Volume n° 5 - from P37 to P54

Field Trip Guide Book - P40

32nd INTERNATIONAL GEOLOGICAL CONGRESS

GEOLOGY TASTING AND WINE MAPPING IN CENTRAL ITALY

Leader: R. Colacicchi

Florence - Italy
August 20-28, 2004

Post-Congress **P40**

The scientific content of this guide is under the total responsibility of the Authors

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Front Cover:
Grapes carved in the Late Cretaceous Scaglia stone, Pieve di Castel Ritaldi, Umbria, XII century.

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Introduction

Italian viticulture is influenced by several factors, the most important of which are the following:

A)- The geology: from North to South many different lithologies are present. Crystalline, metamorphic and carbonate rocks prevail in the northern Alpine region. Shaly, marly-calcareous sediments, and turbiditic sanstones (Flysch) are present in Tuscany and Umbria. Carbonate platforms are widespread in Central and Southern Italy. Clayish-sandy and gravelly deposits of a marine environment spread particularly over the coastal plains. Each of these lithologies gives different pedologic substrata according to climatic characteristics, up to a numberless type of *terroir* .

B)- The climate: it is typical of the Mediterranean region, which means wide variations. Northern Italy has a climate similar to that of continental Europe, while the southern regions are directly influenced by the North African climatic characteristics. The central zone is dominated, in turn, both by the cold and dry northern and northeastern winds, and by the hot and damp southeastern ones.

C)- The physiography: Italy is characterized by two main mountain chains: the Alps and the Apennines, respectively oriented East-West and Northwest-Southeast. The chains are articulated in basins and ranges, by a very irregular morphology which gives rise to peculiar microclimatic environments that influence the vineyards.

D)- Historical influences (partially induced by climate). In Southern Italy (mainly in Sicily and "*Magna Grecia*") grape-growing was introduced by the Greeks who imported grape vines and viticulture methods, with small, low vines, in order to protect them from drying out. In central Italy (Tuscany, Umbria, Marche), the growing systems derived from the Etruscans, with vines trained to tall trees (*viti maritate*) up to ten meters tall. To the North, the Celtic influence prevailed with awnings, in order to catch the maximum of sun.

The above characteristics explain the extreme variability of Italian grape-growing, and during the field trip it will be possible to see some of those traits peculiar to central Italy and to understand the origin of the variety of some Italian wines.

The three regions selected, Tuscany, Umbria and Marche, occupy the whole northern strip from the Tyrrhenian to the Adriatic Seas, so they may give an idea of the variation of vine-growing across the peninsula.

The first day will be dedicated to Tuscany: we shall cross the zone in which the world's most well-known wine, Chianti, was born and is produced. We shall go to the Brolio castle and visit the Ricasoli winery, where Chianti wine was conceived. The next stop will be in Montalcino, where Brunello, the Italian wine that can be aged for the longest number of years, is produced. Finally we will reach Montepulciano, whose wine was classified by Francesco Redi (a poet of the 16th century) "*Montepulciano d'ogni vino è Re*" (Montepulciano is the King of every wine). The road will be long, but the Chianti DOC region (that is, the geographical region in which a wine must be produced in order to be called "Chianti") is the largest DOC in Italy.

The following day will be dedicated to Umbria: here an ancient autochthonous grape variety, Sagrantino, produces a very peculiar wine, slightly sweet, but very tannic. Also in Umbria is a small zone on volcanic rocks, where the Orvieto wine, which has been famous since the Middle Ages, was, and still is, produced. It will be possible to visit the Cathedral of Orvieto, which is one of the masterpieces of medieval architecture in central Italy.

During the third day we will cross the Marche to reach the Adriatic Sea. Here we will examine the vine-growing developed both in some narrow valleys, confined by anticlines, and vineyards on a coastal plain opposite the sea and thus exposed both to the gentle marine breezes and to the cold winds from the northeast.

Field references

The itinerary may be followed using the **Atlante stradale d'Italia** edited by Touring Club Italiano, volume II (central Italy), tables 6,9,10,11,13,14, or on any other well detailed road map.

Geological maps: the **Carta Geologica d'Italia 1: 100,000** is not recommended as sheets are large and too cumbersome. There are some **Regional geologic maps** of Umbria and Marche 1:250.000, and of Tuscany 1:500.000 which are more handy.

Field Guide: **Geologia dei Vini Italiani, Central Italy** (BEMA editor) which refers to the zone crossed by the present field trip.

The regional geology and some geological itineraries are described in the **Guide Geologiche Regionali**, published by the Italian Geological Society (BEMA editor), vol. 4 and

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Geologic setting

In order to outline the geologic features of central Italy, it is necessary to start from the end of the Paleozoic age, when all the continental masses were joined together in a huge supercontinent called Pangea.

In the late Permian, Pangea began to break up into several continental blocks. The European and African plates started to drift apart. The African plate had a promontory, projecting towards the north, the Adria, from which most of the Italian peninsula is derived.

In the Triassic, between the African and the European plates a sea channel was formed; this progressively widened and became an ocean: the Tethys.

During the Late Triassic, on the African (southern) margins of the Tethys, continental fluviatile deposits (Verrucano Fm.), overlying basement rocks subaereally exposed, were encroached by the sea; owing to the warm and dry climate, evaporite and carbonate deposits developed. During the Early Jurassic a drowning of the neritic carbonates occurred and pelagic limestones were deposited in the bathial environment. During the Tertiary, tectonic activity, with these materials built up the Tuscan units**.**

On the West, during the Middle Jurassic, a new arm of the Tethyan ocean (the Ligurian arm) was formed. The ocean floor was made of basic rocks above which deep ocean sediments were laid. During the Apennine tectonic activity (Tertiary) all these rocks were wedged and thrusted above the Tuscan continental margin, to constitute the Ligurid units which are now recognizable in Tuscany.

The spreading of the Ligurian ocean floor went on during the Triassic and Jurassic. In the Cretaceous the dynamics of the plates changed as the Ligurian ocean crust was subducted under the European plate: the African and European plates began to converge. The subduction was situated along the European margin, close to the present eastern border of the Iberian peninsula.

During the Eocene and up to the Early Miocene, after the complete subduction of the Ligurian ocean crust, continental margins collide, the orogenic chain begins to form, and parts of the continental margins are scaled and thrust toward the East together with the Ligurid units derived from the ocean floor.

Later on in the Mediterranean zone, plate dynamics change again: the subducting slab is driven back towards the east and the Ligure-Provenzale basin opens. The orogenic chain together with the Corsican-Sardinian block, is detached from the European margin, and is dragged to the east with a counterclockwise rotation, leading to a crustal stretching and, later on, to the opening of the Tyrrhenian sea as a back-arc basin.

Owing to this eastward dragging, from this period (Oligocene) onward the tectonics of the Apennine consist of a spatial tectonic sequence: foredeep basins, compressional belt, and extensional basins, migrating from West to East in a kind of tectonic wave in the central part of the peninsula.

During the Oligocene, Miocene and Pliocene, at least three compressive phases may be recognized. Each of them, as said abve, was preceded by a period of subsidence, during which furrows and trenches were formed, then followed by extensional phases. The Apennine chain was highly compressed and shortened, and the fold and thrust-sheet structure was defined. The chain emerged progressively until it reached its present position. Eastern foredeeps were filled with sediments coming from the emerged zones, and thick Flysch sequences were formed.

In the Late Miocene and Early Pliocene, owing to the extensional and subsiding regime of the rear zone, the sea encroached again on Tuscany from the west until close to the Umbria boundary, while in Umbria, which remained emerged, tectonic grabens were transformed into wide lakes.

In the easternmost region (Marche) the compression was still going on and the present Apennine thrust fronts were formed.

In the Late Miocene, owing to the break of the connection with the Atlantic Ocean, the Mediterranean Sea become dry, and thick evaporite sequences were deposited on the sea bottom and even in the regions covered by the shallow sea, such as Tuscany and Marche, producing the Gessoso-solfifera Fm. When the connection was restored, the Mediterranean was flooded and filled again.

During the Pleistocene almost the whole peninsula emerged, the lacustrine basins were drained and the present situation was reached.

Following the general geologic evolution explained above, in Central Italy there are many stratigraphic and structural units, which derive from the original paleogeographic position.

Tuscan Units: they are formed by the sedimentary cover of the continental crust of the African margin, which was deformed and thrusted during the Apennine tectonism. The lowermost levels are Middle and Upper Triassic continental clastics and shallow water carbonate deposits, overlain by pelagic muddy carbonate sediments, occasionally mixed

with clay, in a typical Tethyan sequence, of Jurassic, Cretaceous and partly of Tertiary age. The well-known formations of the Tethyan sequence (Calcare Massiccio, Calcare Selcifero. Ammonitico Rosso, Radiolariti or Calcari Diasprigni, Maiolica, Scaglia) belong to these units.
In spite of their name, most Tuscan units crops out in Umbria and in Marche too, even if with slightly different names. Differences arise in the transition from the youngest pelagic sediments (Scisti Policromi Fm. and Scaglia Umbra) to the Flysch sequences. In Tuscany the Macigno-Cervarola unit lies just above the Scisti Policromi Fm, whereas in Umbria and Marche, the Marnoso-arenacea Fm. and Laga Flysch are separated by Scaglia by marly, marly-pelitic and carbonate turbiditic sequences (Scaglia cinerea, Bisciaro, Schlier, Cerrogna). (More about the youngest sediments will be said in the appropriate section).
Ligurid Units: They are made up by ocean floor materials: basalt, gabbro and serpentine, above which deep ocean sediments were lying: radiolarites, shales (Galestri) interbedded with deep-sea, thin-bedded pelagic limestones (Palombini), or thick-bedded marly limestones (Alberese). These formations are totally allochthonous as they have been divided in tectonic slices, thrust on the African continental margin above the Tuscan units during Apennine tectonic activity. Sometimes, due to the strong tectonics, the Ligurid units are totally disorganized and mixed together to form the so-called "indifferentiated chaotic" or "Argille Scagliose". The Ligurid units are typical of Tuscany and are not present in Umbria and Marche.
Flysch Units: thick sequences of shales interbedded with arenaceous beds or marly layers deposited in the foredeep by turbidity flows, in front of the rising chain. In Tuscany thereare the Macigno Fm. and the Cervarola Sandstones, Oligocene to Early Miocene in age. In Umbria the Marnoso-arenacea Fm. crops out, it is Middle Miocene in age; in Marche the Laga Flysch Fm., Late Miocene to Early Pliocene in age, is present.
Gessoso Solfifera Fm: this is an evaporitic formation related to the dessiccation of the Mediterranean Sea during the Late Miocene. In Tuscany it was deposited after the onset of the Apennine tectonic structure, so it must be considered a post-orogenic unit. In the Marche, where the tectonic movements are younger, the Gessoso Solfifera sediments are deformed, so it must be considered a pre-syn orogenic unit.
Postorogenic Units: they are formations sedimented upon the already built-up Apennine chain, in subsiding basins due to a later block-faulting extensive phase. In western and central Tuscany a sequence of NW-SE oriented basins and ridges were formed, starting from the west: the Volterra Basin, the MidTuscany Ridge, the Elsa-Siena-Rdicofani Basin, the Momti del Chianti-M.Cetona Ridge, (Bortolotti et al., 1992). In the basins the sediments consist of the already-mentioned Gessoso Solfifera Fm. and by clays, sands and gravels of the marine coastal environment.
In the Siena Basin, in southern Tuscany, the ***Crete Senesi*** is a widespread regional peculiarity that consists of gently-sloped,rounded hills (but with some badlands) of clay, deposited by the Pliocene transgessive sea.
In Easternmost Tuscany and in Umbria, the tectonic furrows gave rise to elongated lacustrine basins (the Valdarno, the Valdichiana, the Great Tiber Lake, etc.) that collected the fluviatile sediments originating from the uplifting ridges, and stored thick sequences of clays, sands and gravels, frequently interbedded with lignite layers. These basins lasted as marshes from the Late Pliocene up to the Olocene.
At the eastern margin of the peninsula (the Marche region) the sea drew back later, during the Plio-Pleistocene, and coastal plain deposits were laid down from the Apennine thrust front till the Adriatic Sea.
Magmatic Units: volcanic rocks are present in southern Tuscany and in a very small zone in Umbria, around Orvieto. They are related to the crustal stretching caused by the eastward retreat of the subducting slab. They belong to the alkali-potassic sequence of the Tyrrhenian region, and have an evident supra-subduction imprint.

Viticulture notes

The most widespread formations on which Tuscany vine-growing has developed are the marly calcareous formations of the Ligurid units (Galestri, Alberese), the Macigno, and the Plio-Pleistocene marine or continental clastic sediments. But these formations are not exclusive; vineyards are cultivated on all lithologies, provided that morphology and climate are suitable.
During the field trip we shall see the above-mentioned formations. Furthermore, at Brolio and Montalcino it will be possible to see what happens when vines are growing partly on the Macigno and partly on the Ligurid units (Galestri and Alberese).
In Umbria most vineyards grow on the lacustrine sediments of the ancient Great Tiber Lake or in the Marnoso-arenacea Fm. The grain size of the former

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is highly variable, from gravel to sand to pure blue clay, and different vines are cultivated on each rock. The most famous Umbrian wines, Sagrantino and Rubesco, developed in these lithologies.
The ancient Orvieto wine originated in a small volcanic zone. Its grapes grow partly on volcanics, partly on Pliocene marine sands and clays, and it will be possible to taste the peculiarities among wines grown on the different soils.
In the Marche region, the geological formations most used for vine-growing are: A) those related to the transition from pelagic sequences to Flysch that are marly-calcareous and contain some carbonate turbidites (Bisciaro, Schlier, Cerrogna); B) shaly sediments of the Gessoso-solfifera Fm.; C) shaly levels of the Laga Flysch; and D) coastal plain clastic sediments and alluvial deposits. The differences are due both to the different vines and to the position of the vineyards. In fact the same vine, the Verdicchio one, gives different wines if cultivated in front of the sea, or on a syncline closed in by two ridges and protected from the sea's influence (refer to day 3).
The field trip will end in a winery which makes one of the best Marchesan wines, the Rosso Conero.

Field trip itinerary

DAY 1

Tuscany

The first day will be dedicated to Tuscany. The geology here is very complicated, as Tuscany was closest to the active margin of the Adria promontory. Many tectonic deformations affected the region which, in the zones not covered by post-orogenic sediments, is almost totally characterized by thrust sheets made up of Ligurid units, Tuscan units (Falda Toscana = Tuscan Nappe) and related Flysch units. It is very difficult to define a stratigraphic sequence that could be effective for the whole region, so, at any one time, single units may be recognized following the outline detailed in the general geologic setting section.
The field trip will cross the Chianti region: here the vineyards grow on the Tuscan and Ligurid units, on the Macigno and on the Pliocene marine clastic sediments.
Leaving Florence, which lies in a Upper Pliocene-Lower Pleistocene basin, we take the A1 highway towards the south. First we cross some hills where Ligurid units, constituted by calcareous-marly turbidites, and patches of the chaotic undifferentiated complex, come in contact with the Macigno of the Tuscan units.
Later we drive along the Valdarno, a large valley that in the Late Pliocene – Early Pleistocene was occupied by a wide lake. Within the lacustrine sediments, containing thick banks of lignite, several fossil bones of mammals were found and recovered; now, restored, they are in the museum of the Geological Institute of Florence: elephants, hippopotamus, rhinoceros, bovids and many others, constitute one of the most important collections of Plio-Pleistocene continental faunas.

Fig 1 - A poster advertising that we are entering the "Castelli del Chianti" realm.

At the Valdarno exit we leave the highway, and go towards Montevarchi. From this town we take a winding road climbing up to cross the Monti del Chianti ridge.
Monti del Chianti, in spite of its name, are not big mountains; it is rather a ridge of big hills, little more than 800 m. high and about 40 km long. From a morphoclimatic point of view, it is enough to shield its southwestern region, the Chianti zone**,** from the northern and northeastern cold winds. The ridge is

made up of Macigno, and on the northeastern side, where we are climbing, a facies with thick arenaceous beds and very thin, shaly interbeds dominates. Along the road scarp, Macigno crops out and it is possible to see the thick arenaceous beds.
This lithology is non suitable for growing vines and on this side vineyards are scattered and rare, even if at Cavriglia Junction a poster informs us that we are entering the "*Porta del Chianti*" (Chianti gate).
As we cross the pass, the southwestern side of the ridge is almost completely covered by vineyards that belong to the Chianti Classico DOCG. We pass close to Badia a Coltibuono which is a famous place for Chianti wine.

Figure 2 - Montegrossi quarry: the Montegrossi calcarenites form a double fold; on the left side, west-dipping calcarenite beds are reversed, in the middle, due to a synform they become normal, and on the right an anticline changes the dip to the east. The Dudda argillaceous rocks are ejected from the syncline core

Stop 1.1:

(n.1 on the map)

At Montegrossi quarry, it is possible to see the threefold partition of the Scisti Policromi Fm. (Late Cretaceous to Oligocene) and the transition to the overlayng Macigno. The lowest part of the Scisti Policromi is very rich in clay so that it is considered a separate member and has been called "Argilliti di Brolio Member"; the middle part is made up of thin and thick (up to 2 m) beds of turbiditic calcarenites with Nummulites, and it is named the "Calcareniti di Montegrossi Member"; the uppermost part consists of reddish shales with minor intercalations of thin calcarenite beds ("Argilliti e Calcareniti di Dudda Member"). This member passes upwards to the turbiditic sanstones and shaly beds of the Macigno. In the quarry it is possible to see the complicated tectonic deformations of the thin clayey-marly beds.

Around Montegrossi and Gaiole in Chianti there are many old "villas" and "castles" that are country houses of important Tuscan families. Each of them is surrounded by vineyards and olive plantations that are perfectly lain out. If time is sufficient it will be possible to have a look at Villa Vistaregni, which is one of the more typical ones.
We go through Gaiole in Chianti and reach the Brolio Castle, which is the place where Chianti Wine was born.

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Stop 1.2:

(n.2 on the map)

The Castello di Brolio (Brolio Castle) is a fortress built around the year 1000, at the boundary between the territories of Siena and Florence, in the middle of woods and forests, for defensive purposes.

In the second half of the 1800s, Baron Bettino Ricasoli retired from political life (he had been Premier in the newborn Italian Government), came to live in Brolio and dedicated himself to studying and experimenting with wine. He was looking for the best ratio of different grapes to have a wine of great quality that could age for a long time. After a long period of study and experiments, Baron Ricasoli established the following percentage of grapes for his wine: 7/10 Sangiovese, 2/10 Canaiolo, 1/10 Malvasia, and rigid rules for wine making and aging. These rules eliminated the bitter and harsh characteristic of the Sangiovese grape and gave a softer, finer wine, with great flavor and able to compete with the famous French wines.

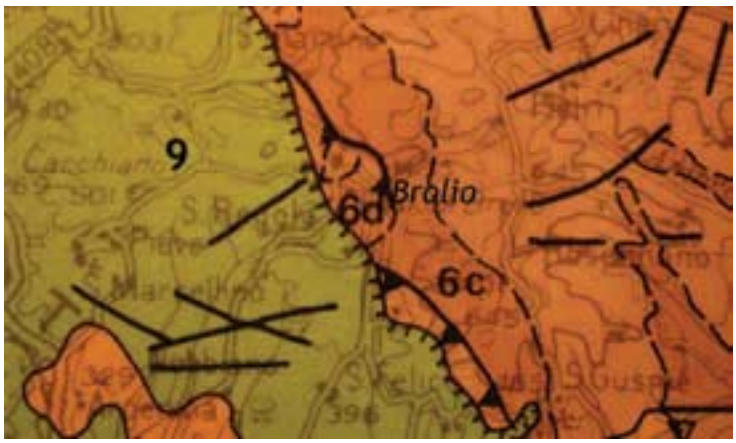
The zone is particularly interesting because, just around the Castle, there are different lithologies cropping out and the vineyards grow both on the shales and calcarenites of the Scisti Policromi Fm., and on the sandstones of the Macigno, that constitute the hill on which the Castle is placed, as well as on the Ligurid units: Galestri shales, calcareous turbidites, Argille Scagliose, Alberese . (color Figure 1)

In the Ricasoli winery it will be possible to taste some types of wine grown in different soils and different climatic environments. After the winetasting we shall go to "taste" the geology in the field, visiting some vineyards planted on different lithologies. The agronomist and enologist of the Ricasoli winery will explain to us the characteristics of the soils and their influence on the wine.

Figure 3 - Brolio Castle and the vineyards which produce the "Chianti Castello di Brolio".

After a fast lunch in a typical Tuscan inn, we take the road for Castelnuovo Beradenga and then the motorway from Siena to Bettolle. At Rapolano we leave the motorway and go towards Asciano, Buonconvento and Montalcino. Between Asciano e Buonconvento we cross the "*Crete Senesi*" region.

The Crete Senesi region take its name from Pliocene clays (*creta* means clay) laid down by the transgressive post-orogenic sea that covered the Siena-Radicofani Basin. The lithology consists of clay and sandy clays; owing to the thickness of the lithofacies, to their wide outcrops and to the peculiar climatic conditions, the morphology is characterized by badlands and by a moon-like landscape. From Buonconvento we reach Montalcino built on a hill that is the northern part of the M. Amiata ridge which bounds to the west the Siena-Radicofani Basin.



Color Figure 1 - Brolio geologic map. Brolio Castle and related vineyards lying along the contact between Scisti Policromi, Macigno (Tuscan units) and Alberese, Galestri and Palombini limestone (Ligurid units). 6c=Scisti policromi/Nummulitico, Eocene–Lower Oligocene. 6d=Macigno, Upper Oligocene. 9=Galestri and Calcare Alberese, Upper Cretaceous-Lower Eocene.

Figure 4 - Vineyards of the "Brunello di Montalcino" spread on the hills around the town.

Stop 1.3:

(n.3 on the map)

Montalcino is an ancient medieval town built around the 10th century, close to an Etruscan settlement, "Poggio della Civitella" which dates from the sixth century B.C. Placed in a strategic position close to the boundary between Siena and Florence, for a long time it was contended by the two cities and was conquered several times by the one and the other. In 1559, Montalcino was annexed to the Tuscany Grand Duchy together with the territory of Siena.

Montalcino is famous for Brunello wine, classified as DOCG which is the highest standard for Italian wines, and it is considered the most suitable for aging.

The Brunello territory is only 24,000 hectars wide, but only 2,000 are cultivated as vineyard, and only around 1,200 of these for Brunello DOCG wine.

The territory is a quadrilateral zone limited by the Orcia and Ombrone rivers and by the Asso creek. From the lower part of the river valleys, at around 100/150 m a.s.l., it rises to 564 m at the town, and up to 661 m at the top of Monte Civitella. The general shape of the territory is a kind of square-based pyramid whose sides each have a different exposition to the sun and to dominant winds.

The geology of the territory has many different lithologies. Most of the territory consists of Ligurid units: A) Argille a Palombini, jaspers and ofiolitic sanstones, Late Jurassic to Cretaceous in age; B) the city of Montalcino is built on Pietraforte sandstone and on the Santa Fiora Unit, turbiditic calcarenites, Late Cretaceous to Eocene in age; moreover, C) a thin strip of Macigno Late Oligocene, and D) lacustrine clays, Messinian in age, and marine clays, Pliocene in age. (color Figure 2)

Even the climate is peculiar,,which is slightly influenced by the Tyrrhenian Sea and is sheltered from southeastern winds by the M.Amiata inactive volcano.

The Brunello vine is a peculiar clone of the Sangiovese one, it has been developed for long time by enterprising vine-growers and adapted to the soils and climatic characteristics of each zone. It yields top qualities after a long period of mellowing in oak barrels, losing its harsh and bitter taste due to tannins, typical of young Sangiovese wines.

We shall taste some types of Brunello coming from different places and climates, and then we shall go to see vineyards growing on different soils.

Leaving Montalcino, at Torrenieri we take the S.S.1 Cassia road (one of the Roman roads that joined Rome to Florence), till S. Quirico d'Orcia (in the middle of the Siena-Radicofani basin) and then take the S.S. 146 road towards Pienza and Montepulciano.

Stop 1.4:

(n.4 on the map)

Montepulciano is built on the crest of a hill facing the

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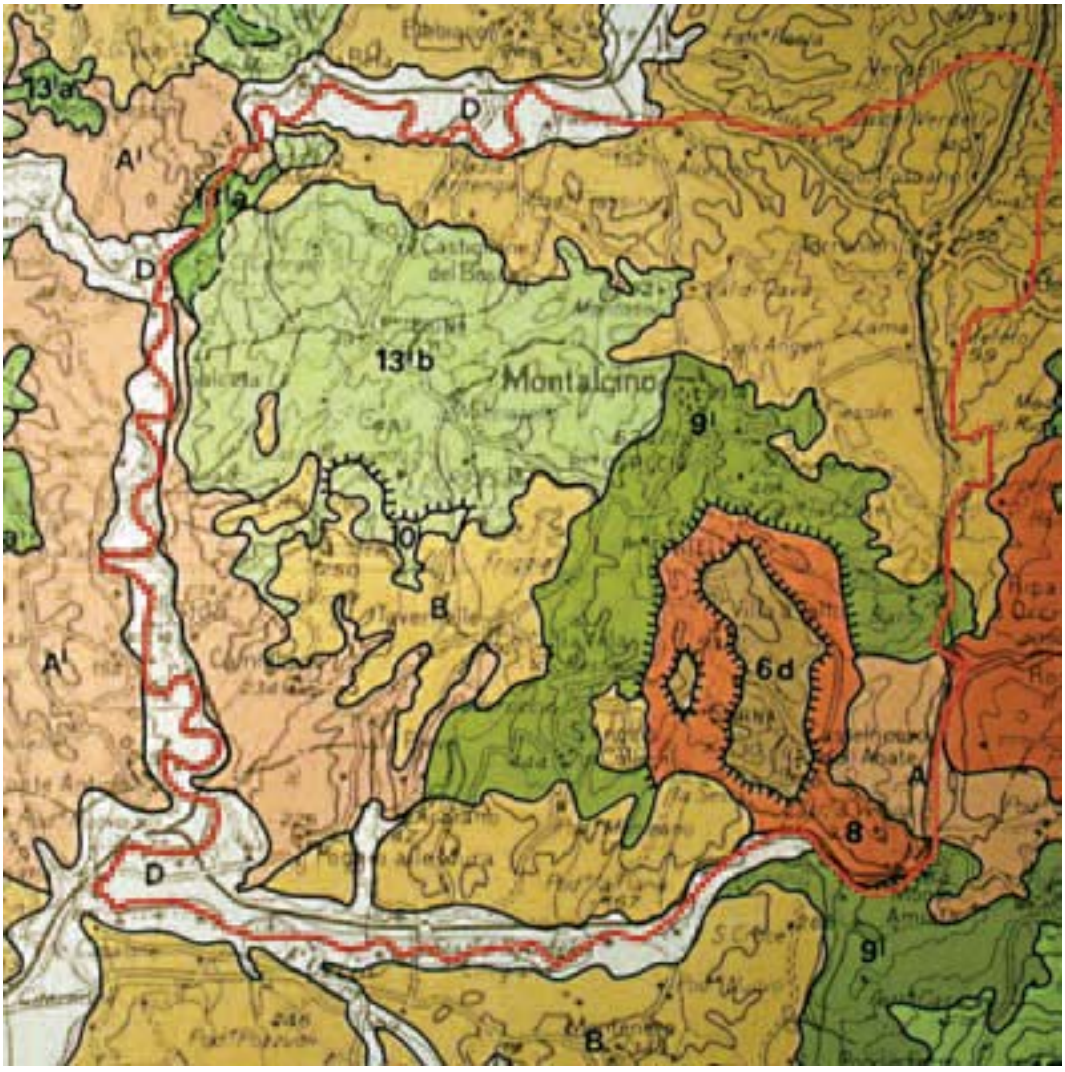
Valdichiana (another tectonic depression), from which one has a splendid view. The architectural imprint is in the Renaissance style with several buildings from the 14th century.

The importance of the town in the past was mainly due to its position at the crossroads of two main roads: one from Arezzo to Chiusi (North-South) and the other from Tuscany to Umbria (West-East).

Color Figure 2 - Montalcino geologic map. The DOCG area is characterized by several geologic units, most of them belonging to the Ligurid units. Vineyards are cultivated indifferently on any ground; microclimate and exposure to the sun are most important and selective. 13^1=Ophiolites: Basalt, Gabbro, Serpentinite, Jurassic, (Ligurid units). 13^1b=Sedimentary cover of the ophiolites: Calpionella limestones, Palombini clay, Upper Jurassic–Lower Cretaceous (Ligurid units). 9^1=Calcarenite turbidites, pinky marls and varicoloured clays, Cretaceous–Eocene, (Ligurid units). 8=Verrucano Fm.: quartz conglomerates and quartzarenites, Triassic, (Tuscan units). 6d=Macigno, Upper Oligocene, (Tuscan units). A=Gessoso solfifera fm.: evaporitic deposits and organic limestones, Upper Miocene. A^1=Lacustrine deposits: clay, sand, conglomerates, Upper Miocene. B=Marine deposits: clay, sand, conglomerates, Pliocene. The red line marks the boundary of the DOCG area.



Furthermore, it was close to the boundary of the territories of four important cities: Orvieto, Siena, Perugia and Arezzo. During the Middle Ages the town formed alliances with different cities and so it gained some independence. In 1511 it became part of the Florentine kingdom, and its economic decay slowly began. In the 19th century, after the Valdichiana was drained, the town become the administrative center of the zone.

The Vino Nobile di Montepulciano DOCG is very famous; as F. Redi, a poet of the Florentine court, in the 17th century termed it as "*Montepulciano d'ogni vino è Re*" (Montepulciano is the King of every wine). The geologic substratum of the growing area is rather homogeneous, as it is made up by clays and sands of a marine environment, Pliocene in age. The wine derives from another clone of the Sangiovese vine, called *Prugnolo gentile*, with a small percentage of Canaiolo and white grapes. After two years of ageing in small barrels, the wine loses its tannic harshness and becomes fruity, mellow and spicy.

In a winery it will be possible to taste the Montepulciano, and on the road, Pliocene sandy clays will be "tasteable".

Taking the road towards the East we shall run along the northern shore of Lake Trasimeno, we shall pass below Perugia and enter into the Valle Umbra, which in the Late Pliocene and Pleistocene was the eastern arm of the Great Tiber Lake. This was then partially filled with lacustrine sediments and later became a marsh, which was drained in the last century. We pass by Foligno and reach Bevagna to overnight. (n.5 on the map)

Bevagna is a small town with a very long history. It was a settlement of Umbrian-Etruscan origins, in the VII-V century B.C. Later it became more important in Roman times, (it was named Mevania), especially in 220 B.C., when the Flaminia Road was built and passed right through the town. Bevagna was nominated Municipio Romano in 90 B.C. During this period its territory was greatly extended, to include all the Umbra valley, which was called "Vallis Mevaniae". The economy was prosperous as its commerce was connected to Rome by the Clitunno and Tiber rivers. Many buildings have a Roman imprint: there is a mosaic of a Roman bath, the Vesta temple was transformed into a church, and the general lay out of the city has a Roman mark. The ring wall was rebuilt in medieval times on top of an ancient Roman boundary wall.

At the fall of the Roman Empire, Bevagna, like many other cities, experienced invasions by barbarians who then partially merged with local people. Between 600 and 800 AD, the Longobards had an important influence and left many traces, mainly in the names and in the dialect. After the year 1000 Bevagna, like many other Italian cities, became a Comune and experienced the "Libertà Comunali" (municipality freedom). In the following centuries, the town was annexed to the Spoleto Duchy, which was ruled by the Roman Church. It experienced continuous fighting with other cities dominated by powerful dynasties, and was conquered many times by one party or another, even if it always remained under the Holy See. Later Bevagna lost its identity and in 1860 it was annexed to the Italian Kingdom.

Several interesting buildings delimit the main square: the S. Silvestro and S. Michele churches (XII century.), the Palazzo dei Consoli (XIII century), a Roman column that in the 1800s was used to attach bills of revolt against the government.

A walk in the main square and along the main street will give the idea of a little Italian town with a very long history.

In addition to its historical meaning, Bevagna is important from an enological point of view: in fact, a large part of its territory is included in the Sagrantino area and the wine produced in the zone has been given DOCG assignation. The following day we shall "meet" the Sagrantino wine.

DAY 2

Umbria

Day two is dedicated to Umbria. The geology of Umbria is more simple than that of Tuscany. From the Triassic up to the Oligocenic deposition of the Scaglia Fm. the general stratigraphy of the region is similar to that of the Tuscan units, afterwards the pelagic environment persists, and the deposited marls become more rich in clay. The Scaglia Cinerea Fm. (Late Oligocene-Early Miocene in age) is the continuation of the Scaglia Rossa Fm. and becomes a clay-marly sediment; the Bisciaro Fm. (lower Miocene) has evidence of disaerobic environment, interbeds of siliceous sediments and volcanoclastic levels. The Schlier Fm. (which in part passes laterally to the Bisciaro Fm.) has even more clay. Later, in the Middle Miocene, the siliciclastic sedimentation fills the foredeep basin with the Marnoso-arenacea Flysch.

After the deposition of the Marnoso-arenacea

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Figure 5 - The sandy-clayish hills around Bevagna are covered with the vineyards of the Sagrantino vine

the Umbria region emerged and the subsequent sedimentations occurred in the lakes that characterize the Late Pliocene and Pleistocene (Villafranchian). The Great Tiber Lake was the largest one, going from Città di Castello to Terni for around 100 km. It had a reverse Y shape and close to Perugia divided into two arms, the eastern one called Umbra valley and the western one called Amerina valley. The

Figure 6 - At Briziarelli quarry, the oldest part of the lacustrine deposit crops out: the bluish clay contains banks of lignite broken by Pleistocene tectonics. In the upper part the deposit becomes more and more sandy.

sedimentation in the lake was very active and several hundred meters of clay, sand and conglomerates were laid down.
Only a very small zone to the souhwest, is covered by volcanic tuffs and lava flows related to the activity of the Vulsini volcanoes in the adjacent Latium region.
In Umbria most vineyards are cultivated on the Villafranchian lacustrine sediments of the Great Tiber Lake and on Marnoso-arenacea. A small but important zone is that of the volcanic rocks from which the Orvieto wine comes.

Stop 2.1:

(n.5 on the map)

Leaving Bevagna we stop at the Briziarelli quarry that is close to the town: from this quarry Pleistocene clay is extracted to make bricks and pottery. The quarry is interesting because it is a unique place where it is possible to see and study the lowermost levels of the lacustrine sequence, that is, blue clay and some lignite levels. This quarry did not contain fossil bones of large mammals, as have been found in other quarries, but micro and macro invertebrate fossils allowed us to date the lower levels to the basal Pleistocene.

Leaving the quarry, the road climbs up the hills made of Villafranchian sediments: clays, sands and conglomerates from which come the Sagrantino and the Rosso di Montefalco wines, both DOCG (we will meet them in the afternoon). The hillside that faces the eastern valley (Valle Umbra, on the left) is rather steep as it results from an Upper Pleistocene fault that uplifted the lacustrine sediments. The western side consists of sandy-clay gentle hills.
After Bastardo the road crosses the northern ramification of the Monti Martani and goes through the Scaglia Rossa and the Marnoso-arenacea Fms. We reach the Amerina valley and the Tiber river. In front and then on the left we can see Todi on top of the hill made of the sandy-clay deposits of the western arm of the Great Tiber Lake.
Following the Tiber valley we enter the “Gola del Forello” excavated through the northern ramification of the Monti Amerini. Then, driving beside Lake Corbara, we may see the typical outline of the Orvieto zone: Plio-Pleistocene sandy clays, above which we find a high cliff made up by thick banks of volcanic tuffs and lavas, with steep sides and a flat top. On the flat top rests the beautiful city of Orvieto.

Figure 7 - Vineyards of the Orvieto wine lying at the base of the cliff. On the right is visible the abrupt wall that delimits the tufa bank. On the flat top of the hill is visible the Orvieto skyline with the pinnacle of its famous Dome.

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Color Figure 3 - Montefalco surroundings geologic map. The Antonelli vineyards are spread on three different substrates, the Marnoso-arenacea Fm. (a pre-orogenic flysch), clay /sand, and conglomerates of lacustrine environment. M^{4-2}=Marnoso-arenacea Fm., Middle Miocene. la=Lacustrine clay and sandy clay, Late Pliocene/Pleistocene. lc=Lacustrine conglomerates and sands, Pleistocene. f=fFluvial deposits, recent

Stop 2.2:

(n.6 on the map)

Orvieto is a very old city, On the flat top of the hill, there is evidence of occupation from the Iron Age on. Later, between the VIII and III century B.C., an important Etruscan city developed there. The town was destroyed by the Romans in 264 B.C. In the Middle Ages the town was conquered by Goths and Bizantines. Around 1000 the town was settled as a Commune with the name of Urbis Vetus (from which the modern name is derived) and the Guelphs and Ghibellines fought each other in order to dominate Orvieto. During the XI and XII century most of the city palaces were built and the medieval image of the city was established. In 1354 the city became important as an extension of the Roman Church, and in this period the huge fortress was built. During revolts in Rome it was used as a refuge by the Popes Alexander VI and Clemente VII. The old city maintained the urbanistic character of a medieval fortress and the modern development is mainly at the base of the cliff.

The most important monument of the city is the Duomo (Cathedral), whose building began in 1290 and went on up to 1500. It is an outstanding example of Gothic architecture. In the “Cappella di S. Brizio” there are many frescoes, from the end of the XIII century, a masterpiece by Luca Signorelli. Outside, the decoration is made of white and black stripes, and on the black ones it is possible to recognize large crystals of leucite which is the lithology quarried around the rock.

A rapid visit to the Duomo will be organized.

Orvieto is famous not only for its monuments but for the wine that has its name, too. The cultivation

of grapes and wine-making is documented from the Etruscan period, when people excavated several grottos and galleries in the big tufa bank, in order to create cellars where the wine could ferment at stable temperature. During the Renaissance the Orvieto wine represented one of the best wines present on the table of the Papal court; during the same time the painter Luca Signorelli claimed that part of his salary was paid in wine.

In the Orvieto vine-growing area the geology is very important, because the cultivating area is partly on Pliocene clays and sands and partly on volcanics; so the deriving wines are slightly different. Volcanic tufa and the related soil is extremely rich in potassium and in many other minerals, that boost the development of the vine and its organoleptic characteristics. Furthermore, the vine is more vigorous, produces more grapes, so it has less sugar and consequently there is less alcohol in the wine, so it is lighter, fresher and, more fruity. On the Pliocene clay and sand, vines are less vigorous, producing fewer grapes but with a higher sugar content. These wines are stronger, more mellow, and more similar to other white Umbrian wines.

A winetasting will be organized in a winery, with explanations of the different tastes due to different soils in which grapes are grown. Later a rapid jaunt into the vineyard will allow us to better understand the relationships between soil and wine.

After a light lunch we leave Orvieto and return to Montefalco.

Stop 2.3:

(n.8 on the map)

Montefalco is known as "the balcony of Umbria", because of its panoramic position. From the drive along the wall's ringing the town there is a unique view over the Umbrian Valley, from Perugia to Assisi, Spello, Trevi, all the way tSpoleto. In the Middle Ages the town was called Coccorone, and in 1249 it took its present name from the eagle on the coat arms of Frederick II who stayed many times in the town. In 1270 it was annexed to the Spoleto Duchy, and later, after a period with changing fortunes in 1400 was finally again controlled by the Pope. This fact increased the cultural role of the town, and, in this period, in the St. Francis church, Benozzo Gozzoli painted a series of frescoes that represent a masterpiece of Renaissance art. From 1400 up to 1700 many churches and monasteries were built, but the medieval character of the town's architecture was maintained.

Montefalco is built on banks of conglomerates, Pleistocene in age, resting on sands and clays, that represent the final deposition in the Great Tiber Lake. The conglomerates constitute the hilltop and were lifted up to 500 m. a.s.l. by a fault that shaped the eastern side of the Valle Umbra.

A tour of the town and a visit to the Museum of S. Francesco will give an idea of the importance that these small towns had in the past. A visit to some conglomerate outcropping on the slope will help us to understand the stratigraphy and the sedimentology of the zone.

About the wine, Montefalco, together with four other townships (Bevagna, Castel Ritaldi, Gualdo Cattaneo, Giano) is the place where the Sagrantino grape is cultivated. It is an old grape, probably autochthonous, with small, deeply-coloured grapes, that make the wine strong and tannic, but very rich in poliphenols. For long time it was made by drying the grapes, in order to make a sweet but rough wine, or to correct the taste of other lighter red wines. Recently, Sagrantino has been used alone to make a wine that after some years of aging and mellowing develops its own special aroma. In the last few decades Sagrantino has been classified as DOCG and has been launched on the international market. At the same time the traditional method of drying the grapes and making a sweet wine persists, and the Sagrantino "Passito" is the result. It is a sweet wine, but very rich in body, and so highly tannic that it comes across slightly bitter. A true rarity.

Retracing our steps a few kilometers we reach the Antonelli winery. Here the vineyards are growing on three different substrates: Marnoso-arenacea, Upper Pliocene sandy clays, and Pleistocene conglomerates; it will be possible to taste wines coming from different soils and to appreciate the results. Furthermore it will be possible to "taste" the lithology and the soil that produce the wine. (color Figure 3)

Stop 2.4:

(n.7 on the map)

If time allows, it will be possible to visit another zone that has been given the DOCG classification.

Torgiano is a little town on a hill at the intersection of the Tiber and Chiascio rivers, it is renowned for the wine of the same name. Torgiano is very important from an enological point of view, because the Rubesco wine, created by G.Lungarotti, was the first Umbrian wine able to compete with the famous

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Tuscan wines. The vineyards are on Miocene shales (Marnoso-arenacea, and Schlier) where white grapes grow, and Villafranchian lacustrine sandy clays of the Great Tiber Lake, where the red Sangiovese is cultivated.

The Torgiano Red Reserve, classified DOCG, is produced with a mix of Sangiovese, Canaiolo, Trebbiano, Ciliegiolo and Montepulciano d'Abruzzo. With the particular name of Rubesco, it is produced by the Lungarotti winery and it will be possible to taste it in their winery.

DAY 3

Marche

The third day will be dedicated to the Marche. In this region we shall survey the lithologies that represent the transition from the last true pelagic formation to the flysch sequence, and to the regressive coastal plain deposits.
From the Triassic up to the Scaglia Cinerea Fm. (Oligocene) the stratigraphy is practically identical to that of Umbria, but later on, the marine environment was influenced by the recently emerged Apennine chain, and the sediments show more clay and several detritic interbeds. Three formations are characteristic of the transition from the calcareous pelagic deposits to the Flysch: The Bisciaro Fm., a marly and siliceous deposit which has some evidence of disaerobic periods, and several thin levels of volcanic ashes. The Shlier Fm., a light blue, clay-marly deposit. These lithologies are followed both by the *Gessoso Solfifera* Fm. that derives from the dessication of the Mediterranean sea, and by the Laga Fm., a Flysch, made up of siliciclastic turbidites, that fills the front foredeep basin, and passes laterally, in part, to the Gessoso Solfifera.
After the emersion of the main Apenninic range in the Middle Pliocene, clay, sand and conglomerates were laid down by the transgressive/regressive sea, during its several oscillations induced by the glacio-eustatic sea level variations. Sediments have in general a coastal plain trend, gently dipping towards the sea. This original morphology has been dissected by several rivers that excavated large valleys, almost perpendicular to the Adriatic coastline, which allow the mild sea winds to penetrate deeply into the inland, thus moderating the climate of a large strip. Fluviatile deposits along the wide valleys top the stratigraphic sequence.
Leaving Bevagna, we go through Foligno and take road n.77 in order to cross the Umbria-Marche Apennine which is composed of a sequence of anticline ridges thrusted toward the east. On the western side of the range there are no vineyards; here the prevailing cultivation is that of olives. Close to the village of Pale, on the other side of the valley, a very thick sequence of roughly bedded Calcare Massiccio, Early Lias in age, crops out. It derives from a shallow water carbonate platform that at that time covered all of Central Italy. After Casenove the road scarp has a pink color that is the typical color of the Scaglia Rossa Fm., Late Cretaceous in age.
The Colfiorito zone shows some flats separated by little ridges aligned NW-SE. The structure is determined by small faults that create narrow grabens. It may be compared to the Basin and Ranges region, but in miniature. All the lithology is limestone or marls, and the grabens rapidly became lakes and marshes, most of which have dried up. At present there is still one marsh preserved as a shelter for

Figure 8 - Close to Serrapetrona an ancient way of growing grapes may be seen, The vines are "maritate" (married) to living trees, and long lines strung from tree to tree hold the vine branches.

Figure 9 - The Verdicchio vineyards in the Matelica syncline. On the left may be seen the western side of the anticline that shelters the area from marine winds.

migrating aquatic birds. The name Colfiorito derives from the flowers that in spring completely cover the flats in a colored tapestry.

Going on towards the northeast we cross the front range of the Marche Apennine, which is an anticline thrusted to the east. On the eastern limb

Figure 10 - Verdicchio vineyard around Jesi, well organized on a downhill slope, on the Pliocene sandy clay of coastal plain.

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of the structure we drive along a quarry where the well-exposed sequence of the upper part of Scaglia Rossa, from the Bonarelli level to the KT transition, may be seen. After a tunnel we take the road for Serrapetrona.

Stop 3.1

(n.9 on the map)

Serrapetrona is a little town of medieval origin, built in a strategic position for defending the valley. Just before the town there is the testimony of the old way of growing vines, deriving directly from ancient populations (probably Etruscans). The vines are "*maritate*" (married) -- trained to living trees and long lines, strung from tree to tree, whichhold the vine branches and stretches them out in order to increase their production. Around this small town a particular vine is cultivated: the "Vernaccia nera" that is the origin of a strange, sweet and sparkling wine. Geology and climate contributes to the originality of the wine produced in the zone.

The cultivation area extends down the anticline, and on its eastern limb, theoretically up to 1000 meters of M. Letegge, but grapes are actually cultivated only as high as 600 m. The substrate is composed of Scaglia, Bisciaro, Shlier, the basal part of the Laga Flysch and the detritic apron of the anticline. All these lithologies give a loose soil, well drained and very rich in minerals, especially in iron, which is responsible for the reddish colour of the soil and for the dark red of the wine. The climate is continental, not influenced by the sea, with wide temperature variations both daily as well as yearly, very suitable for growing grapes.

Vernaccia is a grape variety probably related to the Cannonau variety (Sardinia), that in this physiographic situation reaches the maximum of its potential. According to local people the name "Vernaccia" probably derives from the practice of collecting the grapes in October, letting them drythrough the winter (*vernum* in Latin) before pressing them in February or March. The result is a sparkling wine, dark red, lightly sweet or quite dry, that is particular and produced only in this small zone.

In the Quacquarini winery it will be possible to taste different types of Vernaccia in relation to the soils and microenvironments where the grapes grow.

Leaving Serrapetrona we drive northward until S. Severino Marche, then turn to the West and cross again the anticline, following a narrow valley cut by the Potenza River. At the core of the anticline the Maiolica Fm. (top Jurassic-Lower Cretaceous) crops out and it is possible to see the rhythmic bedding, with white beds and thin grey interbeds. We reach the middle of the adjacent syncline and, turning to the north, we reach Matelica.

Stop 3.2:

(n.10 on the map)

Matelica is an ancient town, founded in 664 B.C. by Umbrian people. It became a Roman "Municipio" and flourished, but, after the decay of the Roman Empire, was destroyed and rebuilt many times during the barbaric invasions, because it was a passage for armies crossing the peninsula. The town was really the property of the Catholic Church, but was conquered by Longobards and Goths, and it was dominated by the Germanic Emperors Fredrick Barbarossa and Ottone IV. Around 1100 Matelica become a "Comune", and, even under the control of the Roman Church, had its own political organization. Later it was dominated by the Ottoni dynasty until late 1500. A more active control of the Church allowed the town to develop small industries and commerce. At the Italian Risorgimento Matelica was annexed to the Kingdom of Italy.

Recently Matelica has become interesting from an archeo-viticultural point of view. During excavation for construction work the "Vigna Clara grave" was discovered; it was the burial site of a warrior and has been dated to the VIII century B.C. Among the funeral equipment a bronze basin contained several grape-seeds that have been classified as *Vitis vinifera.* This grape was imported from the Orient and reached the Italian coast from the Adriatic Sea. In Matelica we have the oldest documentation in the Marche, and one of the very rare ones in Central Italy, of the presence, the cultivation, and the importance of domestic grapes eight hundred years before Christ.

Now we are ready to meet the Verdicchio di Matelica wine, which was one of the first to be given the DOC: in 1967.

First the geology: Matelica is in the core of a valley, corresponding to a syncline oriented NNW-SSE. Miocene formations: Bisciaro, Schlier, Gessoso-solfifera and the lower beds of the Laga Flysch crop out in all the area. The deriving soil is loose, with little or no clay, very rich in minerals. The climate itself is particular; placed between two anticlines, the zone is sheltered from the mild effect of the marine wind's influence, and it is open to the north and northwestern cold winds, as well as to the sun from the south. The

climate is continental, with cold winters, very hot summers, and strong variations in temperature even daily. The grape- growing area is 450 m. high on average, but vineyards extend up to 650 m. This situation is favourable for the vines as they become less vigorous, decreasing their production but increasing their quality, developing more flavor and giving structure and body to the wine.

The Verdicchio vine is now considered autochthonous, but probably it was imported in very ancient times by Venetian people migrating southward, and recent studies discovered that it is related to the Soave grape, typical of northeastern Italy. Here, in this region the Verdicchio grape found the ideal environment for developing its whole potential. These characteristics of soil and climate give a very tasty wine with a strong structure due to the high content of poliphenols and sugar. For these characteristics it is considered "a red wine dressed in white".
At Matelica there is a municipal enoteca with a center of sensorial analysis where studies and researches on foodstuffs are carried out. This research center contributes to developing and improving the quality of both the wine and the other products of the region. In the enoteca we shall taste different types of Verdicchio and hear about the cultivation and the differences caused by different *terroir*.

After lunch we will continue our trip, crossing again the front range (M.S.Vicino) and reaching the zone that connects the easternmost Apennine front range with the Adriatic coastline. This is the typical zone of the Verdicchio dei Castelli di Jesi**.**

Stop 3.3:

(n.11 on the map)

The Castelli di Jesi are several small towns, built on the tops of hills in medieval times, in general upon older Roman settlements, and fortified with walls, to defend the city of Jesi from the surrounding cities.
The whole region is covered by Pliocene sediments; to the western part, close to the front range, they are older and pebbly-sandy, towards the East they are finer and more rich in clay, up to the blue clay of the uppermost Pliocene.
In opposition to the zone of Matelica, this area is open to the mild eastern winds coming from the sea, and the temperature variations are lesser. The result is a more vigorous development of the vines, a more abundant production with less sugar that gives a softer wine, more delicate and with a fruity taste.
On these lands the Verdicchio develops best and it is very sensitive to the soil characteristics and to the exposure, giving different results even in vineyards very close to each other. The vineyards are generally small and the pieces of land are highly fractionated,

Figure 11 - View of Monte Conero from the southwest: the highest part is covered with "Mediterranean macchia", while the lower part, sheltered from the cold northeastern winds has vineyards and other crops

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so there are a great number of wine makers that produce small batches of bottles in which there may be wine of very high quality.
With the help of an enologist, and a sommelier it will be possible to explore the production coming from different soils and expositions.

Stop 3.4:

(n.12 on the map)

Next stop will be closer to the coast in the territory of the Rosso Conero wine. Monte Conero, from which the name of the wine is derived, is a promontory 572 m. high, 25 km away from the Apennine range, overlooking the Adriatic Sea. In spite of the low elevation, M. Conero looks higherbecause it rises up from a very low zone, and has a very steep eastern side going down to the sea.
From a climatic point of view it has great importance: it shields the western zone from the northeastern cold winds, allowing a mild climate very suitable to the cultivation of vineyards.
The geological structure gently dips to the West and is made up of Scaglia Cinerea, cropping out to the South, and Bisciaro and Shlier that make a piedmont strip. On these formations Pliocene sediments are transgressive with epibathial clays, as well as Pleistocene ones with sandy clay neritic sediments. The vineyards are cultivated on the Pliocene and Pleistocene sediments, as the higher zone is covered by "macchia mediterranea" (typical Mediterranean brush) and it is a Natural Reserve.
The soils, derived from the detritic apron of the dip side of the mountain, and from sand and clay of the Pliocene and Pleistocene, is rich in limestone and potassium, and ideal for the Montepulciano d'Abruzzo vine that here gives its best results, and is the master component of Rosso Conero wine which is considered the "noble red" of the Marche. In a winery we shall be briefed about the pedologic characteristics of the terrains on which the Rosso Conero is cultivated, and a winetasting which will conclude the field trip.
The end of the field trip will be at the Ancona Railway station or at the Falconara Airport, according to the request of the participants.
The bus will go back to Florence.

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Back Cover:
Itinerary on road map of Central Italy

FIELD TRIP MAP

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