, Giuliano Ruggieri, and Cesare Emiliani, broadening their influence through their schools rich of leading individuals and their frequent interactions with colleagues involved in the oil industry. As a consequence, the Emilia and Romagna geological research reached international relevance and recognition in stratigraphy and micropaleontology, marine geology, sedimentology of clastic (the concept of "turbidite" was born in the Northern Apennines), carbonate and evaporitic rocks, tectonics and sedimentation, applied geomorphology and speleology, Alps and Apennines geology, geology of the Palaeozoic, seismology and historical seismicity, seismic land classification, geological mapping, promotion of geosites and geoparks.

B. 2.2 - *Geology*

a) Regional frame

The Apennines as the Alps are mountain chains. Both are close and contiguous each other, but rather different. Like the Alps, the Apennines consist of a pile of *nappes*; each of them is a succession of strata of the same overall age but of different type, for having been deposited in different environments, and mechanically superposed each other. Unlike the Alps, the Apennines have no or low traces of metamorphism, bearing neither schistosity nor transformation of the original minerals in new ones as a result of heath, load, and stress. For example, the ophiolites (serpentinites, gabbros, basalts, often known as "devil's stones"), common in both the Alps and Apennines, appears to have been metamorphosed in the Alps (where new minerals have been formed when they have been buried in the bowels of the Earth under 50 to 10 km depth). The two Italian mountain chains have also different age of birth, with the Apennines still developing in the depth of the ocean when Alpine peaks were raised into the sky and produced a lot of detrital matter eroded and transported by rivers to supply new sediments to the growing Apennines. Within the long geologic time, the Alps are now a dismantling chain, whereas the Apennines are a still growing chain.
Almost all the rocks building the Northern Apennines have been produced within the sea over an oceanic floor of Jurassic age. A part of them, however, has been deposited over a flattened earlier Palaeozoic chain beginning with the Mesozoic Era, some 250 million years (Ma) ago. The chain marked the edge of this continental margin toward the ocean. Such a dual origin is characteristic of the Northern Apennines.



Stratigraphic correlation chart of the most important Formations outcropping in the Bologna (Ligurian and Tuscan domains) and Western Romagna (Romagna-Marche domain) Apennines.

The different rocks occurring at the top of the Earth crust are grouped into families, called *formations*, each one being named from its common rock type(s) and from the locality where the formation is best expressed and visible. The main formations of the N Apennines are listed in chronologic order in "Stratigrapic correlation chart", where those outcropping in the Bolognese (left) and Romagna (right) valleys are coloured. It is shown that most of the Bolognese mountains originated at the floor of the ocean called *Ligurian*, whereas the Romagna mountains formed over the part of African continental margin called *Adria* or *Adriatic microplate*. The Apennine formations are arranged in space from W (left) to E (right), in the way we believe they were located at the time of deposition/emplacement. Three main columns called *Ligurian*, *Tuscan*, and *Romagna-Marche* domains are shown from W to E. The Ligurian domain extended to the homonymous ocean. The Tuscan domain covered the submerged margin of the Adriatic continent. The Romagna-Marche domain occupied the submerged inner part of the same continent. Bold wavy lines limiting coloured formations indicate time of rock deformation gradually building the chain. Deformation phases were increasingly younger moving from W to E. Thus, the growing chain migrated in time toward the E, and involved new still undeformed areas. Sediments accumulated on the ocean floor were deformed earlier, followed by those on the continental margin.

The *Ligurian domain* was deformed through two severe late Cretaceous and early Eocene tectonic phases, which have attained the Argille Scagliose (AS) (violet) and the Helminthoid Flysch (HF) (pink). The HF, having escaped the first deformation phase, is visibly less fragmented than the AS, which underwent both phases. All later deformations of this body of rocks have been weaker and mostly vertical. As a result, bedded deposits of the *satellite basins* (called here *epi-Ligurian* because they overlie Liguride rocks derived from deformation of AS and FH) are not folded, have tabular setting, and are simply discontinuous in space. The oldest rocks of this section are the ophiolites (middle Jurassic) a trade mark of the N Apennines.

The *Tuscan domain* shows a succession of rocks beginning in the Paleozoic much earlier than and quite different from the Ligurian one. Its main deformation was much more recent and migrated in space and time from W to E and from early to late Miocene.

The Romagna-Marche domain is quite similar to the Tuscan one in its lower succession, whereas its upper part shows an analogue but delayed development. The two subdomains are closely bounded each other by their heterochronous foredeep deposits migrating

in time toward E with the outer margin of the chain.
The Liguirian and Tuscan domains are labelled at their bottom with arrows pointing up and eastward to signify the push on the Liguride deformed succession and its undeformed cover to overlap the Tuscan one, and both together to overthrust the Romagna-Marche succession. This process was completed with the Tortonian, although additional eastward translation of the uppermost Liguride nappe easy occurred in the subaqueous environment and in such a clayey matter.
Today the N Apennine arc is a mountain chain with *nappes* building its inner Tyrrhenian part and a thrust fan exposed in its outer Adriatic part. Three major flat-lying nappes are superposed each other in the inner SW part. From top they are called *Ligurian* (ophiolites and oceanic sedimentary rocks), *Tuscan* (calcareous rocks below and siliceous turbidite above), *metamorphic* (rocks that underwent high temperature and middle pressure) nappes. Toward NE, the three nappes together are thrust over a series of minor piggy-back thrust sheets common in the Romagna-Marche-Adriatic outer belt. At depth of some km in the SW section of the N Apennines the nappes have been intruded by granites related to a thermal dome which has supplied also the recent Tuscan volcanism and the present geothermal fields. The original triplet of nappes has been duplicated by late compression and dissected by recent extension (as in the Mugello, Casentino, and other intramountain basins). The N Apennine chain is still slowly growing and migrating toward NE.

b) Bolognese Apennine and Vena del Gesso in Western Romagna

This part of the N Apennines has the privilege to exhibit both Ligurian and Tuscan nappes together overthrusted upon the Romagna thrust belt. In a few valleys from Reno to Lamone river all different rocks and formations of the three domains are concentrated, which in origin were far apart each other. This is a unique place to read the fascinating histories of their deformation and assembly together. Formations coloured on "Stratigrapic correlation chart", which are characteristic of the Bolognese and adjacent Romagna mountains, are shortly described below with the aim to help this first reading.

The following simple or complex formations are well characterized *within the Ligurian domain* and related satellite basins.

Argille Scagliose (AS) (1)

AS consist of magmatic rocks of oceanic floor, called *ophiolites* (serpentinized peridotites, sheeted gabbros, pillow basalts and breccias, referred to as Steinmann's trinity), followed up by diaspers, chert, *Calpionella* limestone, black Palombini shales, varicoloured argillites, calcareous arenites, all of Jurassic to Cretaceous age. Their fine mud component has pervasive scaly texture as a result of tight-spaced shear stress (hence the name). Fossils are rare except for radiolarians, calpionellids, a few bivalves and fragments of ammonites, plus fossil traces of organisms feeding in and on the bottom mud. An exceptionally well preserved complete ammonite test of the middle Cretaceous *Anahoplites* genus, recently found S of Montovolo, is exhibited in the museum of Castiglione dei Pepoli. Many mountain chains have rocks with the same scaly texture, rock association, and genetic environment of the AS, as the Californian Franciscan nappes and mélanges, which have also the same age.

Helminthoid Flysch (HF) (2)

This is an old German name used for an equivalent formation of the Alps. It consists of late Cretaceous to early Eocene calcareous turbidites rich in fossil traces of organisms feeding on the sea-bottom mud, including the characteristic *Helminthoidea labyrintica*. This formation deposited in a very deep basin over the already severely deformed AS. This is witnessed by the highly tectonized to chaotic texture of the AS, whereas the HF even after deformation maintained the continuity of strata although involved in wide-angle folding, as shown by the so-called Monghidoro tabular and partly upside down block. This Eocene deformation attained the entire Ligurian domain producing a still submerged Liguride chain. The overlying epi-Ligurian deposits, still laid down in marine environment, have been weakly folded and later fragmented by vertical faulting.

Loiano (L) (3)

Mudstone (Emilia) and turbiditic siliceous arenites (Bolognese) of deep-sea environment unconformably overlie the Ligurides. To this and the following formations submarine slide deposits, called olistostromes, are often intercalated, marking intervals of tectonic instability of the basins and/or pulses in the Liguride orogen migration. Maximum thickness is about 700 m; middle Eocene to early Oligocene age.

Ranzano (R) (4)

Its deposits are more widespread westward in Emilia, also lying unconformably directly over the Ligurides. Thin siliceous turbidites of deep marine environment are common. Maximum thickness 200 m; early Oligocene age.

Antognola (A) (5)

This is the most widespread formation of the epi-Ligurian basins. The Burdigalian *marne selciose* member contains Oligocene to Miocene volcanoclastic rocks, quite common through the Mediterranean in this time span. Beside marls, a plenty of deep-sea rocks occur. Among them, the *Anconella Sandstone* is quite similar to the Loiano arenites. Maximum thickness up to few hundreds of m; late Oligocene to early Miocene age.

Bismantova (B) (6)

These deposits are less widespread than the previous, especially in the southern areas. Calcareous rocks of marine environment shallower than before are common; they are associated northward to other carbonate rocks of slope to basin environment. The overall shallowing depends on (1) local Burdigalian tectonics and (2) global Mid Miocene Climatic Optimum increasing carbonate productivity in both oceans and continental shelf, as seen also in the Vienna and other Paratethys basins. The well-known prominent cliff at Pietra di Bismantova is the historical stratotype of the lower part of this formation. Maximum thickness 400 m for the lower calcarenite part and 400 m for the upper marly part of the formation; middle Miocene age. A collection of megafossils of B from the Monte Vigese and Montovolo geosites is on display in the Castiglione dei Pepoli museum. The Bismantova calcarenite (especially known the *Montovolo Stone*) has been used for tools, sculptures, and buildings since the copper age.

Termina (T) (7)

The marly deposition of the upper B continues, with addition of few dolomitic limestone layers. Sandy intercalations bear frequent globular concretions of diagenetic origin (centrifugal cementation by pore fluids around cristallization nuclei). Maximum thickness about 200 m; latest Serravallian to Tortonian.

Within the Tuscan domain rocks and formations deposited in the inner and early foredeep are mainly the following.

Macigno (M) (4a) (a chronologic equivalent to the Ranzano Formation)

This is a historical name dating back to Aldrovandi, including also the Modino and Falterona formations mapped in the surrounding areas to the W and the E respectively. It consists of siliceous arenitic turbidites of late Oligocene to early Miocene age building a rock body with maximum thickness over 2 km in Tuscany. Such a great thickness indicate the first occurrence of a N Apennine foredeep supplied by detrital flows eroded from the first Alpine cordilleras. A *Lucina* fauna from the Grezzano geosite is exhibited in the Castiglione dei Pepoli museum.

Cervarola (C) (5a) (a chronologic equivalent to the Antognola Formation)

This is a secon large turbidite rock body suggesting the eastward migration of the N Apennine foredeep during the early Miocene. The turbidites are siliceous with rare carbonate intercalations. The granular detritus was supplied from NW by erosion of the widely emerged Alps. Maximum thickness over 3 km; early Miocene age. The *Lucina* fauna from the Suviana Lake on display at the Castiglione dei Pepoli museum is a stratigraphic equivalent to the *Lucina* fauna described by Giovanni Capellini in 1881 from Monte di Stagno, Baigno, and Monte Cavallo di Granaglione. Sandstone layers of this formation, the most widespread in the high Bolognese Apennine, have been used in the past in the superb and well preserved popular architecture of the mountain country.

Within the Romagna domain rocks and formations deposited in the outer and late foredeep are mainly the following.

Marnoso Arenacea (MA) (6a) (chronologic equivalent to the Bismantova Formation)

This is the most widespread and thickest of the turbidite rock bodies of the N Apennines. It represents a further eastward migration of the Apennine foredeep during middle Miocene. It is a wedge-like rock body, over 4 km thick, traceable from Gubbio in the Marche to the Santerno and Sillaro valleys, where it plunges beneath the Ligurides with their epi-Ligurian cover, down to 4 km depth, and raises again to the surface near Salsomaggiore. The turbidites are mainly siliceous (with Alpine granular supply from NW), with some tens of calcareous beds (mud supplied from the Latium and Abruzzi shallow-water carbonate platforms and transported from SE), and rare hybrid beds, like the famous very thick Contessa marker bed. Middle Miocene age. Fossils and sedimentary structures of this formation were first illustrated by Leonardo da Vinci in drawings and paintings. MA has been the focus of thousands of sedimentological and stratimetric studies from authors of any part of the world in the last decades.

Within all the domains and satellite basins beginning with late Tortonian, lateral differences of rocks and formations are so much decreasing that for simplicity basic information can be lumped in a unique succession as follows.

Peliti Eusiniche, Gessoso Solfifera, Colombacci (PE GS CO) (8+8a)

Anywhere in the Apennines from 8 to 6 Ma marine Euxinic Pelites were deposited. These are finely bedded and laminated, often black bituminous, fish-rich shales (about 30 m thick, late Tortonian to early Messinian in age). Biotitic-rich tephras at the base of the Romagna Vena del Gesso evaporite sequence have contributed to duplicate the short duration of the Messinian Stage in the 1990s.
The selenitic coarse-crystal facies of the GS is prominently exposed in the Vena del Gesso basin sequence (up to 250 m thick, early Messinian in age), the epi-Ligurian basin at the front of the Apennine (Vezzano, Albinea, Zola Predosa, San Lazzaro), and the intra-Apennine Marecchia basin. The remaining epi-Ligurian basins are not provided with the GS. The Mediterranean sea-level fall during the Messinian Salinity Crisis, in fact, isolated the Termina basin in the Bolognese and Emilia areas, while maintaining a connection with the epi-Ligurian Marecchia and front-Apennine basins.
The CO (few m thick, late Messinian in age) are markedly unconformable over the GS as an effect of the intra-Messinian tectonic phase. In this area the CO additionally lacks of more than its lower half cyclic succession. The CO yielded a rich continental vertebrate fauna of late Messinian age transported into the brackish water of the CO in the Monticino geologic open air museum near Brisighella (geosite n. 53). This formation is present also in the epi-Ligurian basins at the front of the Apennines and in the outer limb of the intra-Apennine Bologna basin.

Argille Azzurre (AA) (Blue Clay) (9)

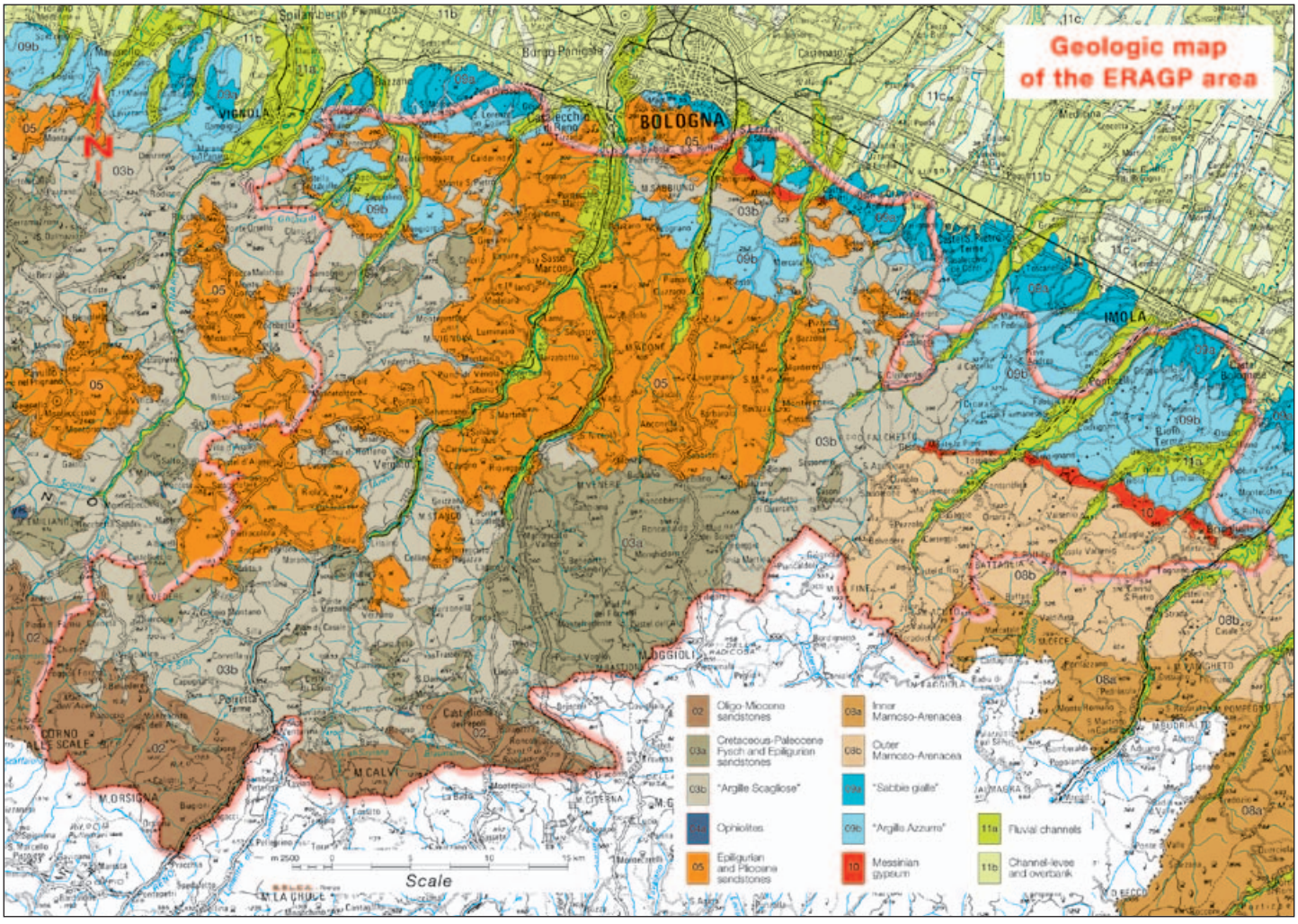
Deep marine blue clay with some fine grained turbidites are common in the inner Romagna domain (Imola and Faenza area) spanning the whole Pliocene and early Pleistocene interval up to the Sicilian, with a thickness of more than 2.5 km. Their name dates back to Leonardo da Vinci. The epi-Ligurian intra-Apennine Pliocene basin, instead, was filled with two sedimentary cycles (about 800 m thick) passing from continental gravel to blue marine clay. This basin was an internal embayment partly connected with the open Adriatic sea through a drowned swell during part of the Pliocene and Pleistocene.

Sabbie Gialle (SG) (Yellow Sand) (10)

These littoral deposits mark the latest marine transgression at the foot of the newly emerged N Apennine. Moving eastward, the sand body is younger in age and composed by two cycles; the second being unconformable is known as the *Imola Sand*. Maximum thickness 40 to 50 m; age varying from late Early Pleistocene to Middle Pleistocene.
This string-like coastal body is uniform independently from the underlying deposits of the different domains. It is followed by continental gravel, sand and loam known as Olmatello Formation and intra-valley terraced plus alluvial fan deposits at the plain margin.

Geologic landscapes

Finally, distinct *dominant geologic landscapes* are directly related to the various stratigraphic successions and structural styles found in the area.
The southern part of the Bolognese Apennine, from the Tuscan border to Castiglione dei Pepoli, is dominated by the well bedded siliceous turbidites of the Tuscan domain (*Cervarola Sandstone*). They are beautifully exposed in the steep E slope of the Corno alle Scale (1945 m). The sandstone usually hosts a tight forest well supplied by hundreds of small springs.
Two contrasting geological landscapes alternate in the central part of the Bolognese Apennine. Valleys and depressions are carved into the soft dark *Argille Scagliose*, rich of lithic blocks, disrupted, often chaotic, prone to landslide and devoid of vegetation. Reliefs and mountains, instead, are flattened, made by tabular plates of well bedded calcareous turbidites (as Monghidoro) of the Ligurian domain, known as *Helminthoid Flysch*. Also these turbidites are tightly forested as a result of numerous small springs.
A more varied geologic landscape is available in the N part of the Bolognese Apennine, with Argille Scagliose still confined in the bottom of the valleys and often buried by isolated or coalescent, steep-walled mountains of *epi-Ligurian deposits*. These have tabular setting and marked, often thick bedding.
The Romagna mountains have a bipolar geologic landscape N and S of the magnificent Vena del Gesso erosive rise dividing the regularly bedded pattern of the forested *Marnoso Arenacea* turbidites to the S and the spotted dry geologic landscape of the *Pliocene to Pleistocene badlands* (*calanchi*) to the N.



Geologic map of the ERAGP.

B. 2.3 - *History of geomorphological research*

The first geomorphological investigations in the study area regarded mainly the ancient development of glaciers and the origin of lakes. The Authors who dealt mostly with these topics were DE STEFANI (1874 and 1883), SACCO (1893), ANFOSSI (1915), SESTINI (1936) and, in particular, LOSACCO (1949 and 1982). The latter carried out an in-depth morphological and paleogeography study of the territory between Mt. Ragola (Piacenza Apennines) and Mt. Corno alle Scale (Bologna Apennines). The more recent of these articles is accompanied by several schematic geomorphological maps and some tables on the glacial stages of the LGM. A more recent publication on all the upper Emilia Apennines deals with a geomorphological study carried out in order to identify an area where a natural park could be established (CARTON & PANIZZA, editors, 1988). This publication is supplied with a 1:100,000 scale geomorphological map of the whole study area and numerous other 1:25,000 scale geomorphological maps concerning some of the most significant sectors.

Another research topic deals with landslides, which have long been frequent in the mountains and hills of the Emilia-Romagna region. The first historical evidence of mass wasting goes back to the 12th century, and numerous chronicles bear witness to ancient episodes and repeated reactivations of slope movements at more or less long intervals. Systematic investigations were carried out, among others, by SANTI (1897) and mainly by ALMAGIA'(1907). The most recent research was implemented by the Mapping and Geological Service of the Emilia-Romagna region (BERTOLINI *et al.*, 2001; Servizio Geologico, Sismico e dei Suoli, Regione Emilia-Romagna, 2012).

A very high number of publications deal with specific problems (e.g. badlands, river morphology, selective erosion landforms, etc.). Among all these, worthy of note are the articles on geomorphological survey and mapping carried out by the National Geomorphology Group (GSUEG, 1976; GRG, 1982).

Another field of investigation was dedicated to karst processes and forms. The gypsum formations of Emilia-Romagna were the first to be the object of scientific investigations worldwide (ALDROVANDI, 1648) and at present they are still the most studied in the world, with a bibliographic index of over 2000 titles. Within these gypsum formations, the largest meteoric caves in the World can be found (Spipola-Acquafredda karst system) together with some of the most important underground cavities for the study of gypsum speleogenesis (Grotta Novella, etc.). General articles for obtaining all necessary information on gypsum karst areas of Emilia-Romagna and, in particular, with regard to the Geopark project, can be found in: ALTARA *et al.* (1995), LUCCI & ROSSI (editors, 2011) and AGOLINI *et al.* (2012).

B. 2.4 - *Geomorphology*

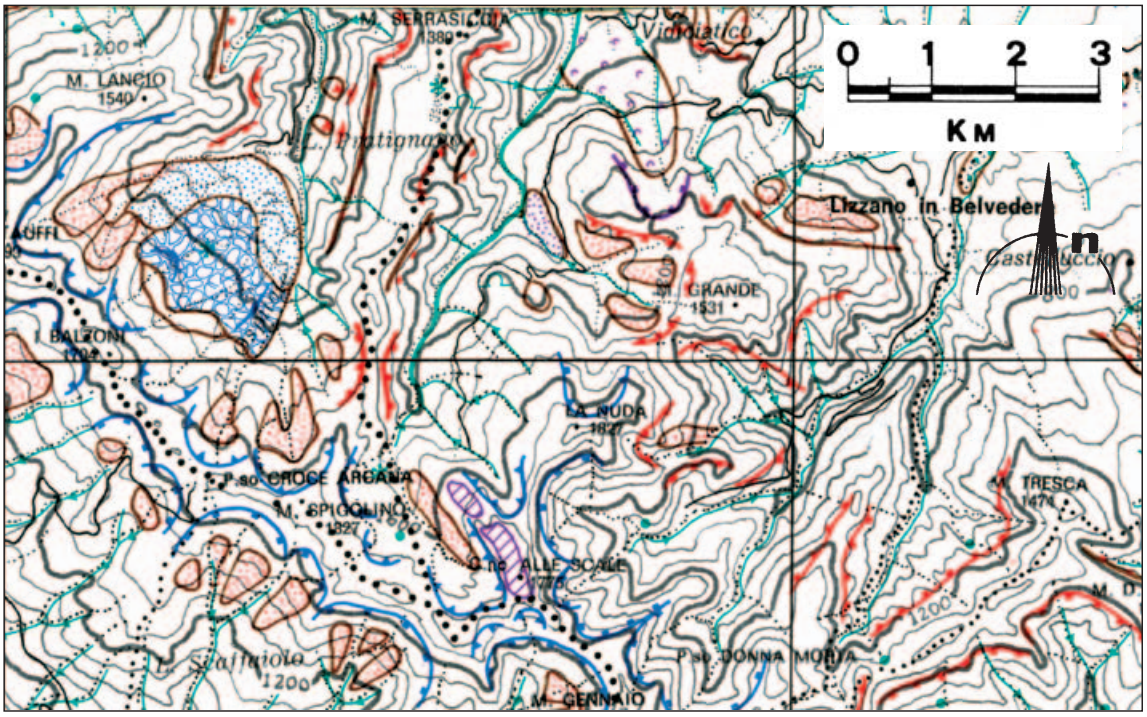
The Emilia-Romagna Apennines

a) Regional frame

The Northern Apennines between Mt. Penice and the River Marecchia is an axial mountain chain stretching from WNW to SE, with a series of transversal ridges which descend gradually, though irregularly, towards the Po plain and the Romagna plain: from the River Trebbia as far as the River Marecchia.
A peculiarity of the axial zone of the Emilia sector of the Apennines is given by the fact that the highest peaks (Alpe di Succiso, 2017 m, Mt. Cusna, 2120 m, and Mt. Cimone, 2165 m) do not coincide with the Tuscan-Emilia watershed but are set more to the north. This should be related to the tendency of the chain and its axis to shift towards NE.
Another typical characteristic of the summit area of the Emilia Apennines is witnessed by the numerous forms resulting from ancient glacial modelling: cirques, glacial valleys, moraine arches, *roches moutonnées* etc. All these make up a set of relict landforms related to a morpho-climatic environment quite different from the present one, when numerous glaciers were set at the heads of the valleys and some of them stretched their tongues for long distances downstream. Examples are offered in the areas surrounding the villages of Corniglio (Parma valley), Febbio (Secchia valley), S. Anna Pelago (Scoltenna-Panaro valley) and Madonna dell'Acero (Dardagna valley). This glacial modelling took place during the last great Ice Age, some 75,000 to 15,000 years BP. These relict landforms have been well preserved especially in the upper valleys of the rivers Nure and Ceno and in those between Mt. Orsaro and Mt. Corno alle Scale, thanks mainly to their geological constitution, capable of resisting the subsequent erosion processes. East of Mt. Corno alle Scale, towards the Romagna Apennines, there is no trace of glacial morphology, since the mountain peaks were too low for the onset of glacial morpho-climatic conditions.
Unlike the Alpine chain, in the Emilia Apennines there are traces ascribable to the last Ice Age only, although isolated moraine

remnants have been hypothetically attributed to a possible previous Ice Age, corresponding to the Riss in the Alps. The lack of evidence of this glacial period could be attributed to two factors: i) the fast degradational processes, determined mainly by the high erodibility of the rocks, which could obliterate the forms and deposits of previous morphological processes; ii) the altitudes of the Apennine crest, which in that period were not sufficiently high to allow the formation of a glacial morpho-climatic environment.
In the upper Emilia Apennines small lakes are quite frequent, most of which are of glacial origin as they are set in cirque troughs or are barred by moraine arches. Among these, worthy of note are Lake Nero (in the province of Piacenza), Lake Santo (in the province of Parma), Lake Cerretano (in the province of Reggio Emilia) and Lake Baccio (in the province of Modena). Other lacustrine basins have a more complex origin, as Lake Santo Modenese, which was formed in correspondence with a tectonic dislocation and was later remodelled by glacial exaration processes, or Lake Pratignano, along the border between the Modena and Bologna Apennines, which occupies a depression due to summit gravitational processes.
In the Emilia-Romagna Apennines some so-called relict surfaces are found. They are morphological units characterized by low relief energy, bounded by scarps or acclivity changes, mostly ascribable to frost creep, which were dissected by erosional processes and still bear witness to ancient landscapes.
Talus fans are typical high mountain forms, partly relict and partly active, which are being formed at the foot of steep rocky slopes due to the accumulation of debris produced by rock shattering processes due to frost-thaw actions.
This high-mountain zone tapers towards the Romagna Apennines and is bounded to the north by a mid-mountain belt, corresponding more or less to the cropping out area of the so-called “Argille scagliose” (mélanges and block-in-matrix clayey formations). The latter are juxtaposed or overlapped by generally more compact rocky formations, such as arenaceous-marly blocks, calcareous-arenaceous slabs, fragments of igneous rocks etc. The resulting selective morphology is mainly made up of rounded and monotonous rumps or low-acclivity slopes, interrupted by massive, isolated slabs surrounded by steep slopes, as Pietra di Bismantova (in the Reggio Apennines), or by rocky steeples or large boulders as Mt. Nero (in the Parma Apennines) or Mt. Sasso Tignoso (in the Modena Apennines), or sharp towering rock blocks, such as Sassi di Rocca Malatina (in the Modena Apennines) or Sasso di Vigo (in the Bologna Apennines). On the summit of some of these rocky rumps medieval castles were built, as in Bardi (in the province of Parma), Rossenna (in the province of Reggio Emilia) and San Leo (in the province of Rimini).
A negative peculiarity of the Emilia mid-Apennines is given by the high frequency in time and space of mass wasting phenomena: a large part of the slopes is indeed affected by slope movements of various kinds. This is mainly due to the prevalently clayey nature of the rocks as well as their jointing, tectonic setting and climate characteristics, with intense precipitation in the springtime and autumn. Finally, human intervention should not be ignored since various anthropogenic activities in the past have caused instability situations on vast slope surfaces, such as deforestation or slope cuts for engineering works. Owing to all these characteristics and processes, the Emilia Apennines is to be numbered among the most landslide-prone regions in the world.
Earth flows-earth slides are the most typical kinds of landslide to be found in this region. Clayey soils can absorb plenty of rain or spring water until they become plastic or liquid, giving rise to long landslide bodies up to several kilometres in length. Other frequent landslide types are rotational or translational slides. As typical examples of these slope movements, worthy of note are the large landslides in the Secchiello valley in the municipality of Villa Minozzo (province of Reggio Emilia), which originated from the ridges of Mt. Penna and Mt. Torricella. Also the translational slide of Cerredolo (province of Reggio Emilia) of 1960 should be mentioned. Its large landslide body moved along the right hydrographic slope of the Secchia valley until it barred the riverbed, thus originating a barrier lake some 191 ha wide. Generally speaking, translational slides along steep surfaces of rupture, often constrained by faults, are quite common in the Marnoso-Arenacea Formation of the Romagna Apennines.
Indeed, landslides in the Emilia Apennines create considerable problems for the local economy and, also for the entire region, to the point that many inhabited centres were destroyed and rebuilt several times. Among the most famous cases, Bettola (1800) , Baiso (1895) and Succiso (1951) in the Province of Reggio Emilia, Lama Mocogno (1650, 1879) and Sant’Anna Pelago (1886) in the province of Modena, Mercatelle di Camugnano (1851) in the province of Bologna, Torretta in the district of Faenza and Rocconi in the province of Forlì-Cesena should be mentioned.
Badlands are typical slope degradational landforms particularly widespread in the foothill area and on the low reliefs of the Apennines, where the Plio-Pleistocene grey-blue marine clay formation crops out. The steep, bare badland slopes are caused by rill-wash erosion which has formed vast systems of very narrow small valleys separated by thin crests, usually organized in a herring bone, radial or parallel-line pattern. The most typical badland sites are found in Castel’Arquato, Salsomaggiore, Quattro Castella, Sassuolo, Vignola, Passo dell’Abbadessa (near Bologna) and the vast bare areas south of Imola and Faenza.
Mud volcanoes (locally known as “salse”) are typical features of the Emilia Apennines which create a very peculiar morphology. The Nirano mud volcanoes, in the province of Modena, are well known and others are found in the hills of Bologna and Imola. They are the product of pseudovolcanic activity consisting in the emission of liquid and gaseous hydrocarbons mixed with cold, salty muds. They develop as cone-shaped vents or mud pools and are often located on top of recent sedimentary formations, where high

pore fluid pressures are found. These high pressures are created because the fluids contained within the sediments find it difficult to escape towards the surface, especially when the rock types are mainly argillaceous, that is, nearly impervious. Nevertheless, if the latter are affected by joint systems, as in the case here discussed, the fluids take advantage of these weaker surfaces and rise to ground level. Eventually, the whole area where these cold emissions are active tends to subside.
Also karst morphology, with its particular features, is typically found in various areas of the Northern Apennines. Gypsum and limestone formations and occasionally other rock types such as calcarenites etc., have been modelled according to particular erosion forms on the ground surface (limestone pavements, sinkholes, ponors, etc.), or within underground cavities (caves). On the other hand, owing to chemical precipitation, there are deposition processes with typical forms affecting underground cavities (stalactites and stalagmites), but also at ground surface (travertine deposits).
These morphological features are common in the Triassic Gypsum Formation of the Secchia valley and, in particular, at the karst water springs of Poiano (Province of Reggio Emilia). The Miocene calcareous-arenaceous rocks, such as those cropping out near Pavullo nel Frignano (Province of Modena), show a less developed karst topography, with doline-like depressions and small caves which have been conditioned also by tectonic and gravitational phenomena. Large, deep sinkholes and fully developed karst systems are found in the Messinian gypsum of the Reggio Emilia province and especially in the Bologna Province and in the Vena del Gesso Romagnola.
The Romagna Apennines show a more harmonious landscape with respect to the Emilia Apennines, which is mainly the result of their geological characteristics. In Romagna rock types are characterized by alternating arenaceous and marly layers. Whereas the former are more coherent and compact, the latter are more easily eroded. This typical Romagna formation is in fact known as “Marnoso-arenacea” (marly-arenacea formation). Only the foothill belt is made up of clayey soils which are quite similar to those cropping out at the northern margin of the Emilia Apennines. In between these two formations, a third one is interposed which transversally cuts through the Apennine valleys: it is named “Vena del Gesso”.



Geomorphological sketch of a sector of the high Emilian Apennine, with the ERAGP territory

Glacial landforms	River landforms	Gravitational landforms
Structural landforms	Periglacial landforms	

b) Bolognese Apennine and the Vena del Gesso in Romagna

In the province of Bologna all the particular processes and deposits of the Northern Apennines are more or less found: structural morphologies as well as glacial, landslide, river and karst landforms.
Among the former, the left flank of the Dardagna valley makes up a typical feature since it was formed on a monocline arenaceous structure; also the NW-dipping wide flat was developed on layer surfaces of the "Macigno" sandstone formation.
Also glacial morphology is well developed in the Dardagna valley: the head of the Corno alle Scale corresponds to a large and well preserved cirque, whereas the valley floor is covered by the resulting moraine deposits as far as Madonna dell'Acero, at the altitude of 1725 m.
Moreover, in this area a high number of landslide bodies, both active and dormant, is found, some of which are of considerable extension. Among these, worthy of note are the deep-seated gravitational slope deformation found at Bagnadori, at the foot of Monte la Nuda.
Morphological features resulting from differential erosion are particularly evident, such as well-developed bluffs in correspondence with the Contrafforte Pliocenico and the Bologna gypsum formation and, to a greater extent, the Vena del Gesso in the Imola and Faenza districts.
The whole area is characterized by well-developed badlands, which in the Bologna province are mainly found in the "Argille Scagliose" clayey formations. These areas were already known and exploited in ancient time thanks to the presence of minerals such as pyrite, marcasite, native copper and baryte. The latter is found in both the fibrous-radiating form and in euedral crystals inside septarian concretions. Baryte, which was also known as "Bologna Phosphoric Stone", induced Goethe himself to describe the Bologna badlands in his famous book "*Italian Journey*".
The Pliocene badland areas are very rich in fossil remains such as: shark teeth, whale fin bones, silicified tree trunks, fish, leaves, tree stumps etc.
In various areas the emergence of thermal-mineral waters and other fluids is observed. They give rise to both hot and/or sulphureous springs (Porretta) and mud volcanoes, as near Monterenzio (Salsa del Dragone cited by Calindri in his Dizionario Corografico and other active "slase" between Castel San Pietro and Imola). The emergence of deep waters has also caused, especially in Labante, the deposition of large amounts of travertine, which host the largest primary caves formed in this particular kind of limestone in Europe.
Gypsum karst phenomena, though, remain the most important and interesting geological characteristic of this area. From the surface viewpoint, there are external morphologies like large sinkholes (up to over 500 m in diameter and 100 m in depth), blind and closed valleys, among which the vast canyon (500 m wide) found at the exit from "Grotta sorgente del Rio Basino" is worthy of note, being of great ecological importance. Among small landforms, mounds or detachment ridges should be quoted. They are found in the gypsum formation in both the Bologna and Romagna Apennines. In particular, the "candles" or deep dissolution furrows due to rill-wash were the first gypsum karst forms to be described in the world by Capellini in 1872.
Among karst hypogean systems, it should be noted that in the province of Bologna there is the largest gypsum karst system in the World, which was formed by the percolation of rain water in the ground: the Spipola-Acquafredda system, with over 12 km of caves. In addition, in the district of Faenza some of the deepest gypsum caves are found, such as the Abisso Acquaviva and Abisso Fantini. Many of the most characteristic morphological features of this kind of karst morphology have been studied in these areas, where their most typical expression is found: the "paragenetic tunnels". Furthermore, very recently, the best example of intra-Messinian fossil karst morphology in Europe was found inside the Gypsum Cave of Zola Predosa (geosite no 28).
From the mineralogical viewpoint gypsum caves are very important both for the incredible variety of secondary gypsum crystals they host, and also for the presence of ephemeral and rare minerals such as epsomite and mirabilite (Pelagalli Cave at Farneto). An exceptional mineralogical feature of this area is the presence of secondary skeleton quartz on gypsum in a cavity of Monte Mauro. From the paleontological viewpoint the karst phenomena of this area have provided fundamental materials for both the Messinian (fossil ponor of Monticino quarry in Brisighella, geosite no 53) and the Mid-Upper Pleistocene (ponor of Filo quarry and Calindri cave in San Lazzaro di Savena).
Finally, the gypsum caves are of paramount importance from the archaeological standpoint since they have allowed prehistoric reconstructions from the Chalcolithic onwards (Farneto and Calindi Caves in the Bologna province and King Tiberius Cave in the Faenza district).

Geological and geomorphological karst area between the Savena and Zena valley.

c) The "Croce Arcana Map"

In the past the ERAGP area played a very important strategic and political role owing to the presence of mountain passes between Emilia and Tuscany which were highly frequented with rich high-altitude pastures, as witnessed by the "Croce Arcana Map" (BADIALI, 2012). This ancient map, preserved at the State Archives of Modena (Mappario Estense, Serie Generale 104), can be defined as an *ante litteram* excursion-geomorphological map. It was produced at the Estense court in Ferrara around 1480, according to the style patterns used by the most important painters and illuminators of the *Officina Ferrarese* (Ferrara school of art). The map was made using tempera colours on parchment and it measures 49x57 cm circa. By means of an unusual centrifugal "fish eye" perspective, it depicts the high Bologna and Modena Apennines between Mt. Corno alle Scale and Mt. Cimone, with the valleys of the torrents Dardagna and Ospitale. The cardinal points have been inverted (the south is upwards).
All the main place names of the area are reported, as well as the Tre Termini and Croce Arcana mountain passes and the roads leading to them. On the top left of the map, between Mt. Corno alle Scale and Croce Arcana, an area affected by landslides is depicted. It is represented by dark stripes which interrupt the important road leading to the Tre Termini pass. Differences in altitude are represented by different types of vegetation covers and rocky layers on the highest peaks. Similarly to present-day excursion maps, it shows the signs of intense folding, witnessing the use in the field that was made of this pictorial document.
This map is therefore based upon direct and in-depth investigations carried out over the territory. Furthermore, the choice of the elements represented shows that its purpose was to provide the traveller with precise information on the positive and negative aspects of the different communication routes towards the passes of the Apennine watershed. Indeed, in the Geopark territory there are important routes going over mountain passes which are indispensable for present-day communications and trades between Emilia and Tuscany. They were already in use in pre-Roman times and assumed a strategic role in the Middle Ages and in the following centuries. Furthermore, the public use that was made of large mountain pastures was a reason, already in the Middle Ages, for frequent controversies amid local communities, although the intense pasture exploitation of the soil could have a negative influence on slope stability.
This map is therefore a document of paramount importance also for the history of cartography. It bears witness to the early awareness on the negative influence of disarray phenomena on the state of the roads and communications. It also testifies the strategic importance of the Northern Apennines which were at the centre of the political and economic interests of the Estense rulers.

Croce Arcana map: *ante litteram* excursion-geomorphological map.

B. 2.5 - *Geodiversity: the key of description and assessment*

Starting from the definition of Landscape (European Landscape Convention, 2000) and of Geoheritage (European Manifesto, 2004), Geodiversity is defined (PANIZZA, 2009) as the critical and specific assessment of the geological features of a territory, by comparing them in an extrinsic way (with other territories) and in an intrinsic way (in the territory itself), taking into account the scale of investigation, the purpose of the research and the level of scientific quality.

It should be noted that some authors consider the number and variability of geological elements to be the basic parameters on which the quantitative and qualitative assessment of geodiversity should be founded; they also use mathematical indexes and formulas. This procedure can be considered as a mere statistical elaboration of geological data which, in most cases, had been previously collected: it seems an unfruitful exercise, simple spatial statistics that add nothing either from a conceptual viewpoint or regarding content.

The concept of geodiversity cannot be univocal: the whole set of all geological data of the study area should be critically assessed, by comparing them with those from other territories (in an *extrinsic* way) and with each other of the territory itself (in an *intrinsic* way), in order to evaluate their specificity and, therefore, their geodiversity. The scale of the investigations should be taken into the right account and the level of their scientific quality assessed. A proper choice of the geological elements to be examined and evaluated in a specific way, in particular for applied purposes, might be important. Practically, it is a matter of carrying out original research, finalized each time towards well-defined goals, by avoiding statistical elaborations which are only an end in themselves.

With reference to the above defined concepts, the various types of geodiversity in the Bologna Apennines, at different scales of representation, can be illustrated.

In the case of ext*rinsic geodiversity,* the ERAGP area can be considered as an exemplary case in the Apennines owing to its typical geological features: it is in fact an educational example for illustrating structural-tectonic evolution and stratigraphic-sedimentological sequences in this chain, compared with other mountains in the world. These are indeed sites of international value, which bear witness to some of the most significant tectonic and stratigraphic events in the geological evolution of our planet. Other characteristics of the extrinsic geodiversity are related to epigean and hypogean karst landforms: the Labante and Spipola-Acquafredda caves should be quoted; the former is in travertine whilst the latter is in gypsum and they both are among the most important and studied caves in the World.

On the other hand, *intrinsic geodiversity* concerns first of all the complexity and variety of geomorphological features: LGM glacial and periglacial landforms, landslides, badlands, cuestas, tafoni, waterfalls, meanders, mud volcanoes etc. In particular, the spectacularity of badlands and the high frequency of landslides are also a sort of open-air laboratory for investigations on their evolution and, in some cases, on their hazard. Other characteristics of intrinsic geodiversity are related to mineralogy (e.g., etching- and skeletal-crystal quartz, gypsum, documentation on the Messinian Salinity Crisis in the Mediterranean Sea, or barytine, which Goethe defined as *phosphoric stone*), or petrography, such as the ophiolites (known also as the *Devil's stones*) or paleontology, including some specific types of vertebrate and invertebrate fossils.

It can be observed that, considered from the standpoint of *geodiversity*, the ERAGP territory shows a multifaceted and complex image, depending on the various points of view of scientific observation. In order to carry out a through territorial analysis, it is therefore of paramount importance to first chose the goals of our investigations and, consequently, the most appropriate conceptual and methodological path.

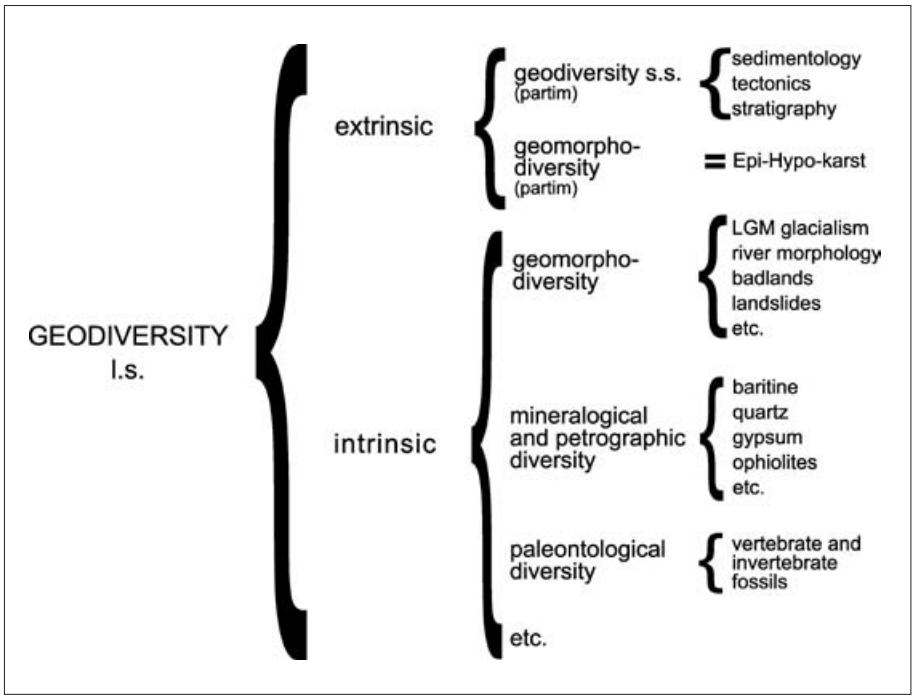


Diagram of Geodiversity.

B. 3 - Listing and description of geological sites within the proposed Geopark

B. 3.1 - *Census and filing*

The Geological and Soil Survey Service of the Emilia Romagna Region carried out the first systematic census of the Emilia Romagna geosites, following the Regional Law no. 9 - July 2006, that recognize the role of the Survey and of the Speleological Federation as responsible for the promotion and valorisation of the geological heritage. During this first census, 711 "geological heritage elements" and 775 caves were detected as: "the sites that preserve the most important evidence of the geological and geomorphological Emilia Romagna history", following the ISPRA and ProGeo guidelines. Between these, 141 have been selected as "Regional geosites", valorised by the Region, the Parks authority and local Institutions (geological paths, exhibitions, museums leaflets, etc.). The data base of the E.R. Geological Map (1:10.000) is a result of several updates that have been made by the Geological and Soil Survey Service of the Emilia Romagna Region since 2003. Through a Web GIS program is possible to get the detailed description of the geosites, a geological detail map and a picture.

The census and filling of the ERAGP geosites list, was prepared following the same criteria (ISPRA and ProGeo) of the Regional database. The methodology has been completed following other scientific researches (e.g.: PANIZZA & PELLEGRINI, ed., 1999; PIACENTE & CORATZA, ed., 2005). The Scientific Committee selected 47 single or group of geosites between the most significant for the ERAGP census: these are insert in as much forms. 10 new geosites have been chosen with specific characteristic that integrate the different geo-scientific and cultural aspects. The Scientific committee set up an original description underlining the characteristic mentioned above, the holistic approach and the geodiversity values (extrinsic and intrinsic).

The description of each ERAG geosites include 5 main categories:

1. **Location:** Region, Province, Municipality, Sector (low Apennine: until about 500 m a.s.l; medium Apennine: from about 500 m to about 1000 m a.s.l; high Apennine: from about 1000 m a.s.l.), Altitude (rounded to 5 m).
2. **Interest**: Scientific interest (mainly for Earth sciences), Contextual interest, Key words, Geological contest, Rarity in Regional contest (low, medium high), level of interest (regional, national, international, "local" interest is not examined).
3. **Conservation status** (data from the census of Emilia-Romagna Region): Level of protection (none, fair, good), Probability in human impact (none, medium, high), probability of natural deterioration (none, medium, high).
4. **Geological and environmental description** (synthesis of the main characteristics).
5. **Geodiversity and level of interest** (following the adopted and explained criteria).

The attachment "a" contains: 1 - the list of the 57 selected and descripted ERAGP geosites; 2 – the geosites from the Regional database and comprised in the ERAGP area, plus the 10 new geosites. The same attachment contains the 48 cards with the detailed description of the 57 selected ERAGP geosites.
The Table A (page 25) summarizes the main characteristics of the 57 selected ERAGP geosites.

ERAGP GEOSITES		INTEREST		GEO-DIVERSITY	SECTOR of the Apennine
N.	Name	Level	Type		
1-2	Upper Dardagna valley	Nat.	Geom. , Veget.	intrinsic	High
3	La Possessione	Nat.	Geom., c.Land.	intrinsic	High
4	Quartz of Porretta	Int.	Min., Petr.	intrinsic	Low
5-6	Brasimone gorge	Nat.	Geom., Struct.	extrinsic	Medium
7	Serra del Zanchetto	Nat.	Min., Petr.	intrinsic	Medium
8	Rocca Corneta	Nat.	Struct., c.Land.	intrinsic	Medium
9	Sasso di Rocca	Nat.	Petr., c.Land.	intrinsic	Medium
10	Rocca Pitigliana	Nat.	Geom., c.Land.	intrinsic	Medium
11	Affrico landslide	Nat.	Geom., c.Land.	intrinsic	Medium
12	Soprassasso	Nat.	Geom.	intrinsic	Medium
13	Labante cave	Int.	E.-H.-karst, Petr.	intrinsic	Medium
14	Sasso Baldino	Reg.	Geom.	intrinsic	Medium
15	Sasso di Vigo	Reg.	Geom., c.Land.	intrinsic	Medium
16	Monte Vigese & Montovolo	Reg.	Strat., Struct.	intrinsic	High
17	Rupe di Calvenzano	Reg.	Sedim., Veget.	intrinsic	Medium
18	Val di Sambro landslide	Reg.	Geom.	intrinsic	Medium
19	Balzo dei Cigni	Reg.	Geom.	intrinsic	Medium
20	Castel dell'Alpi landslide	Reg.	Geom., Struct.	intrinsic	Medium
21	S.Zenobi & Mantesca ophiolites	Int.	Petr.	intrinsic	Medium
22	Moraduccio waterfall	Int.	Sedim.,Geom.	extrinsic	Low
23	Tole'	Nat.	Geom.	intrinsic	Medium
24	Balzo dei Rossi	Reg.	Strat., Geom.	extrinsic	Low
25	Castello di Serravalle	Reg.	Geom., c.Land.	intrinsic	Low
26	San Teodoro badlands	Nat.	Petr., Geom.	intrinsic	Low
27	S.Lorenzo etc. fossil whales	Int.	Paleont.	extrinsic	Low
28	Zola Predosa gypsum	Int.	Min., E.-H.-karst	extrinsic	Low
29	Ca' Monari Lagune	Reg.	Paleont., Strat.	intrinsic	Medium
30	Rupe del Sasso & Sasso di Sopra	Reg.	Geom., Sedim.	intrinsic	Low
31	Mulino del Cucco	Nat.	Geom., c.Land.	intrinsic	Low
32	Misa	Nat.	Arch., Strat.	intrinsic	Low
33	Scascoli gorge	Nat.	Struct., Geom.	intrinsic	Low
34→40	Contrafforte pliocenico	Int.	Strat., c.Land.	extrinsic	Medium
41-42	Pieve del Pino and Sabbiuno	Nat.	Geom., c.Land.	intrinsic	Low
43	Phosphoric stone (Paderno)	Int.	Min., Petr.	intrinsic	Low
44	Gypsum of Croara-Ponticella	Int.	E.-H.-karst,	extrinsic	Low
45	Gypsum of Farneto	Int.	E.-H.-karst,	extrinsic	Low
46	Abbadessa & Settefonti badlands	Nat.	Geom.	intrinsic	Low
47	Sillaro Liguride nappe front	Int.	Tect.	extrinsic	Low
48	Monte Penzola backthrust	Nat.	Tect., Min.	extrinsic	Low
49	Riva dei Cavalli	Int.	Strat., Sedim.	extrinsic	Low
50	Paradisa section	Int.	Min., Sedim.	extrinsic	Low
51	Tossignano view point	Nat.	Strat., Geom.	extrinsic	Low
52	*Lucina* limestones in Sintria v.	Int.	Paleont., Sedim.	intrinsic	Low
53	Monticino quarry	Int.	E.-H.-karst, Strat.	extrinsic	Low
54	Monte Castellaccio Imola Sand	Int.	Paleont.,Strat.	intrinsic	Low
55	Bergullo & La Serra mud volcan.	Int.	Geom.	intrinsic	Low
56	Da Vinci Blue Clay formation	Int.	Strat., Paleont.	extrinsic	Low
57	M. del Casino & M.Tondo sections	Int.	Strat.,Min.	extrinsic	Low

Table A. Summarizing the main characteristics of the 57 selected ERAGP geosites.

B. 4 - Details on the interest of these sites

Among all Geosites listed by Emilia-Romagna Region (some 170: Annex "a"), about 47 have been selected. Furthermore, another ten new ones have been added. On the all, there are 57 selected geosites. These geosites have been divided following the main geo-scientific importance (stratigraphy, geomorphology, karst morphology, mineralogy, paleontology etc.). Apart from the values concerning Earth Sciences, many of them show important biological (vegetation, zoology) and cultural (landscape, history, architecture etc.) values in the broadest possible sense. In general, they have also a very high importance from the educational point of view. In particular, some groups of geosites are here described since they have significant and similar typologies of geo-scientific interest. In the description of the single geosites (see Annex "a"), the values of the ERAGP landscape are quoted as geodiversity, biodiversity, spectacularity, cultural heritage etc. All these values are considered as inter-related and inter-dependent elements within a holistic conception.

Geomorphology

In ERAGP we can find a lot of interesting and characteristic landforms, connected with glacial, gravitational, fluvial, water erosion etc. processes, both ancient and present. Among these, the following ones are worthy of note.

The upper Dardagna valley (geosites 1 and 2), from Mt. Corno alle Scale (1945 m) and Mt. Cornaccio (1881 m) down to about the altitude of 1150 m, shows a typical glacial morphology. There are prevalently glacial cirques and moraine deposits both frontal and lateral. It can be inferred that the Dardagna's ancient glacier stretched for a length of about 5 km, with snow-line at about the present altitude of 1640 m.

The geosites no. 16 (Monte Vigese and Montovolo) and, in particular, no. 23 (Tolè), show some periglacial landforms, whose genesis goes back to the LGM: they are, respectively, a partly cemented large rock-block talus fan and a relict surface modelled by areal processes and covered by loess deposits.

Various geomorphosites show series of river landforms: terraces, meanders, waterfalls, glacial pits, gorges etc. Among all these, it is sufficient to quote no. 22 (Moraduccio waterfall), also because it appears to be the result of accelerated, man-induced river erosion which has affected practically all the rivers of Emilia-Romagna, following the excavation and removal of thick gravel deposits from the riverbeds. Another geomorphosite worth of notice is no. 14 (Sasso Baldino), where there is a deep gorge with striking waterfalls.

Both in the above described site no. 14, and, in particular, in geomorphosite no. 12 (Soprasasso), typical *tafoni* are found. This latter site is characterized by the presence of these cave-like features, resulting from hydrolysis affecting sandstone feldspar minerals.

In any case, the most characteristic geomorphological feature of the middle and low Emilia Apennines and of ERAGP corresponds to *badlands* (in Italian *calanchi*). Many geomorphosites show some spectacular ones, among which nos. 41 and 42 (Pieve del Pino and Sabbiuno) should be quoted. All the evolutional stages of this process can be observed: very steep slopes, thin watershed crests, highly branched rills, up to residual landforms such as dome-like mounds (*elephant backs)* and isolated pinnacles (*earth pyramids*). The latter are typical of selective erosion combined with the protective action offered to the underlying clayey soils by the more resistant arenaceous layers. Badland formation was prevalently triggered by deforestation which resulted in a practically irreversible disruption of the morpho-climatic balance.

In ERAGP also morphostructural landforms can be found: *cuestas* (no. 12, Soprasasso, and no. 51, Tossignano view point), in dip-upstream sandstone ridges; or *mud volcanoes* (in Italian *salsa,* geosite no. 55). This landform is supported by rising gas (mainly methane) and mixed fresh phreatic and salty fossil water which provides a certain salty character to the water which was used for medical purposes since ancient Roman times. Both gas and fossil water rise at the surface along deep active fissures and faults which are often reactivated during earthquakes.

The level of interest of these landforms is mainly national, but in some cases it is also international; they show a typical geomorphodiversity of intrinsic type.

Landslides

These phenomena are widespread in the ERAGP territory and mainly consist of mass movements occurring in the last Post-glacial period to date. The frequency and magnitude of gravitational phenomena is proved to be very high. Almost all the different types of landslides described by CRUDEN and VARNES (1996) can be found in the Apennines. Among these mass movements the following ones should be quoted.

Rock falls (e.g. no. 30, Rupe del Sasso and Sasso di Sopra). A sudden rock fall, occurring in June 1982, caused the fall of at least 2500 m^3 of rock and caused the death of 14 people.
Translational slides (e.g. no. 18, Val di Sambro landslide). This landslide body caused the damming of the River Sambro and the consequent formation of a barrier lake with a potential water storage which could have reached 300,000 m^3. Stabilization interventions were carried out in order to guarantee the stability of the dam since its possible breaching could have released a high-water wave downstream with disastrous effects also for the safety of the local population.
Rotational slides (e.g. no. 15, Sasso di Vigo). This slope movement was caused by a displacement of the arenaceous base overlying the clayey bedrock with consequent activation of a rotational slide; indeed the concave part on the top corresponds to the detachment niche of an ancient landslide.
Flows (e.g. no. 10, Rocca Pitigliana). Landslides of this type are very frequent in the Emilia Apennines and also within the ERAGP territory: they affect prevalently clayey formations (earth flows). In this geosite it is possible to observe both active and dormant flows. They are characterized by a rather long tongue which usually stretches as far as the valley floor.
Deep-seated Gravitational Slope Deformations (in Italian with the acronym D.G.V.P.). Worthy of note is geosite no. 20, Castel dell'Alpi landslide. This Deep-seated Gravitational Slope Deformation is easily recognizable, since it appears as a wide undulating belt marked by several reverse slopes, where small ponds have sometimes been formed. A deep surface of rupture probably corresponds to a tectonic overthrust surface. The main feature of this gravitational process is the probable absence of a continuous surface of rupture.
All the aforementioned landslides, with others which are described more in detail in the attachment "a", make up an exemplary range of diverse and complex phenomena. They have the attributes of scientific and educational exemplarity, morphological evolution and evidence and turn the ERAGP territory into a field laboratory of international importance for mass wasting research. They show also high intrinsic geodiversity from a geomorphological viewpoint.

Stratigraphy and sedimentology
Most outcrops and selected geosites are beautifully exposed and well preserved. Standard worldwide known type sections (stratotypes) of the Santernian and Emilian Substages (geosite no. 56), two additional reference magnetostratigraphic, cyclostratigraphic , biostratigraphic, and chronostratigraphic sections of the Tortonian/Messinian boundary (geosite no. 57), and the type and historical localities of the Imola Sand, Blue Clay, Gessoso Solfifera, Euxinic Pelites, Marnoso Arenacea, Antognola, Loiano, and Monghidoro formations (geosites ns. 15, 22, 49, 50, 54, 57) are found in the ERAGP. Here were first discovered and described the Argille Scagliose by Gian Giuseppe Bianconi in 1840. Here the concepts of marine turbidity currents and the related widespread deposits called turbidites were first conceived in 1949 (geosites ns. 22, 49). Here the concept of Messinian Salinity Crisis was first theorized by Raimondo Selli in 1957, 1962 and Giuliano Ruggieri in 1967 (geosites ns. 50, 53). Here was the first major Natural History Museum established in 1547 by Ulisse Aldrovandi who also introduced the term Geology in 1603.

Palaeontology
Many formations and geosites outcropping in the ERAGP contain rich worldwide known fossil faunas and floras and have supplied important collections. From bottom they are the following. The latest Jurassic calpionellids and Cretaceous radiolarians contained in the limestone, diasper and chert associated to the Argille Scagliose (the Palombini Shales have yielded a complete middle Cretaceous Anahoplites specimen of ammonite). The characteristic fossil traces of the Helminthoid Flysch. The scattered but diverse shallow carbonate platform middle Miocene fauna of the Bismantova Formation (geosite no. 16). The rich, low diversity Miocene *Lucina* limestone fauna found in the Macigno, Cervarola, and Marnoso Arenacea formations (geosite no. 52). The rich fish and leave early Messinian association preserved in the Euxinic Pelites and the Gessoso Solfifera, including also large gypsified tree trunks (geosites ns. 44, 45, 50, 51). The rich, diverse late Messinian continental vertebrate fauna displaced into the brackish mollusc-rich Colombacci Formation (geosite no. 53). The very rich and diverse micro and megafauna of the Tortonian and Pliocene to Pleistocene Blue Clay Formation (geosite no. 56). The whale- and other marine mammalian- rich fauna of the Bolognese Intra-Apennine Pliocene basin (geosites ns. 27, 34–42). The famous continental vertebrate fauna displaced into the littoral Middle Pleistocene Imola Sand, studied by Giuseppe Scarabelli.
One should also take into account the rich historical palaeontological and micropalaeontological collections coming from the ERAGP, made by Aldrovandi, Cospi, Marsili, Ranzani, Bianconi, Scarabelli, Capellini, Fornasini, Foresti, Gortani, and Selli, which are stored in the Capellini (Bologna) and Scarabelli (Imola) museums.

Karst

The area of ERAGP it is world renown due to its surface and deep karst phenomena and for hosting primary caves in travertine.

The karst areas within the ERAGP were visited and studied by Italian and foreign scientists since the beginning of XVII Century.

The geosite n.13 hosts the Labante cave which is the largest primary travertine caves in Europe (over 50 m. in length and 12 m. in depth). The importance of this cavity is also enhanced by the presence of a huge cave pearls deposit.

The surface and deep karst in the Messinian gypsum is the main element of the Geosites ns. 4, 28, 44, 45, 53. These areas are the best studied and the most important gypsum karst in the World due to their geo-historical value and the great variety of the hosted phenomena and forms.

In particular the geosite no. 28 (Zola Predosa gypsum) hosts a fossil deep intra-Messininan karst which is presently the largest and the best preserved in Italy and perhaps in Europe.

The main site is also important due to the presence of widespread and beautiful "sericolite" (a rare variety of gypsum) which was already described at the end of the XVIII Century. Another relict of intra-Messininan karst, the importance of which is surely International, is located in the Monticino quarry (geosite no. 53) where an extremely rich fossil fauna have been found and studied.

The geosite no. 44 (Gypsum of Croara-Ponticella) hosts the largest epigenic (meteoric) karst system in gypsum of the World which presently consists of more than of 11 km of mapped passages: the "Spipola Acquafredda" karst system; moreover it hosts also epigean karst forms (candles and tumulus) and hypogean karst forms (antigravitative-paragenetic galleries) which were described here for the first time in the World. Finally there is also an extremely important archaeological cave,the:"Calindri cave" and a paleontological site fundamental for the presence of Pleistocene remains.

The geosite no. 45 hosts one of the most famous archaeological caves of Italy (the Cave del Farneto and its "Sottoroccia") and a cave transformed into an experimental laboratory: the "Novella cave", which was the base to: define the speleogenetic mechanisms active in gypsum, the development of speleothems in gypsum caves and to study paleseismicity from cave deposits.

The geosite no. 51 (Borgo Tossignano view point) hosts a huge canyon which is the largest roofless cave in Europe ("Rio Stella-Rio Basino" karst system) and a small cavity: the "Carlo Azzali" cave characterized by dendritic quarts after gypsum which allowed to define a completely new mechanism for the very first stages in the karst development within gypsum rock. In the same area there is also a very important archaeological cave: the "Re Tiberio" cave.

In conclusion the geosites of ERAGP with prevalent karst interest can be considered as having international value. They show also extremely high intrinsic geodiversity from geomorphological, mineralogical and paleontological point of view.

"Rio Stella - Rio Basino" (Karst system, paragenetic tunnel).

Mineralogy and Petrography

The area of the ERAGP has been visited and studied by Italian and foreign scientists since long time ago: can be considered as an open space laboratory due to the presence of different types of very rare minerals (like the “millerite” of Ca di Leder and the amber of Quinzano).

Furthermore the area of ERAGP is particularly famous in the World due to the presence of: quartz, gypsum, datolite and barite.

Among quartz crystals the most famous inside the international scientist community is the:”Quarzo aeroidro di Porretta” (geosite no. 4), thank to the perfect skeleton structures over its faces and for hosting huge biphasic fluid inclusion strictly related to the uplift of hydrothermal fluids in the whole Porretta surroundings. The quartz of Monte Acuto Ragazza even less known than that of Porretta is is probably even more interesting due to its bipiramidal habit and the presence of peculiar solid inclusions. Finally the quartz of the “Francesco Azzali” cave (geosite no. 51 Borgo Tossignano view point) is actually the only location in the World in which a pseudo-morphosis of quartz is developing over gypsum in a “non thermal” environment: it presence allowed to identify a completely new chemical process allowing for the first step of the karst development within gypsum.

In all the sites interested by karst within the ERAGP area (geosites ns. 4, 28, 44, 45, 51, 53) shows an incredible variety of euhedral crystals and aggregates (from few millimeters up to several meters in size): many of these forms are unique in the World.

Large druses with transparent to pale honey euhedral crystals of Datolite (a rare neosilicate of boron) are in the area of Serra del Zanchetto (geosite no. 7). Scientist found in this locality several other well crystallized rare minerals associated to the datolite like the analcime and the prehnite.

Finally barite is present in several outcrops of the ERAGP area where display particular forms (like large radial aggregates, or huge euhedral transparent to pale honey developed inside the “septarie” of the San Teodoro Badlands (geosite no. 26). The “septarie” of this site are also important form the geo-historical point of view because this was the locality where they were firstly described during the XVII Century.

From the petrographic point of view the area of the ERAGP is important for the presence of several outcrops of ophiolites clearly represented by the San Zenobi and Mantesca ophiolites, geosite no. 21. These ophiolites have a major diagnostic importance as genetic signature of magmatic rocks emplaced in the depth of the oceanic floor. The ophiolite suite consists of serpentinized peridotites, sheeted gabbros and pillow basalts referred to as Steinmann’s trinity.

In conclusion the geosites of ERAGP with prevalent mineralogical and petrographic show high intrinsic geodiversity and are characterized by International and National scientific value.

C. Geoconservation

C. 1 – Current or potential pressure on the proposed Geopark

The ERAGP area is under the EU Leader Programme involving two Local Action Groups. The general objective of the programme is to improve the development of rural areas by realising their potential, improving the job market, appraising local cultural traditions and increasing participation in regional policies. The geographic areas funded by the Leader Programme are characterized by low population and by the migration of the younger generations towards more populated areas in the ERAGP area, like the cities of Bologna, Modena, Ravenna and Forlì. However, it is possible to pinpoint three different areas inside ERAGP: i) the municipalities closer to Bologna in which the population density has been increasing over the past four years; ii) the medium valley where local migration has given way to immigration from abroad; iii) the Apennine municipalities with high levels of unemployment and lower levels of population compared to the other two areas. Consequently, the pressure on the territory depends on the location of the geosites. Those which are closer to the plain and cities have a higher risk of being destroyed or damaged due to urban expansion. Nevertheless, in order to counterbalance this tendency, thanks to the awareness and sensitivity of the Emilia-Romagna Region on these issues, three natural areas were constituted in the ERAGP with the precise purpose of protecting nature and the geosites in the plain, so as to safeguard them from the threats of development. Geosites nos. 26, 44, 45, 46, 48, 50, 51, 53, 57 (from NW to SE): the "Monterenzio Abbey Park", the "Gessi Bolognesi e Calanchi dell'Abbadessa Park" and the "Vena del Gesso Romagnola Park" were instituted mainly to protect the hypogean karst forms, gypsum caves and geosites, and building inside these protected areas was prohibited. On the contrary, the geosites identified inside the ERAGP areas in the mid-valleys and Apennine municipalities have a very low risk of being damaged by human activities since most of them are already included in Natural Park areas. They are nos. 1, 2, 3, 5, 6, 7, 16, 21, 32, 40, 39, 38, 34 (from SW to NE: "Corno alle Scale Park", "Suviana and Brasimone Lakes Park", "Montovolo Park", "Monte Sole Park", "La Martina" Park and the "Contrafforte Pliocenico Park"). Together with the Natural Park areas, the presence in the area of seven ZPS-SIC sites, part of the Europe 2000 Net, must be considered. They contribute to decreasing human pressure on the territory and on the geosites by preserving biodiversity and natural habitats.

C. 2 - Current status in terms of protection of geological sites within the proposed Geopark

Regional Law no. 9 - July 2006 aims to protect and appraise geodiversity and related activities in Emilia-Romagna and guarantees the totally protection of the geosites in case they belong to a Natural Park area or a SIC-ZPS areas.
This law aims to promote the protection, management and educational activities connected with geodiversity, recognizing the value of Regional geosites. This law also identifies the importance of the hypogean heritage: caves, karst systems, underlining the important role of the Regional Speleological Association in the education field and for the safeguarding of geosites.
Following the Law, the Geological and Soil Survey Service of the Emilia Romagna Region has been in charge of collecting information and for setting up databases of official geosite and hypogean sites in order to improve and guarantee their protection and appraisal in the future.
The geosites have been catalogued in an on-line database following the ProGeo and ISPRA (Italian Higher Institute for Environmental Protection and Research) criteria, in which each landform indicates geoscientific interest, contextual interest (archaeological, historical, botanic or faunal) and suitability for tourist uses: speleological, geo-tourism or scientific.
Each geosite in the database is also provided with the explanation of the conservation level, potential pressures, appraisal proposals and protection requirements.
Twenty one geosites in the ERAGP list are located in Natural Park areas where protection measures follow the Regional and National laws concerning natural areas: their protection and safeguard has long been guaranteed and will continue in the future. Six ERAGP geosites (nos. 13, 15, 17, 41, 43, 52) are not included in any Natural Park but their protection is guaranteed since they are included in SIC (Site of EU Importance) and ZPS (Special Protection Zone) areas (92/43/EEC and 79/409/EEC). They are safeguarded by EU laws concerning biodiversity and habitat protection and are therefore preserved from destructive human activity.
As described at the beginning of this paragraph, the Geological and Soil Survey Service of the Emilia Romagna Region, together with the support of the Regional Speleological Federation, has set up the hypogean heritage database: the caves are described according to their geographic location, development, length, height difference, karst typology, conservation level and potential pressures for each site.
There are 213 hypogean sites inscribed in the Regional Survey database. There is free public access to 200 of these sites, while public access to the other 13 is limited by means of a booking system directly managed by the Regional Speleological Federation.

12 caves are located in the "Gessi Bolognesi e Calanchi dell'Abbadessa Natural Park", whereas another two caves outside the Parks are included inside the SIC and ZPS areas of the Emilia-Romagna Region list. Therefore, it can be stated that all the 14 caves protected by Laws are included in the ERAGP area.

Furthermore, safeguard and conservation of the ERAGP Geoparks will be guaranteed by two Local Action Groups, thanks to the "Geoparks" project outlined in the master plan attached herewith. These actions will improve accessibility to the sites, poster designing, footpaths crossing the Geosites and will also offer new tourism packages focusing on Geotourism.

C. 3 - Data on the management and maintenance of these sites

There are several Institutions and associations involved in the management of the ERAG geosites: the Emilia-Romagna Region with the Geological and Soil Survey Service of the Emilia Romagna Region, the Regional Speleological Federation, the CAI (Italian Alpine Club), the Emilia-Romagna Region, etc.
The general management responsible for the geosites in the Region is the Geological and Soil Survey Service of the Emilia Romagna Region supported by the Regional Speleological Federation (official partner of the ERAGP): this collaboration aims to conserve and appraise geological heritage both on the earth's surface and underground. The Geological Survey staff is responsible for studying regional geological phenomena, the implementation of the Regional database and the drawing up of geological maps, is also responsible for spreading Earth Science awareness in order to promote sustainable development through European projects and local activities.
The Regional Speleological Federation is a voluntary association which has been responsible for management, appraisal and education activities concerning hypogean heritage for several years. Its main activities are linked to the scientific exploration and protection of caves, as well as guidance for visitors in order to make people aware of their importance in the natural cycle. A group of qualified guides belonging to this Association accompanies visitors or scientists into the gypsum and karst caves.
The CAI (Italian Alpine Club, Emilia-Romagna Regional Group) also has an extremely important role, with over 80 professional hiking Guides who take care of the maintenance of the many paths (more than one hundred) crossing the ERAGP and who contribute to the preservation of the geosites along them. The Association, together with the Region, has set up an on-line geographical information system (GIS) "WEB PATHS" that enables people to create their own personal trip. It provides information about the duration and level of difficulty of the various paths.
Several other Institutions and associations are involved in the management, depending on the geosites' positions in relation with natural areas.
A geosite belonging to a natural area, or to a ZPS or SIC, is under the jurisdiction of the Emilia-Romagna Region together with the Parks and Natural Resources Service (including the Geological and Soil Survey Service of the Emilia Romagna Region), the Bologna and Ravenna Provinces with the Environmental Department and the Municipalities.
The economic management, the education activities, the communication of geosites located in natural areas is guaranteed by the Municipalities and Natural Parks, the Emilia-Romagna Region and the Provinces. They provide for their maintenance, appraisal, promotion and protection following the Law (Regional Law no. 6/2005). The staff of the Natural Parks included in the ERAGP (nine Natural Park areas) is composed of sixteen employees: six of them are part of the territorial patrolling sector (Park Rangers) and are in charge of ensuring that laws are respected, the others are in charge to ensure the education activities, promotion, and the economic management of the areas.
Each Natural park included in the ERAGP area is also connected with working cooperatives involved in environmental education initiatives, supporting the Parks employees. They aim to make children and adults aware of the various features of natural areas and ERAGP areas, with special attention given to geological aspects. Each Park inside the ERAGP area yearly organizes a calendar of environmental activities in collaboration with the local schools that involve approximately 1000 kids of different ages. The activities aim to make kids and adults discovering the ERAGP area, through different thematic path concerning nature, geology, fauna-flora, water and local food. The Natural Parks together with the Region and the Provinces publicise and communicating the different activities through their Web pages and distributing materials in public spaces like: gymnastic, swimming pools, schools, trains, etc. the "Gal Appennino Bolognese" has set up several didactic paths (provide by panels and leaflets) in order to valorise the geological-paleontological heritage of the ERAGP area (Ca' Monari –Lagune- geosite no. 29, San Lorenzo etc. fossil whales-geosite no. 27, Labante cave no. 13), Gal organized a summer school together with the Urbino and Bologna Universities in the paleontological site of Ca' Monari-Lagune, geosite no. 29.
Gal promotes the Natural Park education activities financing a specific Webpage: http://www.parchinaturali.bologna.it/portale/index.asp with all the information concerning the Parks.

In the case of a geosite which does not belong to a Natural Park area, the Geological and Soil Survey Service of the Emilia Romagna Region is in charge of management whereas the Municipality is responsible for the maintenance, fruition and tourism appraisal by applying local and regional strategies.
The role of the Local Actions Group (GAL) in the management of the Geosites is twofold: through the Leader programme, it supports projects in the ERAGP area to help Municipalities and Natural Parks in carrying out their activities connected with geological heritage, on the other hand GAL will also focus on Geoparks activities following the guidelines of the Geological and Soil Survey Service of the Emilia Romagna Region and the Regional Speleological Federation. The Local Action Groups in the ERAGP action-plan have set up several specific "Geopark" projects in order to give financial support to both the working cooperatives and the Italian Alpine Club, who deal with environmental activities and footpath maintenance.

C. 4 - Listing and description of non-geological sites and how they are integrated into the proposed Geopark

C. 4.1 - *Natural Heritage-Vegetation*

The ERAGP area is situated in the Northern Apennines, This mountain chain has a particular importance in European biogeography as it is located in the southernmost part of the Central European region and adiacent to the Mediterranean one, All the the Apennine four vegetation and bioclimatic belts can be found in the Geopark area. Their altitudinal sequence is described by the corresponding sequence of the most natural plant communities as follows: semideciduous woods, mixed deciduous woods, beech woods and ericaceous dwarf shrublands above the timberline.

From the lowest foothills to about 600 m a.s.l. semideciduos woods lie on southern exposed slopes. They are dominated by the white oak (*Quercus pubescens*). Their ground cover is characterized by *Ruscus aculeatus, Asparagus acutifolius* and *Pyracantha coccinea*. In some sun-exposed slopes and in skeletic and nutrient.poor soils their shrub layers can contain some Mediterranean species as *Rosa sempervirens, Osyris alba,* and *Phyllirea latifolia*. Deciduous mixed woods are settled on the northern exposed slopes, with mesic ecological conditions. They are dominated by the hop-hornbeam, *Ostrya carpinifolia*. The manna ash, *Fraxinus ornus*. is frequent.
Within this altitudinal belt the sandstone cliffs offer a refuge habitat to *Quercus ilex* ,the "flag" tree for the Mediterranean vegetation. The gypsum outcrops, with dolines, closed valleys, and cliffs. offer suitable habitats both to Mediterranean species and to species usually living northernmost as well as at higher altitudes. The Mediterranean shrubs *Rhamnus alaternus* and *Phyllirea latifolia*, and other mediterranean species, including many orchids, can be found in xeric grasslands. The small deciduous woods that lie in dolines and closed valleys are dominated by the hornbeam (*Carpinus betulus*) and contain some species locally rare, which belong to higher vegetation belts, such as *Lilium martagon, Galanthus nivalis, Isopyrum thalictroides, Allium ursinum* and *Mercurialis perennis.*
Badlands are ecologically similar to other inland european salt steppes habitats in central and eastern Europe. The occurrence of species as *Elyimus athericus* and *Scorzonera jacquiniana* clearly show this similarity.
From 600 to about 800-1000 m a.s.l., the natural mixed deciduous woods are dominated by the Turkey oak, *Quercus cerris*. Until the first half of XX century these woods were largely replaced by *Castanea sativa* orchards and coppices, At present, the remains of these cultivations are classified of European importance as a cultural heritage and a suitable habitat for many animal and plant species. From about 800 – 1000 m to 1700-1800 m a.s.l. beech woods, meadows and pastures largely characterize the landscape. The beech , *Fagus sylvatica*, dominates these woods. Apart from beech, the ash, *Fraxinus excelsior*, the sycamore, *Acer pseudoplatanus*, the largest leaved lime, *Tilia platyphyllus*, and the montane elm, *Ulmus glabra*, are the most frequent trees. Meadows and pastures are artificial grasslands. Meadows are dominated by the false oat-grass, *Arrhenatherium elatius* and include also many other grasses, e.g. *Festuca pratensis, Poa pratensi, Alopecurus pratensis , Bromus hordeaceus.* Pastures include chiefly *Lolium perenne. Anthoxanthum odoratum, Phleum pratense* and *Cynosurus cristatus.* The juniper, *Juniperus communis,* as well as the Carline (*Carlina acaulis*) are frequent in abandoned or overdriven pastures.In some areas, as an heritage of past reforestations, tree planting, of spruce, *Picea abies*, black pine, *Pinus nigra* and the Oregon pine, *Pseudotsuga menziesii*, can be largely found.The natural timberline corresponds to the altitudinal limit of the beech woods. It locally soccurs at about 1800 m a.s.l.. Only on the GeoPark highest peaks, Mt. Corno alle Scale (1944 m a.s.l.). La Nuda (1828 m a.s.l.) and Mt. Gennaio(1812 m a.s.l.), it can be found. Above the timberline dwarf ericaceous shrublands and pastured grassalnds dominate the landscape The bilberry, *Vaccinium myrtillus*, and the small-leaved bilberry, *Vaccinium uliginosum microphyllum*, characterize these dwarf shrublands, where *Hypericum richeri, Deschampsia flexuosa* and *Luzula sylvatica sieberi*, are some of the most common species. Grasslands are mainly due to pastures and are dominated by the unpalatable matt grass, *Nardus stricta*. Only on few, small surfaces natural grassland can be found natural grasslands, where the rare *Viola calcarata cavillierii* lives.

Name and BioItaly code on Natura 2000 sites	Description of the Natura 2000 sites
3240	Alpine rivers and their ligneous vegetation with Salix eleagnos
3270	Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation
4060	Alpine and Boreal heaths
5130	Juniperus communis formations on heaths or calcareous grasslands
6110	Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi
6150	Siliceous alpine and boreal grasslands
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)
6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea
6230	Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)
6520	Mountain hay meadows
8210	Calcareous rocky slopes with chasmophytic vegetation
8220	Siliceous rocky slopes with chasmophytic vegetation
8240	Limestone pavements
8310	Caves not open to the public
9110	Luzulo-Fagetum beech forests
9130	Asperulo-Fagetum beech forests
91AA	Eastern white oak woods
9260	Castanea sativa woods

C. 4.2 - *Cultural heritage*

Due to the geomorphological landscape characteristics, since the Early Period the ERAGP area has been characterized by reciprocal strong influences between human activities and geomorphological landscape. Evidence of this relationship is more evident in the ERAGP territory then in the surrounding Apennine areas.

C. 4.2.1 - Prehistory

During this period all the tools discovered were produced by man using local rocks such as ophiolite, gypsum and flint.
Thanks to the good life conditions offered by natural caves, evidence of the human presence can be recognized since the Lower Paleolithic (750,000 BP). The first archaeological finds were discovered by Luigi Fantini in the Farneto cave (geosites no. 45) BRIZIO 1882. Several tools from the Upper Paleolithic (40,000-12,000 BP) were found near the Rupe of Calvenzano (geosite no.17). Other discoveries of artefacts dating from the Mesolithic and Neolithic Ages were made near the Upper Dardagna valley (geosites no. 2), in the Monte del Casino and Monte Tondo (geosite no.51) and in the Reno and Setta valleys.
In the ERAGP area finds dating from the Eneolithic (2500-1800 b.C.) are frequent, such as several flint arrows found in the Misa area (geosite no.32). In the Gypsum of Farneto (geosite no.45) human burials, clay artefacts and copper tools were also found.
During the Old Bronze Age (2300-1700 b.C.) the river valleys became important ways for trades and human communication, especially with the Po Plain, as proved by important finds from the Tanaccia cave (karst system) and the King Tiberius cave (PIASTRA).
At the end of the Medium Bronze Age (16th-14th century b.C.) the human settlements in the hills of ERAGP were abandoned as the population moved to the plain areas and caves were no longer used. The most important footpaths used by ancient people are found along the ridges near Monterenzio (geosite no.36) and Rocca di Roffeno, thanks to their favourable position between the villages of Vergato and Castel d'Aiano.

C. 4.2.2 Etruscan-Celtic Age

The presence of Etruscan population is recorded in the ERAGP territory since the 7th century b.C. with several archaeological remains mostly found in the low Reno valley. During the 6th and 5th century b.C., together with the considerable political and economic changes in the set up of the Po Plain, the Apennine footpaths acquired great importance, thus leading to the foundation of the villages of Monte Bibele (geosite no. 36-Contrafforte Pliocenico) and Marzabotto-Misa (geosite no. 32) (PALLOTTINO 1960). The latter is a unique archaeological site mainly due to the great influence of the geomorphological setting in urban planning, which followed the rules set up by Ippodamo from Mileto. The foundation stones were found in their original place and were identified as pebbles from the Reno riverbed. Extremely interesting are the travertine bases of the temples (SASSATELLI 2006), along with the necropolis funerary monuments which are also made of travertine dug out from the Labante Cave (geosite no. 13) ancient quarries. At the beginning of the 4th century b.C., the ERAGP territory was invaded by Gaul tribes from northern Europe. In the valley a high-altitude village dating back to the 5th century b.C, naturally defended by Monte Bibele (geosite n. 36-Contrafforte Pliocenico) and which was settled by Etruscan populations, was discovered (VITALI 2006).

C. 4.2.3 Roman Age-Upper Medieval Age

During the 2nd century b.C. the ERAGP area was affected by a serious crisis following the Celtic occupation. In this period a general shift of the location of villages towards the Idice Valley took place. Several tracks crossed the ERAGP area, linking the various urban settlements. With the creation of the "Via Aemilia" and the foundation of Bologna (189 b.C.) the northern part of ERAGP was inhabited by Roman colonists as recorded by local name places. Since the 1st century b.C., with the building of the aqueduct (geosite no. 24) near the confluence of the Torrent Setta into the River Reno, a substantial demographic increase was experienced in this area (SUSINI 2001).

Porretta had been an important settlement during the Roman Age, as testified by the discovery of three rooms dating back to the 5th century b.C., beneath the present thermal baths (geosite no. 4).

During the Upper Medieval Age (7th-11th century b.C.) the ERAGP area was involved in the complex events concerning the definition of the Lombard-Bizantine border: following obvious defence criteria, fortresses were mainly built in high-altitude zones taking into consideration the geomorphology of the territory. The persistency of the main communication tracks between the Po Plain and central Italy allowed the continuity of the human presence. The Lombard occupation affected several Apennine centres close to geosites nos. 7, 9, 14 (FOSCHI 1992).

C. 4.2.4. Medieval Age (11th-15th century a.C.)

As in the whole northern Italy during the Medieval Age, the ERAGP territory experienced an increase of the number of castles (known as "Incastellamento") (FOSCHI 2012). These strongholds were heavily fortified and served as a cohesion factor in the local territory. This phenomenon was favoured by the possibilities of obtaining excellent building material directly *in situ* either from the Vena del Gesso area (Tossignano View Point, geosite no. 51) and from the west (sandstone). The same zone is crossed by tracks which were frequently used by pilgrims: the *Via Cassiola*, the *Strada del Sasso* (geosites ns. 30, 31, 32, 12, 4) from Bologna to Pistoia. In the whole area several abbeys and churches were founded and soon gained a central role in the administration of the rural territories (geosites ns. 15, 25).

C. 4.2.5. Contemporary Age

A major demographical crisis struck Europe during the second half of the 14th century: the ERAGP territory was significantly affected by this phenomenon because of the fierce contrasts between the *Comune di Bologna* (the ancient Bologna municipality) and local aristocracy. In particular, ERAGP experienced a population decline, abandonment of farming activities and social and political instability. In the following centuries a form of simple rural economy was established, based on diversified rural productions by taking into consideration the geomorphological aspect of the region: sheep farming at higher altitudes, chestnut cultivation on the high hills, cereals and vines in the plain. Since the first decades of the 20th century the new needs for intensive agriculture brought the working population to the cities or abroad leading to a new crisis, especially towards the end of the Second World War, given the closeness to the "Gothic Line" (i.e., the German Forces Defence Line). Once again the particular geomorphological aspects of the area influenced human actions: German fortifications exploited the rocky tops of the hills, as well as natural cavities or ancient medieval castles. The main localities affected by war events were Rocca Corneta, Monte Belvedere, Affrico, Castel d'Aiano, Roffeno, San Martino, Marzabotto, Monte Sole, Brento, Monterenzio, Frassineto, Monte Calderaro, Monte Penzola,

Borgo Tossignano (geosites nos.11, 8, 13, 50, 32). Cause to the tragic events that hit this area of the ERAGP (800 people killed by Nazi-fascist troops in 144), UNESCO includes the Casaglia church in Monte Sole Natural Park in the "Culture of Peace Messenger" list. Casaglia church is a tragic example of how hard the last war struck the ERAGP territory. It accelerated population decline even in the following decades, while today a new awareness of the territorial values is favouring new local appraisal initiatives of the environmental and cultural assets (MAGNI 2009).

C. 4.3. - *Gastronomy Heritage*

From the Iron Age to the 20th century, agriculture was the prevalent human activity in many areas of ERAGP, contributing to create the evocative landscape that still distinguishes this territory. In mid-high hill areas, slopes and soil conditions allowed the implantation of chestnut woods for the production of chestnut flour already in the 11th-12th century (ZAGNONI, 2004). Food based on chestnut flour, simple but very nourishing (mostly *polenta* but also *ciacci*, *necci* and *mistocche*, small buns usually cooked on red-hot plates, with different names in different geographic areas), was staple food for the people of this area until a few decades ago. Therefore the *Civiltà del castagno*, typical of the Bolognese Apennines, did not involve only the gastronomic traditions, but also life, society and the landscape (geosites ns. 5, 7, 8, 16, 19, 22). The presence of dense woods, especially chestnut and oak trees, encouraged also the breeding of pigs, and the resulting production of home-made cured meat of excellent quality, a tradition which is still alive, thanks to the cool climate that favours the maturing and preservation of pork produce. In the same areas, and in the high-altitude rich prairies (geosite no. 3) sheep breeding was widespread for the production of milk and cheese, which have always been the traditional accompaniment of chestnut-based food. In the low-hill areas, where the soil is often derived from marine, littoral, delta and alluvial fan deposits (GREGORI, 2007), high quality wine is produced ("DOC Colli Bolognesi", geosite no. 25), a tradition that archaeological remains have dated back to ancient Roman times (BADIALI, 2009).

C. 4.4. - *Intangible Heritage*

In addition to the aspects concerning settlements, defence, production and exploitation of natural resources, the millenary relationship between man and the physical landscape in the ERAGP territory has also involved intangible aspects, related to the supernatural and spiritual sphere. Up to this day, local people have attributed a specific cultural identity to many landforms and geological features, which is still testified by similar place names in different sites. This process has attributed to the landscape deep meanings, which are not only functional but also aesthetic and constitute the common heritage of the people of the Apennines (BADIALI & PIACENTE, 2012). 20% of the natural caves is related to local legends, especially in the mid-high Apennines. Among them, Buca dell'Inferno (geosite no. 45), Buca dei Buoi (geosite no. 44) and Tana dell'Uomo Selvatico (geosite no.14) can be quoted (DEMARIA, 2012). Evocative tales and legends are linked also to the ophiolites, which are quite impressive igneous rocks owing to their harsh morphology and strong contrast with the surrounding landscape, as in the case of Sasso della Mantesca and Sasso di San Zenobi (geosite no. 21), between the rivers Idice and Sillaro. Finally, in many cases, ancient cults of water (e.g., the Labante caves, geosite no. 13 and the holy spring of Marzabotto-Misa, geosite no. 32), trees (e.g. Madonna dell'Acero, geosite no. 3) and mountain peaks (Monte-Vigese and Montovolo, geosite no.16) have survived until today (BORGHI, 2007).

D. Economic Activity & Business Plan (including detailed financial information)

D. 1 - Economic activity in the proposed Geopark

The traditional economic activities of the ERAGP area are mainly rural and manufacturing activities. The agricultural sector is acquiring importance in the field of organic produce (74% of the total farms in Bologna province) especially in the northern sector which is characterized by quality innovation processes and prime quality cultivations. In the southern part people are abandoning agricultural activities: woods and forage areas are replacing cultivation fields. The agricultural sector is extremely important: the four DOP-Protected Designation of Origin (*salamino italiano alla cacciatora, parmigiano-reggiano, grana padano and aceto balsamico)* and the eight IGP-Typical Geographical Indication Products (*mortadella, cotechino, zampone, vitellone bianco, marrone di Castel del Rio, scalogno di Romagna, pesca nettarina di Romagna*) which characterize the area are a clear evidence of this excellent production. High quality products are also represented by the rare white truffle and the "porcini" mushrooms that grow in the area close to Savigno. The most important fruit cultivations of the ERAGP are located in the valleys of the rivers Santerno and Samoggia, with peaches, kiwis and apricots. The reintroduction of the cultivation of the olive tree has characterized the area around Sasso Marconi, Monteveglio and Pianoro. Recently the Slow Food organization has recognized the Corno alle Scale char fish ("salmerino") as an excellence product in the ERAGP area. Wine production and its satellite industries have a key role in the economy of several ERAGP municipalities, such as: Monte San Pietro, Savigno, Monterenzio, Sasso Marconi, Pianoro, Marzabotto, Fontanelice, Borgo Tossignano, Castel del Rio e Casalfiumanese. Wine production in these parts of the ERAGP area come to the excellence with the Controlled Designation of Origin (DOC).
The area is characterized by two artificial lakes: Suviana and Brasimone (geosites nos. 5 and 6), where the particular geological situation has favoured the construction of a dam and a hydroelectric basin, together with a joint hydraulic system with the Suviana basin (470 m a.s.l.). This system contributes to the economy of the area not only for the production of electricity (ENEL Private Company) but also for tourism: the lakes, included in the "Natural Park of the Lakes" are an important attraction for visitors from Tuscany and from the Bologna surroundings.
Tourism is indeed an important sector in the ERAGP area, with app. 500,000 visitors in 2010 (GAL Local Action Plan). The places that offer seasonal facilities to tourists are Porretta Terme, Suviana Brasimone Lake and Lizzano in Belvedere. During the winter skiing is concentrated around Mt. Corno alle Scale, although the number of tourists is not as high as in the adjacent Modena skiing localities. Following the Emilia-Romagna tourism trends, also the ERAGP area has registered the effects of the economic crisis, with a decrease of 20% of tourists in 2011 compared with the previous years. ERAGP aims to be the most important answer to this problem, not only by improving tourism offer but also by increasing the job situation in this field.

D. 1.1 - *The main structures responsible for sustainable development policy in the territory*

The Emilia-Romagna Region, through INFEAS (Information and Education to the Sustainability), which is a net of public and private institutions, supports the promotion of the actions directed to the education and sustainability, following the Regional Law no. 27/2009. This net is composed of one regional committee and several coordination committees at local levels that coordinate education centres, Natural Parks activities, schools and different private subjects working together in order to spread the sustainability education culture among the young. They have set up projects in all the Region (and part of ERAGP area) to improve awareness, sustainable practices in the energy field, the recycling sector, the use of water and promoting sustainable mobility.
"ICES" (Innovation Centre for the Environmental Sustainability) is an extremely important agency in the area. It is composed of several ERAGP municipalities and the Bologna Province, and it promotes several local fairs in the energy field (e.g., Expo-EcoAppennino, with the "Gal Appennino Bolognese" support) and several pilot projects, together with the Emilia-Romagna Region in order to support new technologies and the transfer of innovations in the remote Apennine areas.
Natural Parks play a very important role in the education to the sustainability as mentioned above.
More specifically, the area is also characterized by two: "Roads of the Wines and Flavours" which cover half of the ERAGP area, appraising the local products such as the special Bread route in-between Loiano, Monghidoro and Monzuno, which is characterized by three educational paths concerning the use of cereals and water mills, explaining the old mountain traditions by means of sustainable tourism strategies.

D. 2 - Existing and planned facilities for the proposed Geopark (e.g. geo-education, geo-tourism, tourism infrastructure etc)

D. 2.1 - *Museums*

Three years ago a regional project, in collaboration with the Cultural and Natural Heritage Institute (IBC) economically supported by Gal Appennino Bolognese, set up a Museum interactive Guide in order to offer a common platform concerning the local offers in this field. Through this database it is possible to search the information about a Museum in the ERAGP area, searching by geographic or category criteria. The ERAGP area is under the category: «Apennines» and is divided into several categories: *archaeology, arts, history, identity and sciences*. The *archaeology* section includes: the archaeological Museum of Kainua-Misa (geosite no. 32), the MAM in Monte Bibele-Contrafforte Pliocenico (geosite no. 36) and the Prehistorical Museum: "Luogi Donini" in San Lazzaro. This Museum includes special exhibition concerning the prehistoric findings from the Farneto gypsum (geosite no. 45). The *arts* Museum in the ERAGP area includes: the Museum "Laborates" in Porretta Terme (geosite no. 4), the "Giorgio Morandi Centre" in Grizzana, the "Mengoni" Museum in Fontanelice and the sacred art Museum in Monghidoro. There is only one Museum in the ERAGP area concerning *history* and is the "War and Gothic Line" Museum in Castel del Rio which hosts a very important collection of war heirlooms from World War I and from the Risorgimento Wars. As for the *identity* section. The *sciences* Museum are: the "G. Marconi" Museum in Pontecchio Marconi-Balzo dei Rossi (geosite no. 24): it is dedicated to the life and experiments of this famous Nobel prize laureate who was born here in 1874. The Museum includes several educational areas to explain the history of electricity, electromagnetism and also the history of communications.
The Gal Appennino Bolognese and the geological Museum: "G. Capellini" signed a special agreement that considers the Museum Director, Bologna University professor G.B. Vai, as a member of the scientific committee of the ERAGP, on the basis of his academic knowledge and experience. This Museum, which is one of the most important geological museums in Italy, was founded in 1881 and its collections have attracted scientist from all over the World.
The Museums have an important educational role that will be improved and organized into a system coordinated by the ERAGP activities in order to appraise local heritage by means of a holistic approach.

D. 2.2 - *Geological educational paths*

The ERAGP area includes three "geological paths":

1. Monticino quarry (geosite no. 53)
2. Ca' Monari-Lagune (geosite no. 29)
3. S.Lorenzo etc. fossil whales - Gorgognano (geosite no. 27)
4. Monte Castellaccio Imola Sand (geosite no. 54)

1. Monticino quarry

The Geological open-air Museum in Monticino offers a clear picture of the most important geological formations of the Vena del Gesso (Marnosa arenacea, Gessoso Solfilifera, Colombacci, Argille Azzurre) and has been created inside a dismissed gypsum quarry. Past quarrying activities allowed the discovery of a precious geological and paleontological heritage: the site has international importance for the study of the Messinian evaporites. The educational path was organized by the Park Authority, together with the University of Bologna (Earth Science Department) and the Geological and Soil Survey Service of the Emilia Romagna Region, and is composed by three explanation panels. Very interesting are the fossil remains of crocodiles, rhinoceroses, hyenas and apes which were found in the gypsum cavities. Every year many school children visit the area and ERAGP will improve the educational activities in this site thanks also to the Treasure Hunt platform.

2. Ca' Monari-Lagune

This geo-palaeontological path is located in the area of the "Shells" agritourism, in the Ca' Monari-Lagune geosite. The Gal Appennino Bolognese, with the Geological and Soil Survey Service of the Emilia Romagna Region, has contributed to appraise this area, giving visibility to agritourism activities, through the "GEO Agritour" project; it has also created the educational palaeontological path and a summer school for students in geology. The educational path is developed along three panels: the first explains the main Earth history steps of the last 250 million years, the second comprehends pictures and texts in order to explain the palaeogeography of the Pliocene Gulf and the genesis of the rocks, the last describes the most important kinds of shellfish and the research carried out by the Urbino University, also financed by the Gal Appennino Bolognese. ERAGP aims to organize two "Days of Geology" in this site with free access to students and visitors, with the possibility to taste the local organic

products from the "Shell" Agritourism. During these days special attention will be given to the connection between geology and the food-wine productions.

3. The San Lorenzo etc. fossil whale - Gorgognano

In 1965, in the Val di Zena, a fossil whale was found. In 2009, the Emilia-Romagna Region, the Gal Appennino Bolognese and the Geological Museum: "G. Capellini" in Bologna decided to make this finding known by means of three explanation panels and a gypsum reconstruction of the whale at the 1:1 scale. The explanations describe the history of this aquatic mammal which was transported by the water of the Pliocene basin that covered part of the ERAGP area two million years ago. The ERAGP staff and its partners will organize special guided tours to discover the ERAGP ancient sea floor.

4. Monte Castellaccio Imola Sand

The Monte Castellaccio site, along with Le Lastre, is known as a typical location for Yellow Sands (also known as Sabbie di Imola), which are very common in the Romagna Apennines and were studied in the mid-19th century by Giuseppe Scarabelli, who described the Villafranca fauna (composed by terrestrial vertebrates floated in the sea). The Imola sands are about 30 to 40 m in thickness, and representatives of the last, important episode of marine ingression at the foot of the Apennines during the Middle Pleistocene. Their remains of continental fossils floated into the sea from the nearby plains include elephants, megaceros, Cervidae, rhinoceroses, hippopotamuses, horses, bovids and vegetal remains (leaves). Since 2000 the area part of the Imola Municipality Park and is characterized by geological explanation panels signalizing the most important yellow sand outcrops and describing the history of this ancient sea during the Medium Pleistocene.

An important project has been developed by the Emilia-Romagna Region and the Geological and Soil Survey Service: a geological map reconstruction about the buildings in Bologna, pinpointing the different kinds of rocks from the ERAGP area. In the city of Bologna it is also possible to visit the geological exhibition in the garden of the Geological Survey Service with the chance to appreciate several rock specimens from the ERAGP area, like gypsum and limestone.

D. 2.3 - *Future facilities planned*

Following the ERAGP master plan, different activities have been planned by the partners and some of them are addressing to implement the Geopark project visibility for tourist and inhabitants. Several communication and promotional actions are already run by Gal Appennino Bolognese in the ERAGP area, and several "Geopark educational and information points" are planned to be included inside six Natural Park headquarters equally distribute in the area. The ERAGP will implement the Natural Parks headquarters with a specific space concerning the Geopark project, the EGN and GGN, local tourist offers etc. In this way it will be possible to have Geopark corners in all area, sharing initiatives with the Natural Park staff and the local authorities, with a small economic contribute. In the same context the project aims to improve education activities and events directed to the discovery of geological heritage. The ERAGP will appraise 20 of the 50 geosites detected by the scientific committee as having special importance in the area through Geopark panels with the same layout information and the process to make it standardized has been started and will be finish at the end of 2013. More in detail, the panels will include a general map of the ERAGP area with the specific site pointed out together with the closer accommodation and list of the paths. The panels will also include short explanation of the scientific interests and specific geological explanation of the geosites. From the panels tourists will have the possibility, through the smartphones (QR codes), to get linked to the ERAGP web page. The project Web-page, organized from the Gal Appennino Bolognese web page, will give the link to the Treasure Hunt platform and to the "WEB PATH" platform. The Treasure Hunt project aims to make the ERAGP localities more attractive for children and adults that can be downloaded free from the website. The Treasure Hunt has its origin in 2011 with the cooperation of Locatify Company in Iceland and Magma Geopark in Norway. In order to adapt the original platform to the ERAGP context, the expertise acquired by the Icelandic and Norwegian companies will be applied.

About 20 paths in the ERAGP area have been selected, among more than 100, to be appraised in order to increase their geological visibility, the education activities connected with geological heritage and geotourism activities like trekking, climbing and mountain biking. These 20 paths will be standardized as "Geopark" paths following a specific communication strategy set up together with the APT Emilia-Romagna Destination Company.

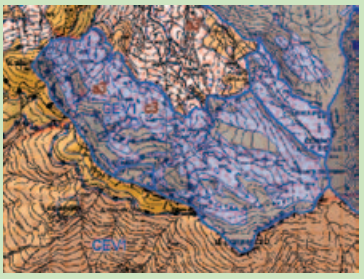
More in detail, specific actions will be directed to the maintenance of the existing climbing routes and the improvement of the existing ones (Badolo-Contrafforte Pliocenico, geosite no. 39 and Sasso di Vigo, geosite no. 15).

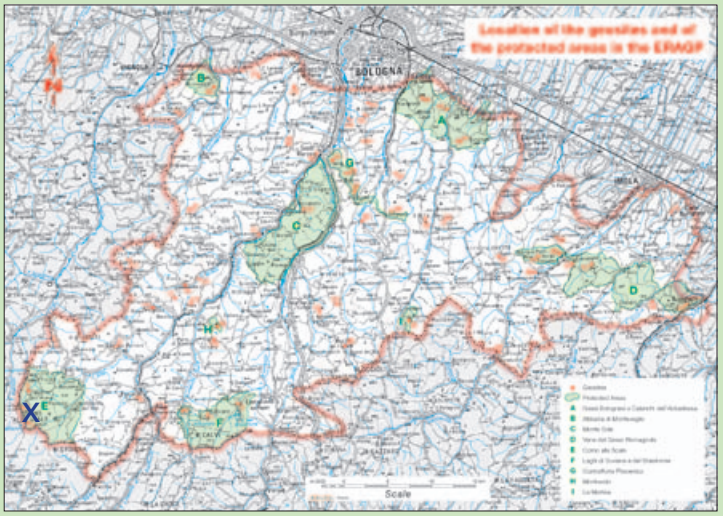
ERAGP panel example

EMILIA-ROMAGNA APENNINE GEOPARK PROJECT GEOSITES Ns. 1 & 2

BOLOGNAPPENNINO
GAL Appennino Bolognese

GEOLOGICAL DESCRIPTION: ita/eng/fra
The upper Dardagna valley, from Mts. Corno alle Scale (1945 m) and Cornaccio (1881 m) down to about the altitude of 1150 m, shows a typical glacial morphology. A typical cirque is found between Mts. Cupolino (1853 m), Cornaccio and Corno alle Scale: it has gentle slopes cut through by a series of stream furrows; at its head there is a secondary niche with a moraine heap at its foot. They all bear witness to the Last Ice Age. Another cirque, named Cavone, is located between Mts. Corno alle Scale and La Nuda (1828 m); it forms a steep-sloped and flat-floored trough bounded by a moraine reverse slope. More typical cirques are found on the NE slope of Mt. Spigolino (1827 m) and between the latter and Mt. Cupolino. Along the slopes in-between the crest and the valley floor, various moraine deposits are observable, separated by rock outcrops. Worthy of mention is the vast flat area of Refuge Cavone (1424 m), on the valley's right-hand side, which corresponds to a lateral moraine bar of the ancient glacier. The most distal moraine deposits of the Dardagna valley, found by Madonna dell'Acero at the altitude of about 1150 m a.s.l., overhang of some 130 m the present valley floor. It can be deduced that the Dardagna ancient glacier stretched for a length of about 5 km, with snow line at about the presente altitude of 1640 m.
Ericaceous dwarf shrublands and seminatural grasslands can be seen on the Mt. Corno alle Scale, over altitudinal limit of beech woods.
On the valley floor, at altitudes of 1300 to 1230 m, there are spectacular waterfalls which the Torrent Dardagna has created by flowing on thick arenaceous strata: they are arranged in a series of steps, falls and rapids spaced out by wide water pools. There are also typical glacial pits, originated by the action of fast rotating pebbles in the stream water.





ⓧ YOU ARE HERE

GEODIVERSITY AND LEVEL OF INTEREST: ita/eng/fra
The geosite comprises all the more typical characteristics of an apennine glacial morphology: it represents a site of national interest from scientific and didactic point of view. It shows also high intrinsic geodiversity from morphoclimatic point of view.

CONTEXTUAL INTEREST: ita/eng/fra
LANDSCAPE

D. 3 - Analysis of geotourism potential of the proposed Geopark

D. 3.1 - *Conceptual and methodological introduction*

According to National Geographic's definition, Geotourism is: "*tourism that sustains or enhances the geographical character of a place – its environment, culture, aesthetics, heritage, and well-being of its residents*". The Emilia-Romagna Region is well aware of the importance of its geological heritage and potentiality and has followed a suitable strategy for the past few years. In particular, several institutions have been involved in the ERAGP area. They are: the Bologna and Ravenna Provinces, several Municipalities, the Parks, the "Gal Appennino Bolognese", the "Gal Altra Romagna", all working together to improve activities focusing on the discovery of the local environment, culture and heritage, in order to enhance the: "sense of place" for inhabitants and visitors. The main goal of ERAGP will be to combine the activities already developed in a single tourist proposal, supported by the Emilia-Romagna Destination Company, following the EGN and GGN geotourism goal: "*to implement holistic experiences of nature which combine leisure, enjoyment and adventure with the acquisition of information and knowledge*" (www.europeangeoparks.org).
In agreement with this strategy, a conceptual path is suggested and illustrated, following the phases of *knowledge, communication, awareness, protection and appraisal* (PANIZZA & PIACENTE, 2011).
Knowledge should be based on a strict analysis of the special features and dynamic processes typical of the Dolomites, avoiding schemes developed for other landscape realities. This knowledge should be divided into: i) strictly scientific interdisciplinary research; ii) accurate interpretation according to original reading codes, within an integrated holistic-type synthesis. Subsequently, analytical-descriptive approaches are to be replaced by systemic-developmental ones, which envisage the landscape as a set

of interacting elements closely connected to socio-cultural development. To obtain this type of knowledge, researchers from the Universities of Bologna and Modena-Reggio Emilia have been involved in all the scientific subjects concerning this proposal for ERAGP (geology, geomorphology, paleontology, vegetation, prehistory, architecture, etc.). A fundamental contribution has been given by the Geological and Soil Survey Service of the Emilia Romagna Region, regarding mainly geology, landslides and landscape.
Communication must be comprehensible in order to enrich knowledge. It cannot be a simplification of complex problems: simplification does not mean something has to be made poorer or more banal. Therefore, specific communication skills are needed, together with a clear cultural and social responsibility. The two main aspects of communication should be popularization (meetings, folders, articles, books, etc.) and education/formation (school, further education, etc.). In particular several leaflets, books and maps have been set up through the education activities developing in the ERAGP Natural Parks.
A landscape can become a common heritage and therefore a "cultural asset" in all its values only when communication leads to a shared *awareness*. Not only would this allow participation but it would also approve territorial management choices. It is obvious that, besides the above quoted specific characteristics, the strategies for involving and awakening public opinion could result also from the perceptions and expectations of diverse territorial realities, taking into account previous local experiences. A project thus conceived would involve the experience and responsibility of administrators, operators and beneficiaries at different levels. Gal Appennino Bolognese together with the Parks and the municipalities has already organized several meetings in order to set up the Geopark strategy the master plan of the ERAGP includes two meeting at local level with active participation of the inhabitants to share the Geopark actions with the people living in the area.
As for *protection* and *appraisal,* the idea is "not planning in order to protect and protecting in order to manage but *planning in order to disseminate knowledge and develop awareness in order to appraise and self-protect*" (PANIZZA & PIACENTE, 2003). In short, not a top-down planning (passive approach) but a bottom-up planning (active approach) with self-involvement.
In order to attain positive results, it is necessary to adequately tackle the problem concerning the relationship between the above mentioned phases and the political choices – that is, *management* – and establish not only constant dialogue between the various sides involved but also constant, indispensable involvement of public opinion.
In this direction different projects have already been carried out involving local inhabitants in various fields, so as to combine the main characteristics of geotourism, such as development of new economic activities based on Earth's geoheritage, geoconservation and education activities (DOWLING, 2009). These projects are specified in the following paragraphs, as they offer a good basis for implementing the development of geotourism in the near future.

D. 3.2 - *Trekking, riding and adventure*

The ERAGP area offers various opportunities for discovering nature and geology by walking, riding or biking, enjoying the wellness and healthiness of the "slow paths". The Emilia-Romagna Region, together with the Geological and Soil Survey Service of the Emilia Romagna Region and the Italian Alpine Club Emilia-Romagna (CAI), has created a GIS browser called: "Web Paths" (http://sentieriweb.regione.emilia-romagna.it) that enables an itinerary, connecting the ERAGP locations to be set up, surfing the interactive maps in Italian or English. The details of the maps describe the panoramic views with short geological descriptions and pictures of the geosites. Furthermore, the project produced fifteen different paper maps of the Emilia-Romagna Region with complete mapping of the walking and hiking paths of the ERAGP area.
ERAGP aims to develop this browser with specific geological information and emphasize the most important geological paths in the ERAGP area in order to offer a complete, free geotourism tool both digital and on paper, available as a "pdf" download from the project web page.
Hiking guides can also be hired in order to explore the Natural Parks included in the ERAGP area, following more than one hundred paths which are well kept by the CAI and Park Rangers.
Riding is an additional activity through which visitors can observe and appreciate the landscape and geological heritage of ERAGP. The "Gal Appennino Bolognese" has been directly involved in this pilot project that has created several riding itineraries crossing the ERAGP area. It is possible to discover these bridle-paths on the dedicated web page: this pinpoints the cultural and natural highlights along the way as well as events and places to rest (http://www.grandeippovia.it).
Riding a mountain bike is a great way of experiencing contact with the geology of the area and tourists are offered several different targets. The Province and five Natural Parks included in ERAGP, together with the Region and Destination Company, have set up a web page focusing on the various pathways (http://parchibolognesi.appenninoeverde.it). For each path, tourists can find maps and descriptions of sites, length and level of difficulty. Starting this year, seventeen paths have been made available in the Corno alle Scale Park which meet the special needs of disabled people. ERAGP will select the most interesting path from the geological and scientific viewpoint and develop specific mapping of all the area of the main project web page.

Worthy of note are other open-air activities offered by the Associations working in the ERAGP area such as: tree climbing, the "via ferrata", canoeing and paragliding.

D. 3.3 - *Environmental and geological activities*

The environmental and geological activities are at present carried out by the Natural Parks, the Regional Speleological Federation, the cooperatives and local schools. These subjects have been developing various activities in connection with the most important natural, environmental, geological and cultural characteristics, involving hundreds of students and visitors every year. Some of these activities are connected with the discovery of the geological heritage of the ERAGP area and have mainly been developed inside the "open-air Geological Museum": the Monticino quarry", geosite no.53; the "Ca' Monari-Lagune" geosite no. 29; the "San Lorenzo etc. fossil whales" (Gorgognano), geosite no. 27, "Monte Castellaccio Imola Sand" geosite no. 54. Excursions along footpaths can be carried out under the guide of a professional Park Ranger, whereas cave explorations will be accompanied by a professional speleologist who can offer explanations to visitors. The experience offered by the Vena del Gesso Park, which organizes camping sites for children staying overnight in the Tanaccia cave, has proved to be extremely successful.
ERAGP will implement the educational facilities for children and adults, using new technologies to make geological sciences more attractive to families. ERAGP will also enable the downloading of maps of the area, together with games connected to local heritage: a new challenge to learn geology by walking in the Geopark. Finally, in collaboration with the Geological Museum of Bologna, ERAGP will offer scientific trips to promote the knowledge of the Apennines and their heritage.

D. 3.4 - *Cultural tradition and handicraft*

The ERAGP area has great potential in the cultural field connected with local heritage and geotourism. All the local institutions involved in the appraisal of local traditions have joined together with all the Museums of the ERAGP area in a specific project named "SBAM" which is financed by the Bologna Province and by "Gal Appennino Bolognese".
In this way tourists will be able to find information about a Museum, searching by themes or areas: http://www.provincia.bologna.it/cultura/Engine/RAServePG.php/P/332911391214/T/Itinerario-geografico-lAppennino.
Some Museums are classified under a special section: "Identities" with the main goal of improving awareness of working traditions linked to environmental characteristics, thus explaining socio-economic contexts of past centuries.
These kinds of Museums bear witness to the past and emphasize the important link between the geological landscape and the inhabitants' evolution. The Palazzo Alidosi Museum in Castel del Rio hosts the "Chestnut Museum". It is an educational exhibition which explores production methods through history in connection with the geomorphological features of the River Santerno valley. In Lizzano in Belvedere it is possible to visit the Ethnographic Museums "G. Carpani" and "P. Lazzarini" in Pianoro and the "Museum of Apennine farming civilization". They all aim to show the main economic activities in the area such as: chestnut cultivation, sheep farming, handicrafts and daily life during the 20th century. The "Ecomuseum of Wine and the Valley" in Castello di Serravalle shows the connection between human activities and the landscape through the centuries with special attention given to the relation between the landscape, architecture and popular tales.
"Gal Appennino Bolognese", together with the Provinces of Bologna and Ravenna, set up a project called : "historic shops" with the aim to promote, valorising and support the local productions in the ERAGP area, following the Regional Law n.5- March 2008. Several shops in the ERAGP area reach the standards (more than 50 years consecutive production, presence of specific ancient equipment, etc.) to enter in the list and obtain special fund to run the activity.
http://www.provincia.bologna.it/botteghestoriche/Engine/RAServePG.php/P/25151BOT0303/T/Appennino-Bolognese

D. 3.5 - *Accommodation and local food*

The most representative project in this category, held by the Geological and Soil Survey Service of the Emilia Romagna Region and "Gal Appennino Bolognese", is the "GEO Agritour", that is a GIS system that links together agritourism in the Bolognese Apennines and the geosites. This site offers information on geosites, participation of agritourism facilities in the project, services and information on the geological features of ERAGP, following the official regional database. This project aims to offer a digital service to the tourist interested in overnight stays in areas of geological interest. ERAGP will improve accessibility to several geosites in the area and provides links with accommodation and restaurants through this web site: http://ambiente.regione.emilia-romagna.it/geologia/cartografia/webgis-banchedati/geoagritur/?searchterm=geoagritur.
There are various interesting activities concerning local food and traditions giving a new perspective of the ERAGP area, enhancing

the relationship between the environment and the tourist. There are two routes of the "Roads of Wines and Flowers" in the ERAGP: "The Food and Wine Trail in the Imola Hills" and "The Food and Wine Trail among Cities, Castles and Cherry-trees".

D. 4 - Overview and policies for the sustainable development of: geo-tourism and economy - geo-education- geo-heritage

AGeo-tourism and economy

In collaboration with Natural Parks, the Emilia-Romagna Destination Company, the ERRSF and the Geological and Soil Survey Service of the Emilia Romagna Region, the "Gal Appennino Bolognese" is developing a market analysis and a survey of the activities carried out by the different local subjects in the ERAGP area related to geotourism. The Geopark project aims to collect the current initiatives under the common ERAGP strategy and, with the support of the main expert (the APT Emilia-Romagna Destination Company), create a new offer for promoting a holistic approach to the natural heritage of the Apennines, following several studies by the European Travel Commission, considering also the incumbent examination of the programme by the Tourist World Organization in 2013 and the canvasses carried out by professional companies. This offer will be disseminated by means of the regional official channels (and will be constituted by thematic tourist packages divided into categories which are now being defined). The creation of this offer will be directed towards an enhancement of the use of social networks as promotional channels. In addition, there will be an intensification of the relationships with low-cost airlines (thanks also to the presence of the Chairman of Bologna Airport in the board of "Gal Appennino Bolognese") and enhancement activities directed to the on-line tourist offer, considering that self-organized tourism seems to prevail on organized package tours. Finally, the possible links with the UNESCO WORLD HERITAGE sites of Ravenna, Modena and Ferrara will be taken into account in creating the thematic offer (APT Emilia- Romagna Destination Company Plan 2012).The organization of the ERAGP project manager into several applications in order to obtain funds for developing the tourist offer linked with the Geoparks Network, will contribute to increase knowledge and awareness and will create new opportunities for the Emilia-Romagna Apennine Geoparks with the involvement of EGN and GGN.

Geo-education and Geo-heritage

s previously mentioned, the Geological and Soil Survey Service of the Emilia Romagna Region is the main geo- Institution in the ERAGP territory. It is responsible for several geoactivities, primarily the official geosite database. This project aims to register on line the most important geosites, following the Ispra and ProGeo guidelines. The service has set up an interactive geological map of all the Emilia-Romagna Region with the description of the main geological features and indication of the geosites described in separate sheets. For each geosite the description includes: geographic coordinates, position, a geological map, a short geological description, scientific interest, level of protection, accessibility. 47 of the 57 ERAGP geosites are already mentioned and described in the database: http://geo.regione.emilia-romagna.it/schede/gs_pg.jsp.

Cave exploration has a long tradition in the ERAGP area. Various scientists have studied the caves and associated scientific phenomena since 1781, when the: "Dizionario Corografico" by S. Calindri, who explored several caves in the Bolognese Apennines, was published. In 1932 L. Fantini founded the Bologna Speleological Group (BSG) and this was the beginning of systematic and multidisciplinary research in the gypsum formation and the karst system in the ERAGP area. In 1974 the Regional Speleological Federation was founded (BSG together with the Bologna Speleological Union), which discovered several important new ramifications in the caves and opened old and new sites to the public (GRIMANDI, 2011).

At the moment the Emilia-Romagna Regional Speleological Federation plays a key role in the geoactivities inside the ERAGP area which have been officially recognized by Regional Law no. 9 of July 2006. The association is in charge of the scientific activities and public guides for all the caves in the area and has also a key role in the management and protection of the karst geosites. Its most recent products are: the official hypogean sites database which allows on-line searches for a description and pictures of the main hypogean geosites of ERAGP: https://applicazioni.regione.emilia-romagna.it/cartografia_sgss/user/viewer.jsp?service=grotte.

Another recent and important product is the publication: "Speleology and karst geosites in the Emilia-Romagna Region" which includes all the 40 karst geosites identified in the above mentioned database. The scientific collaboration of the Federation is very important in the Master plans of the two Natural Parks: the "Gessi Bolognesi – Calanchi dell'Abbadessa" and the "Vena del Gesso" Parks, which make up the two karst sites of the ERAGP area.

Various activities have been carried out in the karst part of the ERAGP: underground laboratories, environmental monitoring, publications, guiding and educational projects. Recently the Federation has signed an agreement inside the "LIFE Gypsum Project-Nature and Biodiversity" with the objective of cleaning and upgrading sinkholes, ponors and caves in order to protect the troglophile chiroptera (cave bats) which live in hypogean environments. The project aims to rediscover thirty karst environments and analyse the qualities of more than thirty water stations within the ERAGP area.

In ERAGP the policies for the protection and enhancement of geological heritage are carried out by the Emilia-Romagna Region in collaboration with the Geological and Soil Survey Service of the Emilia Romagna Region and the regional Speleological Federation, following Regional Law no. 9 - July 2006. The Law guarantees the protection and the appraisal of the ERAGP geosites already recognized by the Region. ERAGP is a concrete opportunity to enlarge the regional geosites database, including the 10 ERAGP geosites identified by the Scientific Committee. By means of several planned actions, the project will increase the economic development of the area appraising the Geopark sites and pointing out a clear geotourism strategy.

In collaboration with Natural Parks, the Emilia-Romagna Destination Company, the ERRSF and the Geological and Soil Survey Service of the Emilia Romagna Region, the "Gal Appennino Bolognese" is developing a market analysis and a survey of the activities carried out by the different local subjects in the ERAGP area related to geotourism. The Geopark project aims to collect the current initiatives under the common ERAGP strategy and, with the support of the main expert (the APT Emilia-Romagna Destination Company), create a new offer for promoting a holistic approach to the natural heritage of the Apennines, following several studies by the European Travel Commission, considering also the incumbent examination of the programme by the Tourist World Organization in 2013 and the canvasses carried out by professional companies. This offer will be disseminated by means of the regional official channels (and will be constituted by thematic tourist packages divided into categories which are now being defined). The creation of this offer will be directed towards an enhancement of the use of social networks as promotional channels. In addition, there will be an intensification of the relationships with low-cost airlines (thanks also to the presence of the Chairman of Bologna Airport in the board of "Gal Appennino Bolognese") and enhancement activities directed to the on-line tourist offer, considering that self-organized tourism seems to prevail on organized package tours. Finally, the possible links with the UNESCO WORLD HERITAGE sites of Ravenna, Modena and Ferrara will be taken into account in creating the thematic offer (APT Emilia-Romagna Destination Company Plan 2012).
The organization of the ERAGP project manager into several applications in order to obtain funds for developing the tourist offer linked with the Geoparks Network, will contribute to increase knowledge and awareness and will create new opportunities for the Emilia-Romagna Apennine Geoparks with the involvement of EGN and GGN.

D. 5 - Policies for, and examples of, community empowerment (involvement and consultation) in the proposed Geopark

The "Gal Appennino Bolognese" has been playing the coordination role since 2009, involving its staff in some preliminary actions for the application of the EGN and GGN: promotion of activities in the area, project budget, coordination activities with "Altra Romagna" Gal, project team organization, etc.
Several public events have been running by GAL in order to present its development program for the area. These public meetings offer good opportunity to the communities to share opinions and the opportunities of becoming a member of the EGN-GGN Network. The ERAGP staff share the Geopark idea with the Communities through several free guides to the proposed Geopark with the aim to involve them for choosing the ERAGP future localities.
The continuity and enhancement of the Gal structures, even beyond the 2007-2013 program, have been re-established by the long and heated debate concerning the reforming of European Union Agricultural Policy, which has given more importance to the programme structures in view of the next Leader planning (2014-2020). Furthermore the Leader Committee in the Emilia Romagna Region gave full support to the ERAGP, considering it as one of the most important regional project ever. These decisions will guarantee the commitment of the ERAGP team over its own territory even beyond 2013. Nevertheless, in order to support the managerial structure of ERAGP in all its complexity, considering also the preparation of the candidature dossier, The "Gal Appennino Bolognese" will entrust experts of the ERAGP territory with the implementation of a feasibility plan during the autumn 2013.
The feasibility plan idea has been shared both with the mayors and the Natural parks staff, the communities will be directly involved through participatory meetings in order to share the proposals and find the better management status.
The main goal of this study will be to define the governance which will support the Gals involved in the management of this

possible Geopark since its inclusion in the EGGN. In this way, the economic and managerial support of one or more public and private institutions identified in the study will be added to the professional competence of the Gals. The coordination of this know-how will be the ideal solution from every point of view for assuring the seriousness and continuities of all planned interventions.

THE BUSINESS PLAN

The strategic objective of the Master Plan of the Emilia-Romagna Apennine Geopark Project follows the Leader Programme rules (2009-2013) concerning Action no. 421 of the Local Action Plan, named: "Cooperation", characterized by the direct management of resources by the BolognAppennino Local Action Group and the Altra Romagna Local Action Group for their respective areas of competence. 80% of the finance for the project comes from the Leader Fund and 20% from private investors: the APT- Emilia-Romagna Destination Company, the Regional Speleological Federation, etc.

The two Local Action Groups (GAL) together have presented the: "Emilia-Romagna Apennine Geopark project" to the Emilia-Romagna Region and the Bologna Province (Tourism and Agricultural Departments), as a new opportunity to develop geotourism in the area as a sustainable new business.

The project has been approved by the Tourism Department of the Bologna Province, including ERAGP in the Local Tourism Promotion Plan for the next few years as a relevant initiative for the development of the area.

The project has been running since 2009. The actions outlined in the Master Plan concern the period from January 2012 to May 2014. Actions must be operatively finished within 2013; nevertheless, a postponement can be allowed, if necessary, until the early months of 2014. The next Leader program have already underline the important role of the Local Actions Groups for the developing of the Leader strategy for the period 2014-2020. After the May 2014 a new Master Plan will be presented to the EGN-GGN Commission, under the Leader program 2014-2020.

The main objectives of the project are:

1. Survey of activities in the area concerning geotourism in order to optimize human and economic resources.

2. Creation of a common strategy to appraise and promote geological heritage following the main guidelines of the Regional Geological Survey Service and the Regional Speleological Federation.

3. Creation of a common market strategy and guidelines for tourism; opportunity for new jobs connected with the sustainable activities in the Geopark (sport, guiding, etc.), together with the APT – Emilia-Romagna Destination Company.

4. Introduction or improvement of educational activities carried out mainly by the Natural Parks and Regional Speleological Federation.

5. The chance to participate in several common projects at a European and Global level through the participation in EGN and GGN.

6. Guarantee of quality standards required by EEG and GGN, especially through strong management strategy planned by qualified Regional Institutions and management research financed by the project itself. The latter aims to find the political-economic organisation that will support the two GALs after 2013 in carrying out the ERAG activities. The geological and cultural heritage descriptions of the application file to EGN and GGN will be included in the management strategy in order to obtain a global overview of the project. The result will be a detailed strategy that will take into account the scientific-tourist potential of ERAGP and will give a strong response about the sustainability of ERAG. This will be a completely new asset for the whole area and, will be the best practice for all the organisations that want to apply to EGN–GGN without being a Natural Park. "Gal Appennino Bolognese" will command the final strategy.

ERAGP was a precursor of the present national political vision focused on the reduction of institutions in favour of a more rational use of human and economic resources in Italy.

In the following pages the ERAGP short master plan approved by the Emilia-Romagna Region Leader Committee is illustrated: it indicates the actions and the budget available from 2012 to the end of 2013 underlining which actions aim to be carry on during

next Leader Program period 2014-2020. It also show how actions can be implemented in the area (most of them will be run by means of special ERAGP agreements with local-regional Institutions).

General objective of the project

Develop further the Geopark in the area concerning the Bologna Apennines and the Vena del Gesso Romagnola, increasing its value through the accomplishment of appraisal tourism strategies planned by the Local Action Plan.

Implementation objectives

1) Definition of a local authority as a Network Park, the uniqueness will be produced by the same EGN and GGN common characteristics.

2) Elaboration of a tailored governance strategy that guarantees both entrance in the EGN-GGN and long-term management beyond the Leader plus Programme.

3) Promotion of rural development in line with tourism appraisal following regional and local plans.

4) Local business involvement through local meetings.

Main project goal

Promotion of the area through the application to EGN and GGN under the auspices of UNESCO.

Preliminary development activities

Pre-development activities concerning preliminary project actions aiming to improve the awareness of local businesses regarding the Geopark, to create new partnerships and to define the common co-operation elements, to enter into contact with EGN-GGN members.

Description of the planned activities

The activities can be divided between local ("Gal Appennino Bolognese" will be the responsible subject) and common (both GALs are responsible organisations), but also divided into three subsequent steps.

a) Preliminary phase (1): This basic phase aims to obtain the necessary responses for creating the partnership and the Geopark. These will be common actions mainly focused on:

- Scientific project coordination, management coordination, definition of the partnership.
- Knowledge implementation, communication and awareness activities, promotion of activities in the area
- Management strategy plan.

b) Transitional phase (2):

These will be local actions:

- Promotion and appraisal activities following EGN-GGN guidelines.

c) Implementation phase (3):

These will be local actions that follow entrance in the EGN-GGN:

- Common EGN-GGN actions;
- Promotion and appraisal of Geopark activities

Accomplishment modality:

a) Common actions:

- The preliminary phase will be managed directly by "Gal Appennino Bolognese".
- The implementation phase will be managed by means of local agreements with Municipalities, Parks etc.

b) Local actions concerning the transitional and implementation phases will be managed by means of agreements with local Institutions and the Geopark management Institution identified by the management plan.

Common actions:

Management actions:

1-2-3 Management activities.

1a Scientific committee organization.

1b Partnership.

1c Executive committee organization.

Reports:

1d Scientific coordination.

1e Application to the EGN and GGN.

1f Management strategy.

1g1 Marketing strategy in several languages.

1g2 Survey of the activities and target groups.

Promotional and communication activities:

1h Active citizenship meetings regarding the ERAGP.

1i Setting up the Geopark Project web page in several languages.

1l Branding and marketing.

3a EGN-GGN events participation.

3b Annual EGN-GGN rate.

1-2-3 Setting up of Geopark headquarters.

Project indicators

Indicators	Measurement Unit	Estimated value
Partner	Number	2
of which GAL	Number	2
of which not GAL Partner	Number	
Region involved	Number	1
Municipalities	Number	
Result Indicators		
"Geopark" panels	Number	15
"Geopark" paths	Number	20
Gps path mapping	Number	20
Paper maps	Number	1000 copies available
Treasure Hunt games	Number	3 or more smartphone games
Tourism	Number	5 "Geopark" tourism packages

Geopark information centres	Number	5
User manual for "Geopark" local businesses	Number	1
Specific educational activities	Number	3
Impact Indicators		
Children involved	Number	1000
Businesses using the manual	Number	10
Educational geological activities	Number	10
Tourist operators involved	Number	5
Download Treasure Hunt	Number	50 Downloads

IMPLEMENTATION STRATEGY

Management and legal status

"Gal Appennino Bolognese" is in charge of the management of the project, supported by "Gal Altra Romagna" in some activities agreed upon in the co-operation contract. The legal and management status of ERAGP will be part of the analysis in the management survey and sustainability of the project.

Implementation mode	Activities	Subject in charge
Direct management	Preliminary steps	Gal Appennino Bolognese
Agreement	Transitory-implementation steps	Gal Appennino Bolognese

ORGANIZATIONAL ASPECTS

Time schedule and budget

Start of the co-operation project : January 2012			
Time schedule			
Activity	**JAN-SEPT 2012**	**SEPT-DEC 2012**	**2013 (2014)**
COMMON ACTIONS			
Management activities			**Continuing 2014-2020**
Scientific committee organization			
Partnerships			
Steering committee organization			
Scientific co-ordination			**Continuing 2014-2020**
Application to EGN-GGN			
Management strategy			**Continuing 2014-2020**
Marketing strategy			**Continuing 2014-2020**
Survey of activities and target groups			
Active citizenship meetings			
Geopark project web page			

Branding and marketing			Continuing 2014-2020
EGN-GGN events participation			Continuing 2014-2020
Annual rate EGN-GGN			Continuing 2014-2020
Setting up Geopark headquarters			
LOCAL ACTIONS			
Activity	JAN-SEPT 2012	SEPT-DEC 2012	2013 (2014)
GPS mapping of Geopark paths			
Geopark Locality panels			Continuing 2014-2020
Path maintenance			Continuing 2014-2020
Educational activities			
Multimedial mapping			
Paper mapping, printing and distribution			Continuing 2014-2020
Multimedial promotional activities (e.g., Treasure Hunt Platform)			Continuing 2014-2020
Promotional tourist activities			Continuing 2014-2020
Manual for businesses working in the Geopark			Continuing 2014-2020

How to accomplish management and implementation actions

The ERAGP will be co-ordinated directly by the "Gal Appennino Bolognese" staff which is in charge of guaranteeing partner communications, administrative management and local activities. For local activities special agreements will be defined with local Institutions, Parks, schools etc. in order to develop specific activities connected with geotourism and geological heritage.

FINANCE PLAN

See the Excel sheet.

Sustainability of the activities

Project sustainability is guaranteed beyond 2013 by the procedures of the Leader programme that have confirmed the role of the "Gal Appennino Bolognese" for next program (2014-2020). The Emilia-Romagna Apennine Geopark activities will be carried out together with the Institution which will be identified as the main partner in the project by the management plan in March 2013.

		GAL APPENNINO BOLOGNESE			GAL L'ALTRA ROMAGNA			GAL(s) total resources		
	Implementation	Total amount	Leader 80%	Private 20%	Total amount	Leader 80%	Private 20%	Total project amount	Leader 80%	Private 20%
Common Actions between two Gals involved										
MANAGEMENT										
1-2-3 Management activities	RD	12.000,00	9.600,00	2.400,00	1.000,00	800,00	200,00	13.000,00	10.400,00	2.600,00
1a Scientific commettee organization	RD	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
1b Partnership	RD	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
1c Steering commettee organization	RD	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total management expenses		**12.000,00**	**9.600,00**	**2.400,00**	**1.000,00**	**800,00**	**200,00**	**13.000,00**	**10.400,00**	**2.600,00**
REPORTS										
1d Scientific coordination	RD	5.000,00	4.000,00	1.000,00	100,00	80,00	20,00	5.100,00	4.080,00	1.020,00
1e Application form to the EGN and GGN	RD	12.000,00	9.600,00	2.400,00	200,00	160,00	40,00	12.200,00	9.760,00	2.440,00
1f Management strategy	RD	14.000,00	11.200,00	2.800,00	400,00	320,00	80,00	14.400,00	11.520,00	2.880,00
1g1 Marketing strategy	RD	6.000,00	4.800,00	1.200,00	150,00	120,00	30,00	6.150,00	4.920,00	1.230,00
1g2 Survey of the activities and target groups	RD	5.000,00	4.000,00	1.000,00	150,00	120,00	30,00	5.150,00	4.120,00	1.030,00
Total reports expenses		**42.000,00**	**33.600,00**	**8.400,00**	**1.000,00**	**800,00**	**200,00**	**43.000,00**	**34.400,00**	**8.600,00**
PROMOTION AND COMMUNICATION ACTIVITIES										
1h Active citizenship meetings about ERAGP	RD	2.000,00	1.600,00	400,00	0,00	0,00	0,00	2.000,00	1.600,00	400,00
1i Setting up of the Geopark project Web page in several languages	RD	1.000,00	800,00	200,00	500,00	400,00	100,00	1.500,00	1.200,00	300,00
1l Branding and marketing (leaflet english translations, etc)	RD	1.000,00	800,00	200,00	500,00	400,00	100,00	1.500,00	1.200,00	300,00
3a EGN-GGN events participation	C	6.500,00	5.200,00	1.300,00	0,00	0,00	0,00	6.500,00	5.200,00	1.300,00
3b Annual rate EGN-GGN	C	2.000,00	1.600,00	400,00	0,00	0,00	0,00	2.000,00	1.600,00	400,00
1-2-3 Geopark headquarters setting up	RD	2.500,00	2.000,00	500,00	1.000,00	800,00	200,00	3.500,00	2.800,00	700,00
Total promotion and communication activities		**15.000,00**	**12.000,00**	**3.000,00**	**2.000,00**	**1.600,00**	**400,00**	**17.000,00**	**13.600,00**	**3.400,00**
TOTAL COMMON ACTIONS BETWEEN TWO GALS		**69.000,00**	**55.200,00**	**13.800,00**	**4.000,00**	**3.200,00**	**800,00**	**73.000,00**	**58.400,00**	**14.600,00**
LOCAL ACTIONS										
1-2-3 Management activities	C	13.500,00	10.800,00	2.700,00	500,00	400,00	100,00	14.000,00	11.200,00	2.800,00
2a Gps mapping of the Geopark paths	C	4.000,00	3.200,00	800,00	0,00	0,00	0,00	4.000,00	3.200,00	800,00
2b Localities Geopark panels	C	8.000,00	6.400,00	1.600,00	4.000,00	3.200,00	800,00	12.000,00	9.600,00	2.400,00
2c Paths maintenance	C	28.000,00	22.400,00	5.600,00	18.250,00	14.600,00	3.650,00	46.250,00	37.000,00	9.250,00
2d Education activities in the area	C	6.000,00	4.800,00	1.200,00	2.000,00	1.600,00	400,00	8.000,00	6.400,00	1.600,00
3c Multimedial mapping	C	4.500,00	3.600,00	900,00	1.000,00	800,00	200,00	5.500,00	4.400,00	1.100,00
3d Paper mapping priniting and distribution	C	5.000,00	4.000,00	1.000,00	500,00	400,00	100,00	5.500,00	4.400,00	1.100,00
3e Multimedial promotional activities (ex. Treasure Hunt Platform)	C	4.500,00	3.600,00	900,00	500,00	400,00	100,00	5.000,00	4.000,00	1.000,00
3f Promotional tourist offer	C	17.500,00	14.000,00	3.500,00	500,00	400,00	100,00	18.000,00	14.400,00	3.600,00
3g Manual for the businnes working in the Geopark	C	2.500,00	2.000,00	500,00	0,00	0,00	0,00	2.500,00	2.000,00	500,00
TOTAL LOCAL ACTIONS		**93.500,00**	**74.800,00**	**18.700,00**	**27.250,00**	**21.800,00**	**5.450,00**	**120.750,00**	**96.600,00**	**24.150,00**
TOTAL COOPERATION PROJECT		**162.500,00**	**130.000,00**	**32.500,00**	**31.250,00**	**25.000,00**	**6.250,00**	**193.750,00**	**155.000,00**	**38.750,00**

1 Preliminary step
2 Transitory step
3 Implementation step

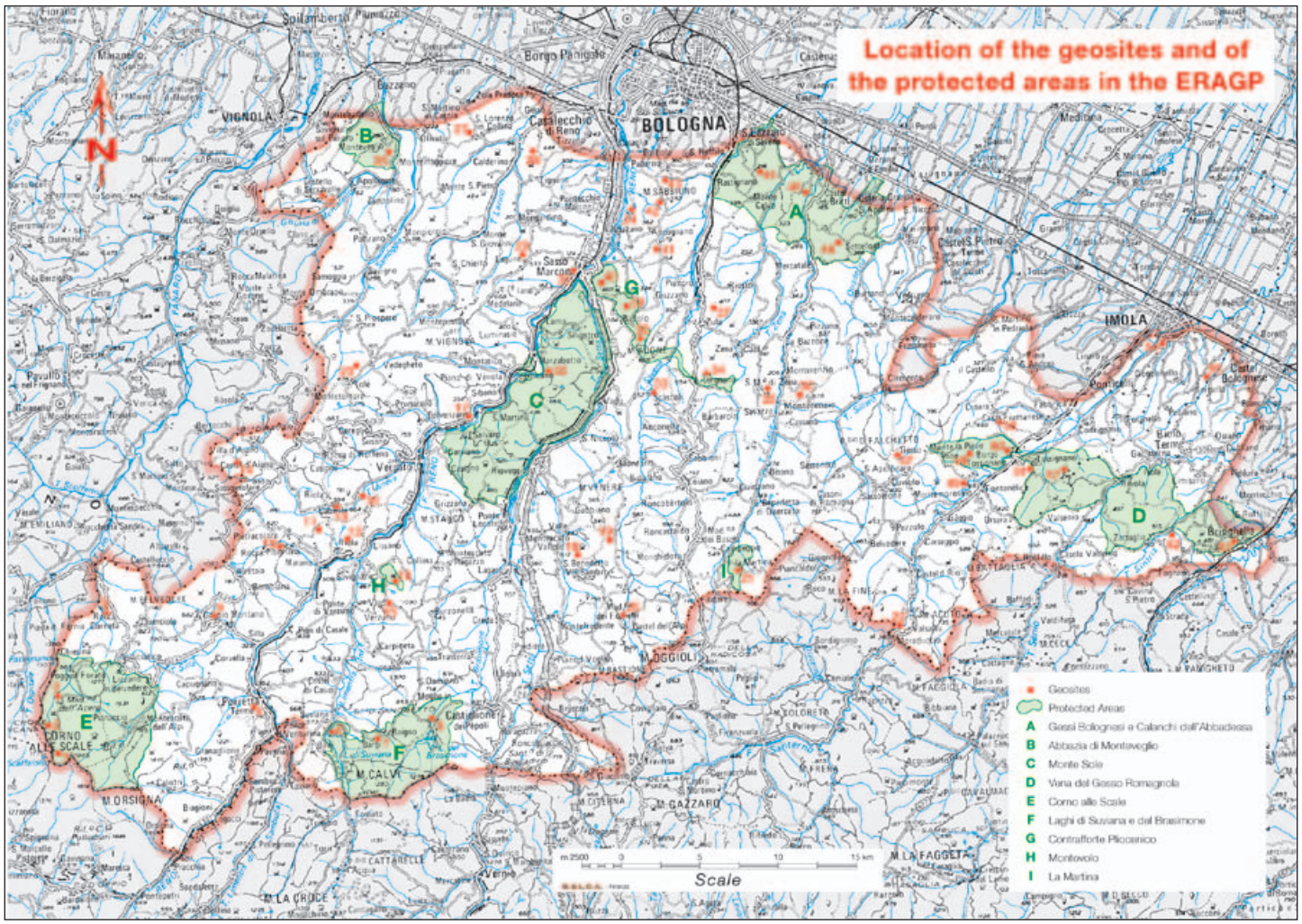
D.6 - Policies for, and examples of, public and stakeholder awareness in the proposed Geopark

In the meanwhile "Gal Appennino Bolognese" are running actions, supported by the project partners that will be public and private boards: the Emilia-Romagna Region, Bologna and Ravenna Province, the Science Departments of Bologna and Modena and Reggio Emilia Universities, the Geological Museum: "G..Capellini", the APT Destination Company,the Regional Speleological Federation and the Geological and Soil Survey Service of the Emilia Romagna Region.

D. 6.1 - *Region, Provinces, Municipalities*
The Emilia-Romagna Region, the Bologna and Ravenna Provinces, especially the Agricultural and Tourism Departments, would support the initiative by the approval of the Local Action Plan and the cooperation project.

D. 6.2 - *Universities and Geological Departments*
The "Gal Appennino Bolognese" has started cooperation with the Modena-Reggio Emilia and Bologna Universities, the Geological Museum: "G. Capellini" and the Regional Speleological Federation thanks to a special agreement. All these boards have guaranteed scientific support to the project from its first steps.

D. 6.3 - *Parks*
There are six natural Parks, from North-East to South-West: the Vena del Gesso Park, the Bologna Gypsum Park and Abadessa badlands, the Monteveglio Abbey Park, the Montesole Park, the Pliocene Ridge Park, the Lakes Park and the Corno alle Scale Park. The recent Law n. 24 of 23 December 2011 on the management of the Natural Areas in Emilia-Romagna, will allow the area of competence and the roles of the partners in the ERAGP management to be defined. In the meanwhile, Gal has already started actions, supported by the Parks, in order to investigate the main Parks activities and their compatibility with the ERAGP initiatives inside the EGN and GGN.



ERAGP area: location of the geosites and of the protected areas.

	NAME OF THE NATURAL PARK	ERAGP GEOSITES INCLUDED (ns.)
A	Gessi Bolognesi e Calanchi dell'Abbadessa	44-45-46
B	Abbazia di Monteveglio	26
C	Monte Sole	32
D	Vena del Gesso Romagnola	48- 50-51- 53-57
E	Corno alle Scale	1-2-3
F	Laghi di Suviana e del Brasimone	5-6-7
G	Contrafforte Pliocenico	34-38-39-40
H	Montovolo	16
I	La Martina	21

BioItaly code of the Site	NAME OF THE SIC-ZPS-NATURA 2000 AREAS	ERAGP GEOSITES INCLUDED (ns.)
IT4050001	Gessi Bolognesi e Calanchi dell'Abbadessa	44-45-46
IT4050016	Abbazia di Monteveglio	26
IT4050003	Monte Sole	32
IT4070011	Vena del Gesso Romagnola	48- 50-51- 53-57
IT4050002	Corno alle Scale	1-2-3
IT4050020	Laghi di Suviana e del Brasimone	5-6-7
IT4050012	Contrafforte Pliocenico	34-35-36-37-38-39-40
IT4050013	Montovolo	16
IT4050015	La Martina	21
IT4050011	Media Valle del Sillaro	47
IT4050013	Monte Vigese	15
IT4050014	Rupe di Calvenzano	17
IT4050029	Boschi di San Luca e destra Reno	41-42
IT4050028	Labante Cave	13

Forty seven of the geosites selected by the ERAGP have already been included by the Geological and Soil Survey Service of the Emilia Romagna Region in the official regional data base list: the inclusion of 10 geosites outside the area will be promoted by the ERAGP Scientific committee and the Regional Geological Survey Service. The ERAGP area includes in total 57 geosites: they will be preserved and appraised thanks to the project actions planned by the two Gal involved in the project for future years. These actions will include, among others: standardization of the information panels, improvement of the education activities connected with geology, such as "The day of geology" and school trips to the geosites. Another activity will consist in the use of new learning technologies within the ERAGP area, with different thematic games on the territory which can be downloaded from smartphones. The project will definitely increase the accountability of the ERAGP inhabitants and the awareness of politicians on the importance of preserving geological heritage for present and future generations. The project will be a step forward to support the implementation of a new regional law strictly focused on geological heritage and its conservation.

As mentioned before, the Emilia-Romagna Region set up a Regional Law (no. 9-July 2006) in order to protect the geodiversity and the connect activities in the ERAGP area. This law is aims to protect the conservation and appraisal to the geological heritage and the karst system in the Region, recognizing the Regional Speleological Federation as point of reference for the Speleological activities (ERCOLANI & LUCCI, 2010).
In Emilia-Romagna the Natural Parks and the "Natura 2000" sites make up a very effective protection system in order to preserve habitats, animal and vegetal species chosen as the most representative of the Emilia-Romagna Region, Italy and Europe (Regional Law n. 6-Febr.2005).

The Natural Parks following the Italian National Law n. 394/ 6 December 1991: "Legge Quadro sulle Aree Protette" that aims to: "preserve the fauna and the flora, the geological features, the paleontological heritage, the biological communities, the landscapes, the natural processes, the hydrogeological processes".
The Bologna and Ravenna Provinces have also set up a net in order to preserve the sites, having as a main goal the implementation of open-air laboratories for educational activities and the best practices in the conservation of rare and fragile habitats.
The Natural areas in the ERAGP are nine in total, covering app. 11% (231 km²) of the total project surface (1950 km²). The nine Natural areas are also included in the ZPS and SIC areas.
Five SIC (Site of EU Importance) and ZPS zones are included (Special Protection Zones) following the Laws ns: 92/43/CEE and 79/409/CEE, their protection and safeguard follow the EU laws concerning biodiversity and habitat protection against human destructive actions.
The result is that 273 km² (12%) of the ERAGP surface is protected by European, Italian and Regional laws: this guarantees an high level of protection for nature and the various habitats.
Following the Italian Law concerning cultural and historical heritage (D.lgs. 22 January 2004, no. 42), which prescribes that every object found underground belongs to the Italian Government, special kinds of protection have been set up to preserve important areas from human development. Two localities in ERAGP are subjected to a high level of protection, the archaeological areas of Marzabotto-Misa (geosite no. 32) and Monte Bibele-Contrafforte Pliocenico (geosite no. 36).

The policies to enhance public and stakeholders awareness have been planned since the beginning of the project and they included:
• Presentation of the project in several public events in the Region. Gal Appennino Bolognese attended to several Conferences in order to present the Emilia Romagna Apennine Geopark Project, like: "New Prospective for the valorization of the Geological Heritage in E.R. Region", in collaboration with the Natural Parks; EUREGEO: 7th EUropean congress on REgional GEOscientific cartography and Information systems, in collaboration with the Geological Survey of the E.R. Region.
• Specific public event: "Emilia Romagna Apennine Geopark Project Event", organized in October 2012 in one Geopark proposed locality. Gal hosted the Directors of the Reserve Geologique de Haute Provence Geopark and from Magma Geopark. Best practices were shared in between the participants and public and private authorities had the possibility to increase the knowledge in the Geopark topic.
• Visit to the Reserve Geologique de Haute Provence Geopark. In April 2012, a political and stakeholders delegation from the Gal area visited the Reserve having the chance to share ideas and build up awareness for the management of the proposed ERAG.

Some specific activities will also run within the Business Plan, next three years. It will include several actions address to increase the knowledge in the Geopark project and its importance for the communities. These activities comprehend: public events, education programs within the Natural Parks, advertising through the National radio channels, the project web page setting up and the use of the most common social networks.

E. Interest and arguments for joining the EGN/GGN

E. 1 - The territory's interest in joining the European Geopark Network

Under the Local Action Plan, action no 7: "Promotion of the paleontological and geological heritage", the "Gal Appennino Bolognese" has been interested in joining the EGN and GGN network since 2009. The implementation of ERAGP was suggested as a final result of a series of local initiatives in line with the objective of the above mentioned action. These activities, which concern the appraisal and promotion of geological heritage, are:

- Cooperation with the local agritourism farms in order to enhance the gastronomic and geological heritage through a geological educational path in Ca' Monari Lagune (geosite no. 29)
- Appraisal of the fossil whale discovered in Gorgognano (geosite no. 27)
- Partnership in the regional project: *"GEO Agritour"* to improve the tourist offer connected with geological heritage
- Enhancement project concerning the Porretta quartz (geosite no. 4).

The ''Gal Altra Romagna", partner in the ERAGP cooperation project, run several activities in order to achieve the common Geopark goals, like:

- Promotion strategies in the Vena del Gesso Romagnola Natural Park, the central role of the speleology and of the karst systems.
- Valorisation of the local cultural heritage through the implementation of the multimedia services.
- Promotion of the green areas in the municipalities included in the area of competence.

ERAGP was approved by the Gal Appennino Bolognese board and presented by Sara Gentilini, the ERAGP project manager, at the National UNESCO Commission in Rome, in June 2009, during the internship at the UNESCO Italian Commission. The project received immediate support by the Commission's members who considered it as an innovative strategy solution for the Bologna Apennines. The ERAGP staff attended the EGN and GGN Conference in the Naturtejo Geopark in 2009 as an autonomous project carried out by Gal Appennino Bolognese. After several months a new approach was set up and the cooperation with the Gal "Altra Romagna" was proposed and accepted: the project became much stronger and accepted as "cooperation" project between the two Local Action Groups. Between 2010 and 2012, the ERAGP staff, has been participating in several meetings at regional, national and international levels, in order to increase the knowledge about EGN and GGN and constitute the Geopark project proposal. In April 2011 the ERAGP staff visited the Reserve of Haute Provence Geopark, kindly hosted by the Director, Mrs. Sylvie Giraud. in order to strengthen the political awareness about the Geoparks importance for the local economy. From 16th to 17th of October 2012 the ERGP staff organized a meeting with Mrs. Sylvie Giraud, from the Haute Provence Geopark, France, and Mr. Pål Thjømøe from Magma Geopark, Norway. This was an important step for the development of the project, several points concerning specific Geopark topic have been clarified, comparing the two Geoparks hosted and their different internal structure. The two managers visited the area and several ERAGP localities enjoying the geological, natural and cultural heritage, discussing the different possibilities to valorise the geosites.

The interest in joining the European and Global Geopark Network dates from 2009 and is directly linked with the rising importance of EGN and GGN among the UNESCO initiatives that label the Geoparks experience as one of the most important examples of geotourism approach of the last 20 years in Europe and worldwide, with 50 approved Geoparks in Europe and 90 at a global level. The possibility to join the Network will give the ERAGP area a concrete chance to enlarge the market job opportunity in order to reduce the abandonment of the Apennines by the younger generations. This is, indeed, one of the main goals of the Leader programme. ERAGP is expected to create several temporary-seasonal jobs in the area, especially those linked to the tourist industry. Furthermore, joining the Network will give the possibility to participate in several projects, exchanging good practices and sharing common goals in the field of sustainable development. Joing the EGN-GGN represents a unique opportunity for the Region in order to develop an innovative tourism strategy between the main public and private stakeholders involved. It will help to reduce waste of money, the economic resources will be address to reach common defined goals. Through the EGN-GGN the Emilia Romagna regional tourism strategy will be address to develop the geo-tourism, increasing the educational purpose of the offer, give to the tourist unique experiences respectful of the geological and natural heritage.

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The complete Application is available at: www.bolognappennino.it