



CONTENT

- Foreword | 3
- Rheingau, Hessische Bergstrasse and the Riesling | 4
- The term „terroir“ | 5
- The project „Terroir Hessen“ | 7
- The origin of the landscape | 8
- The soil | 10
- Soil and Wine | 12
- Quartzite – Lorcher Bodenthal-Steinberg | 12
- Quartzite and slate – Rüdeshimer Drachenstein | 14
- Loess – Winkeler Hasensprung | 16
- Sandy loess – Heppenheimer Steinkopf | 18
- Clay – Hattenheimer Schützenhaus | 20
- Riverdeposits over limestone – Hochheimer Hölle | 22

PICTURES:

Reinhard Antes: S. 4 bottom, 19
 Peter Böhm: S. 5, 7, 8, 10, 12, 13, 14, 15, 16, 17, 18, 18 top right, 20, 21 top, 22, 24
 Peter Böhm, Klaus Friedrich: S. 1 bottom
 Deutsches Weininstitut: S. 2, 6
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 Rheingauer Weinbauverband: S. 3, 4 top, 9 top
 Claudia Schmidt: S. 11 bottom, 23
 Nina Stoelting: S. 11 top
 Schloss Vollrads: Title



Foreword



Klaus-Peter Keßler
 President of the Rheingau
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Otto Guthier
 Viticultural Association
 Hessische Bergstrasse

WINE BUSINESS is increasingly feeling the effects of globalisation. Small wine regions such as the Rheingau and the Hessische Bergstrasse are competing with products from all over the world on the wine market. This development also leads to a globalisation of tastes. Wineries increasingly employ modern technology to tailor wines to suit consumers. The discussion about artificial flavouring is just one example of the trend towards producing uniform, non-descript wines – in the end, wines that could be from anywhere.

the word embraces much more than just the soil, it is understood as the sum of the whole: grape variety, terrain, microclimate, geology and soil as well as the work put in by the winemaker in the vineyard and cellar. The product is a unique wine, with a style that reflects its provenance. Winemakers from the smaller wine growing regions in particular are experiencing a growing demand for wines with distinct styles and personalities.

In response to current interest in terroir wines, the association of wine growers of the federal state of Hesse has commissioned the Geisenheim

Research Centre to investigate the diversity of the vineyards in Hesse and the wine styles they produce. In a joint effort with winemakers in Hesse, numerous sites were selected for producing Riesling „terroir wines“.

Many winemakers are reacting to this „new wine culture“ by focussing on provenance and authenticity. Wine is once more appreciated as a unique natural product. There is a growing awareness for wines with styles that reflect the natural and individual conditions of the vineyards and the work of the winemaker. Wine producers and wine appreciating consumers associate these qualities with the French term „terroir“. „Le goût de terre“ means „the taste of the earth“. However,

This brief brochure introduces you to six wines and their vineyards, focussing on the effect of the soil on the Riesling wine.

We would like to encourage you to take a closer look at the landscape and its wines. You can taste the great diversity of the vineyards of the Rheingau and the Hessische Bergstrasse in the wineglass.

Re-discover the world of the Riesling.

Rheingau, Hessische Bergstrasse and the Riesling

WHY IS THE RHINE SO BEAUTIFUL? This question often inspires romantic glorifications of the landscape, culture and the people that live here. The answer also lies in the local wine. The wine regions in Hesse follow the Rhine along the sunny slopes of the Rheingau and Hessische Bergstrasse. Winemaking is a traditional craft in these regions, pioneered by Benedictine and Cistercian monks. Many important inventions and discoveries still used by winemakers around the world originated here: late harvesting and select picking, the cabinet cellar and bottling. Today this task is carried out by the School of Viticulture in Eltville and the Geisenheim Research Centre – Germany's most important institution for viticulture.

The Rheingau (3100 ha) and the Hessische Bergstrasse (444 ha) belong to the smaller German wine regions. Riesling is by far the most important grape produced in Hesse: 78% of the Rheingau and 50% of the Hessische Bergstrasse is covered by this variety. These regions provide optimum growing conditions for the best and most noble white wine in the world. The wines produced here are both interesting and magnificent. The long ripening period of the Riesling grapes ensures that they can make full use of mean annual temperatures between 10 and 11°C and over 1600 hours sunshine per year - ample time for the grapes to



Gentle Hills – the Rheingau

develop their acidity and aroma. The annual precipitation is 560 mm (Rheingau) and 690 mm (Hessische Bergstrasse) and most of the rain falls during the vegetation period providing the vines with the water they need.

The diversity of the vineyard conditions also contributes to the growing conditions of the vines. Microclimate and subsoil can vary substantially even within a vineyard. The soils have developed from ancient slate and quartzite, magmatic rocks, marine sediments or ice-age dusts. Like no other grape variety, the Riesling responds to different soils and microclimatic conditions. The natural diversity of the vineyards is one of the strengths of the wine regions in Hesse and the basis for producing extraordinary wines.

Companion of the Rhine – Hessische Bergstrasse

The term terroir

PROVENANCE is very important and traditional for German and European wines. In recent years, German wine growers have begun to use the term terroir in this context. The direct translation of the French word means „soil, subsoil, source, provenance, location and vineyard“. However, the word actually describes much more: terroir signifies the overall effects of natural vineyard conditions plus the influence of the winemaker on the style of the wine. It includes site conditions such as soil type, water balance or hours of sunshine but also the grape variety or specific production and ageing procedures. Terroir signifies more than just soil, it means „a sense of place“. The term is not only used for wine but for many other agricultural products.

„TERROIR
IS THE
TASTE OF
PROVENANCE.“

NATURAL VINEYARD CONDITIONS

All natural conditions that affect the growth of the grapevines and therefore influence the development and storage of constituents in the grapes are summarily known as site factors. Apart from affecting the constituents and aroma of the grapes (primary aromas), these factors also have a major effect on the processes during fermentation (fermentation aromas) and storage (storage aromas) of the wine. The interaction between soil, climatic and topographical factors produce grapes and wines with a defined and unique provenance.

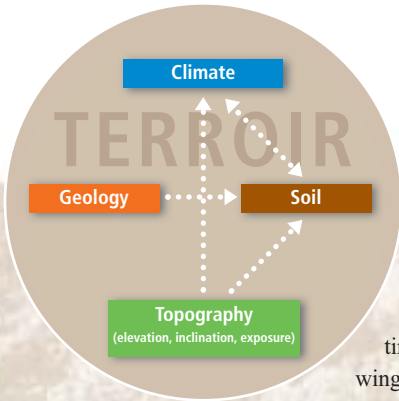
The soil is the most important single site factor. The water and nutrient balance has a profound effect on the wine style and the development of aroma. The texture of the soil or the particle size



Soil texture is one of the determining factors

distribution has a direct influence on the water balance and therefore the amount of water available to the vine during the vegetation period. Thus, plants will experience water stress much more often on sandy or stony soils. In contrast, silty soils, e.g. soils on loess, are much better at retaining water. Vines growing on these soils will only very rarely suffer from low water supply. The wine style also seems to be greatly affected by soil pH and natural calcium carbonate content. Wines produced on alkaline, calcareous soils have a higher pH-value and tend to be better buffered. These wines taste very different from those produced on acid, carbonate free sites. The soil calcium carbonate content and pH-value as well as the texture are determined by the parent material of the soil.

The climatic conditions of a site, the macro-, meso- and microclimate, play a central role in determining the ripening conditions. Degree of latitude, aspect and slope influences the growth of the grapes. However, it would be inaccurate to base an assessment of the influence of climatic factors solely on grape sugar content. Climate also affects a large number of other metabolic processes. The current climate change is causing a noticeable trend in the northern wine growing regions towards earlier ripening of the grapes and increased potential alcohol (°Brix). A higher temperature during the ripening period is a common factor today. This is why sites with climatic conditions that promote a slow, but complete ripening of the grapes are highly valued. In Germany, it is also becoming increasingly important to harvest the



grapes when nights are cool and temperatures low in order to preserve the traditional type of white wine.

THE INFLUENCE OF THE WINEGROWER AND VINTNER

The winegrower modifies the natural conditions by implementing site-optimised viticultural practices to realize the full potential of the vineyard. The production of wines of a specific provenance depends on the selected grape sort, optimally an autochthonous grape, site-specific viticulture and the implementation of traditional oenological practices. The effects of environmental conditions and vintage are deliberately accepted in order to produce highly diverse wines. Of course, this provenance-based



Only high quality grapes make great wine. The vintner inspects the vine.

viticulture also affects the terroir.

However, some restraint is required when implementing oenological practices. Growing international grape varieties or using barrique barrels may be useful additions to winemaking in the Rheingau and Hessische Bergstrasse. However, this has a profound effect on the traditional character of the wines.

Vintners producing specific brands will implement various oenological procedures to minimize the environmental effects. The result is a constant wine style, where provenance cannot be tasted. Only a few international sorts have managed to conquer the market. The project „Terroir Hessen“ is part of the discussion concerning the merits of provenance versus brand.



The grapes require careful treatment. Preparing the grapes for pressing.

**The project „Terroir Hessen“
The secrets of the Riesling**



The project symbol - abstracted illustration of soil horizons

TERROIR IS THE UNITY of soil, topography, climate and the efforts of the winemaker. Many wine producers and aficionados are convinced of the unique effect of the terroir on wine quality. Although the topic is much debated, there is no concrete, scientific evidence. How do the different terroirs in the Rheingau and Hessische Bergstrasse affect the style of wine? The current discussions have moved the Rheingau viticultural association and the viticultural association Hessische Bergstrasse to initiate the project „Terroir Hessen“. These two associations have commissioned the Research Centre Geisenheim (FAG) to address this issue.

Since October 2006 the Research Centre has been working in cooperation with experts from the State Agency for Environment and Geology in Hesse (HLUG), the Regional Council Darmstadt and the Bureau for Viticulture in Eltville to identify the variety of sites and their effect on the style of wine.

When prevailing climatic conditions are comparable, the soil can have a unique effect on the ripening conditions of the grapes. In order to verify this effect, six sites with very different soils were selected for producing Riesling wines. The grapes were provided by the winegrowers. The soils chosen for the project developed from the following parent materials: loess, sandy loess, quartzite, clay and river deposits. The style of the terroir wines is determined by the specific properties of the soils. The aim of this project was to produce wines whose style genuinely reflects the site and to ensure that a maximum of the aromas formed in the grape are transferred to the must and wine. The natural effects of the site should not be masked or removed. This means that the winemaking procedures are reduced to those that are absolutely necessary. A defensive and conservative oenological approach reduces any interference to a bare minimum.

A standardised winemaking procedure carried out at the Department for Oenology at the FAG ensured reproducible results in relation to site characteristics and typicality. Restrained fermentation using a neutral ferment resulted in a high degree of completion. The six sites and their wines are described in full in this brochure.



Handpicking preserves the aroma of the grape

RETAINING THE TERROIR-CAREFUL TREATMENT AND DEFENSIVE WINEMAKING

- Healthy and ripe harvest
- Handpicking
- Careful transport
- Whole-grape pressing
- Cold stabilization
- Cool restrained fermentation
- Careful vinification and bottling

The origin of the landscape

THE OBSERVANT VISITOR is hardly aware of the eventful history of the landscape, which can be traced back to the Palaeozoic. This ancient history is preserved in the long eroded ancient mountain ranges and the remains of the shallow seas that once covered the land. The rocks from which our vineyard soils have developed can be many thousands or hundreds of millions of years old. Very often, the rocks vary from young to old within a small distance, which results in soils with very different properties.

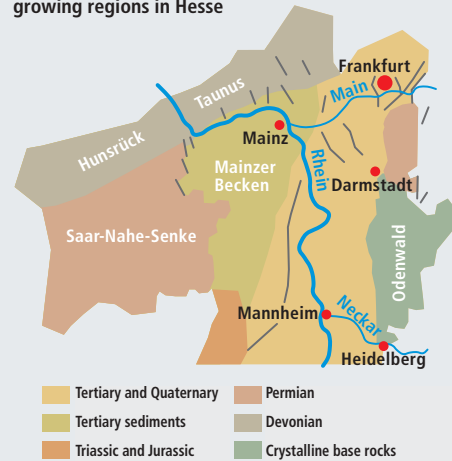
PALAEOZOIC ERA – COLLISION OF CONTINENTS

The history of the landscape reaches back to the lower Devonian (about 400 million years ago). Europe and America formed a single continent called Laurussia. The continent Gondwana, consisting of Africa, India, Australia and the Antarctic

was located south of Laurussia. During this period, the low mountain range called the Rheinische Schiefergebirge was actually a shallow ancient sea. Rivers brought huge amounts of sand and clay into this sea basin.

Coarse sand was deposited nearer to the coast while clay was transported far out into the sea and deposited as mud. As the seafloor slowly sank, the sediments accumulated to thicknesses of several kilometres. At the end of the Devonian, both continents drifted towards each other until they colli-

Geological overview of the wine growing regions in Hesse



ded. During the collision, these sediments were overthrust and folded - forming a large mountain range that rose above the sea. The impressive relics of these events are seen in the steep dip, folding and foliation of these ancient rocks. The slates are the characteristic rock of the Rheinische Schiefergebirge low mountain range. As the sediments were subjected to high pressures during the mountain building process their structure was changed.

This „metamorphosis“ turned sand into quartzite and clay into slate. The terroir of many vineyards along the Middle Rhine are influenced by „Taunus Quartzite“ and „Hunsrück Slate“ parent materials. During the collision, magma ascended from deep down into the upper crust. These rocks outcrop along the Hessische Bergstrasse.

Castle ruin Ehrenfels near Rüdesheim



The Rhine Gorge - the German Grand Canyon
The Upper Rhine Rift Valley ends near Rüdesheim and the Rhine enters the imposing slate mountains. The river has cut a deep gorge into the rocks with very steep walls on either side.

CENOZOIC ERA – TROPICAL SEA, THE GERMAN GRAND CANYON AND ICE-AGE DUST

The landscape today is dominated by the Upper Rhine Graben, a rift in the earth's crust that started to form about 50 million years ago. During the Oligocene (about 30 million years ago), the region was flooded by a sea. The edge of the Taunus and the Bergstrasse marked the coastline of this sub-tropical sea in which sharks and sea cows thrived. Although the sea existed for only a few million years, it left many relics of its existence in the Rheingau: beach gravel, marine sands, clay and limestone. As the sea receded, the Ur-Rhine reconquered the rift valley, flowing in a shallow valley through the lowlands of the Rheinische Schiefergebirge towards the North Sea. During the Pleistocene (2 million years ago), the Rheinische Schiefergebirge was upthrust forming the low mountain range we see today. The Rhine carved its valley into the rising mountains forming the well-known imposing steep-sided narrow valley – the Grand Canyon of Germany. The Pleistocene also marks the beginning of the ice



Built on quartzite - Castle Johannisberg overlooks the Rheingau

ages. The alternation between cold and warm periods continues until today. Our landscape was formed by intensive weathering and deposition of loose sediments. The continuous freezing and thawing of water fractured the rocks. Thick beds of wind-blown dust along the slopes of the Rheingau and Bergstrasse are an impressive testimonial to the power of the wind during the ice ages. Storms removed sand and fine dust from the dry riverbeds. This dust dropped out of the wind in shielded areas creating thick beds of loess. Today loess covers large parts of the Rheingau and the upper slopes of the Hessische Bergstrasse.

The Soil

SOIL AND ART

The pictures in the cycle „le gout de la terre“, created by Nina Stoelting, combine soil constituents with structures of historic vineyards. For many years, the artist from Wiesbaden has been committed to the aesthetic translation of wine themes into paintings.



Nina Stoelting
STEINBERG, natural
stone, earth, pigments,
acrylic paint on wood,
2003, 115 x 165 cm

NO VINEYARD WITHOUT SOIL. Soil is the basis for all that follows. The vine needs support, water and nutrients for producing leaves and roots, oxygen for the roots to breath and warmth to promote growth. These vital requirements are provided by the soil to a greater and lesser degree. Rootability, water and nutrient balance, aeration and the warming capacity all depend on the interplay between the various soil components. The soil is the uppermost, weathered part of the earth's crust. Climate and soil organisms have turned mineral and organic substances to soil. The parent material has a profound effect on the soil properties. Soil texture

determines water and air permeability and the available soil water capacity. The mineral composition controls the inorganic nutrient content. Colour and stoniness influence the storage and distribution of warmth in the soil and on the surface.

Soils consist of different sized particles, which determine the nutrient balance and the long-term reserves - its „mineral power“. The properties of the soil depend on the interplay between many factors: climate, vegetation, topography, parent material and management practices. Since these factors vary from location to location, this accounts for the variety of soils.

VINEYARD SOILS - THE WINEGROWERS WORK

The winegrower forms the soil in the vineyard to create the ideal conditions for the grapevine. Before planting new grapevines, the vineyard soils need to be prepared. Traditionally this involves deep ploughing the soil. This optimises the soil properties and provides the grapes with a homogenous substrate that is easily penetrated by the roots. The natural profile of the soil is changed by deep ploughing and the individual layers or horizons are usually no longer recognizable. The unaltered soil or parent material is found below the plough horizon.

THE TRESURE HUNTERS

A vintner on his deathbed lay,
called his children for this to say:
„In our vineyard a buried treasure lies;
just go along and dig it up!“ –
His children called – „where does it lie?“
„Just dig it up“, he says and dies

As soon as the old man was lain to rest,
his children dug with all their strength.
With picks and mattocks
and spades they toiled,
turning over the vineyard's soil.
Not a clod remained unturned
they even sifted the earth
to examine each stone
and dragged the hoe across the ground.
But in the end no treasure was found
and all believed they'd been put on.

But lo and behold! when one year was over,
came a big surprise for all to see,
each vine carried grapes three times over.
The sons they learned their lesson well
and every year since they dig the soil
to unearth the treasure and so you see

to dig for treasure need not folly be!

(Gottfried August Bürger)

Diversity and fascination - vineyard soils in Hesse



SOIL AND WINE STYLE

How does the soil affect the development and ripening of the grapes and how does this effect vary between soils? Water balance, aeration and temperature regime of the soil are the most important influencing factors. Does the soil warm quickly or slowly? Can the soil provide the plants with enough water? Are water, nutrients and minerals available when they are needed by the plant? Riesling grapes must ripen slowly for high sugar and substance levels and intense aromas. The climate during the year, meaning the intensity and distribution of rain and temperature determines the character of the vintage.

However, each site varies with respect to the microclimate as well as water and nutrient supply. This is why grapes never ripen uniformly. Core soil properties such as texture and cation supply can have a measurable effect on the qualities of the wine. This applies in particular to the extract content and acidity of the wine, as well as the development of aromas.



Soil sampling and
assessment

QUARTZITE

Lorcher Bodenthal-Steinberg

THE SUMMITS of the Taunus low mountain range consist of a hard rock called quartzite. The sandy sediments washed out of long gone mountain ranges were deposited near a coast during the Lower Devonian (about 400 million years ago). These deposits were soon compacted to form sandstone, which was subjected to high pressures when it became buried beneath thick layers of rocks. This resulted in a modification of the crystalline structure of the sandstone turning it into a hard quartzite. This was followed by a period of intense folding during the mountain building process when the Taunus mountain range was formed. The Taunus Quartzite contains more than 90% quartz (SiO_2) and very little mica or feldspar. Therefore, the rock has a very low carbonate and iron oxide content. As a result, the soils derived from this quartzite have a very low plant nutrient content.

The site Bodenthal-Steinberg is located in the Middle Rhine Valley between Assmannshausen and Lorch, at an elevation of 180 m above sea level. The site is steep and faces southwest. Solar radiation is one of the most important factors determining the quality of a vineyard and

depends on the inclination and exposure of the terrain. The favourable location of this vineyard ensures that it receives an optimum level of solar radiation from April to October.

Quartzite soils are debris soils. The weathering processes during the ice ages fractured the rock into large blocks. The grey-brown hortic anthrosol consists of quartzite gravel and boulders as well as slate. The proportion of stones is high so that the soil is only capable of storing small amounts of water. Deep ploughing has resulted in a friable soil with good rootability. The roots of the vine can easily penetrate to great depths on their quest for water and nutrients. This stony, sandy-silt soil is quick to warm and can retain the heat very well. Although the water reservoir in the topsoil is quickly depleted, the plants do not suffer from water stress. The vines find the water they need in the subsoil, where groundwater flows down the slope. The stoniness and high proportion of quartz in the fine earth fraction of this calcium carbonate-free soil means that the mineral nutrient content is low. Decalcified residual loess in the topsoil improves the water balance and nutrient supply. This moderately dry site warms quickly and promotes early ripening.



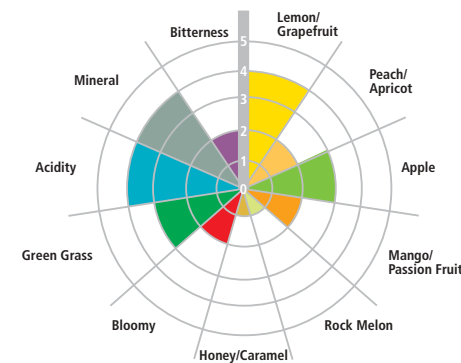
QUARTZITE

Hortic anthrosol with quartzite debris
A calcium carbonate-free, base nutrient deficient, dry site with moderate ripening constraints



SOIL PROPERTIES

- low soil water capacity
- groundwater flow in the subsoil
- medium rootability
- good aeration
- very good warming capacity
- no calcium carbonate
- low mineral nutrient potential



THE WINE

The wines of the Lorcher Bodenthal-Steinberg are lean, light and very lively. The wine is strikingly spritzy, with a lively, pleasantly fresh, tingling acidity. Fine delicate fruit aromas of grapefruit with a hint of lemon underscore the unpretentious elegance. The quartzite furnishes the wine with minerality and a fine tanginess that never dominates, but harmonizes with the fine unpretentious fruit aromas and the lean body. This is an elegant wine with many fine details and a great deal of potential.



QUARTZITE AND SLATE

Rüdesheimer Drachenstein

THE IMPRESSIVE PANORAMIC VIEW from the Drachenstein embraces Rüdesheim with its Rhine islands, Bingen and the Niederwald monument. The very steep site faces southeast and is located at an elevation of 220 m above sea level. The vineyards receive moderately high levels of solar radiation.

Quartzite and weathered slates – this soil is a special variant of the quartzite terroir. In many places, the layers of Taunus quartzite are interspaced with slate. The resistant quartzite weathers into large boulders. Under the subtropical conditions of the Tertiary the slate weathered into a red clay-rich fine earth. Quartzite boulders in a clay dominated matrix forms the subsoil at this site. The grey-brown topsoil also contains residual loess. The rate of erosion is high along the steep slopes of the Drachenstein and much of the soil has already been removed. The remaining thin layer of soil is very stony and can only store limited amounts of water. In addition to this, the dense, clay subsoil is very difficult for roots to penetrate. These are demanding

conditions for the grapevines. Although the soil is acid and contains no calcium carbonate, the clay supplies sufficient nutrients and trace ele-

ments. The soil is quick to warm because of the low water content and high solar radiation levels along the slope. As a result, the vine experiences water stress early in the year and must somehow cope with the available water. The plants react

by reducing the number and size of the grapes. Therefore, this site produces low yields of very aromatic grapes.

QUARTZITE



Hortic anthrosol formed on quartzite debris over quartzite and weathered slate. A calcium carbonate-free, base nutrient containing, dry site with ripening restrictions



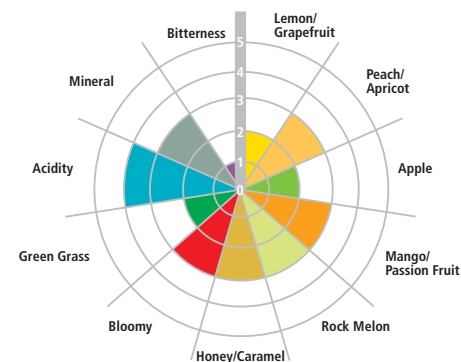
QUARTZITE IN THIN SECTION

This low-grade metamorphic sedimentary rock is almost entirely made of quartz (white, grey and black). Increased pressure and temperature has caused the individual quartz grains to recrystallize to form an interlocking mosaic of crystals. This produces an extremely hard rock.



SOIL PROPERTIES

- low soil water capacity
- restricted rootability
- restricted aeration
- very good warming capacity
- no calcium carbonate
- moderate mineral nutrient potential



THE WINE

The wines produced in the vineyards of the Rüdesheimer Drachenstein also have a fine minerality. However, the character and temperament of the wine is very different: it is fuller in body with a dominating acidity. The aromatic and fine fruity aroma is reminiscent of passion fruit and ripe yellow fruits offset by a fine rose scent. Wines produced in this vineyard typically have a distinct aroma of graphite.

This indicates that the character of the wine is influenced not only by the quartzite but also by the clay-dominated, nutrient-rich weathered slate in the subsoil.



LOESS

Winkeler Hasensprung



HOLLOW WAYS IN THE LOESS

Loess particles are angular. This explains the high stability of the spectacular steep loess walls along the hillsides or in old hollow ways such as this one near Eltville

THE WINE GROWING REGIONS of Hesse are strongly influenced by loess. This sediment is one of the best substrates for agricultural land use. Thick layers of loess blanket the landscape between Lorchhausen and Heppenheim. Usually this light coloured, fine sediment lies hidden from view below the ground. Sometimes the loess is exposed along the steep sides of hollow ways. The ice age dust is found in most of the vineyard soils. Storm winds winnowed the fine dust particles from gravel beds deposited by wide rivers. The dust dropped out of the wind in shielded locations accumulating to thick loess beds. Loess mostly consists of silt particles (diameter 0.02 to 0.0063 mm) and contains quartz, feldspar, mica, various clay minerals and a lot of calcium carbonate. Iron oxides give the loess its yellow-brown colour.

The slightly inclined site faces southeast and is located at 120 m above sea level. The vines receive high levels of solar radiation throughout the vegetation period. The original soil has been nearly completely washed away on the slopes of the Winkeler Hasensprung site. The hortic anthrosol consists of a mixture of loess and residual loess. This means that the topsoil is rich



LOESS

Hortic anthrosol formed on loess
A calcareous, base nutrient rich, moist site with best ripening conditions

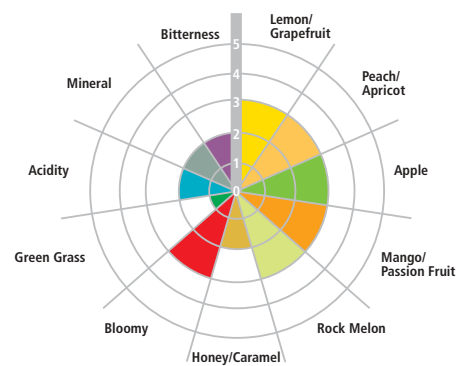
in calcium carbonate. Below the deep-plough horizon lies the unweathered light coloured loess. The friable substrate makes it easy for the roots of the grapevine to penetrate deep into the soil to reach water and nutrients. The most important property of the loess is its high available soil water capacity. However, this does not prevent air from circulating in the pores. The silty soil is easy to manage but is also readily washed away. The natural nutrient reservoir of the loess provides plants with a rich supply of minerals. The loess provides

the vines with plenty of water and nutrients even during droughts. Under favourable climatic conditions, loess soils are excellent for growing wine and provide the best ripening conditions.



SOIL PROPERTIES

- very high soil water capacity
- very good rootability
- moderate aeration
- moderate warming capacity
- contains calcium carbonate
- large mineral nutrient potential



THE WINE

The exceedingly fertile loess soil provides the grapevine with more than it needs. Thus, it comes as no surprise that this excess is reflected in the powerful and rich wine produced here. The harmonious blend of distinctive aromas and richness is captivating. The wine appears juicy with a wide range of different fruit aromas, dominated by peach and tropical fruits.

All loess wines are characterised by a fine dryness. The complex and unbiased interaction between sweet balanced acidity, full body and agreeable softness is typical for wines produced on calcareous soils. A generalist with plenty of potential, which delights both wine lovers and aficionados alike.



SANDY LOESS

Heppenheimer Steinkopf

AT THE FOOT OF THE HESSISCHE BERGSTRASSE, the loess contains a large proportion of sand. This sandy loess also contains a lot of silt. Strong ice age winds transported fine sand to the summits of the Bergstrasse. The sandy loess mostly consists of quartz grains and calcareous fragments with other minerals only playing a minor role.

The Steinkopf is located north east of Heppenheim at the foot of the Hessische Bergstrasse above the Hambach valley. The west facing gentle slope is located 160 m above sea level. The vineyard receives moderately high levels of solar radiation during the vegetation period.

The hortic anthrosol developed from the sandy loess is a „light“ version of a normal loess soil. This available soil water capacity is slightly lower but still sufficient to provide adequate amounts of water. The friable substrate allows roots to penetrate to great depths, enabling plants to tap into additional water reservoirs. Water stress is very rare since the Bergstrasse receives more rain than the Rheingau. However, water supply can be restricted during the ripening time in autumn. The fine sand fraction ensures that the soil is well aerated and quick to warm.

The large pores between the sand grains allow air to circulate so that the soil warms early in spring giving the grapevines a head start. The nutrient and mineral content of the sandy loess is slightly lower than that of loess soils.

SANDY LOESS



Hortic anthrosol formed on sandy loess
A calcareous, base nutrient containing, moist site with good ripening conditions



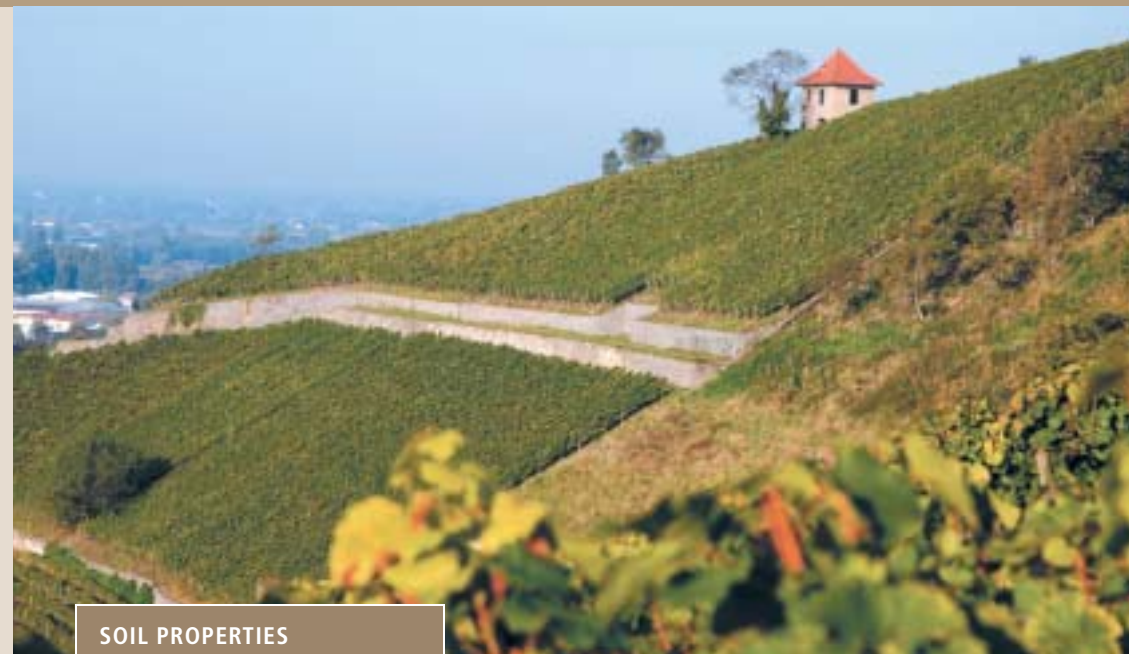
PSEUDOMYCELIA

Secondary, thread-like calcium carbonate concentrations



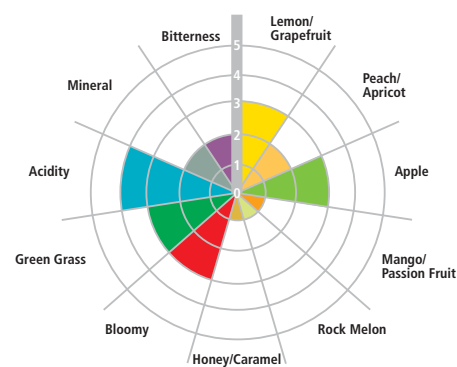
LOESS IN THIN SECTION

Angular loess particles (light grey to white) embedded in crystalline calcium carbonate (dark grey). A fracture is filled with white calcium carbonate.



SOIL PROPERTIES

- high soil water capacity
- very good rootability
- good aeration
- good warming capacity
- contains calcium carbonate
- moderate mineral nutrient potential



THE WINE

In relation to the characteristic of the wine, the sandy loess appears to be the little brother of the loess. The vines are not quite as well provided. The soil supplies a little less water and nutrients, with immediate effects on the wine. The wine is finer and slightly less full-bodied. The acidity is balanced but not sharp. The decreased body of the wine means that the acidity is more prominent. The wines are thinner and crisper than those produced on loess soils. The sandy loess also furnishes the wine with an agreeable tangy tartness. The delicate fine fruit aromas are clear but appear more reserved than those found in loess wines. The distinct aroma of nectar is an interesting nuance.

Sandy loess wines are spring wines that evoke associations with the onset of the flowering of almonds.



CLAY

Hattenheimer Schützenhaus

FROM THE GEOLOGICAL POINT of view it is not so long ago that waves were crashing against the edge of the Taunus mountain range. Deposits of gravel derived from 20 to 30 million year-old tertiary sediments can be found in many places. Finer sediments such as the Cyrena Marl were deposited in the calmer parts of the sea. The Mainz Basin was uplifted at the end of the Tertiary period, cutting off the link to the oceans. The fine brackish sediments from this period are light green, green-grey and blue-green in colour. In many regions, the Cyrena Marls have subsequently been decalcified. Clays and clay marls determine the soil properties in many famous vineyards around Hattenheim (Nussbrunnen, Wisselbrunnen), Erbach (Marcobrunn) and Hochheim (Domdechany, Hölle).

Multicoloured mica-rich clays and sands were mixed during deposition. The subsoil consists of the decalcified clay of the Cyrena Marl. The mottling of the soil developed after the sea had receded. The rise and fall of the groundwater level decalcified the marl. The alternating oxidising and reducing conditions caused iron minerals to discolour.

In many respects, clay soils are extreme. They are heavy soils, wet in spring. They can store large amounts of water, but due to the strong adhesion to the clay particles, only a small fraction is available to plants. The pores of clay soils are

very fine, restricting aeration – „the soil does not breathe“. Water drains very slowly. In spring, the soil is waterlogged and aeration is severely restricted. Therefore, these soils are slow to warm. If the plants get „cold feet“ because of waterlogging, their growth is impeded, which in turn leads to an increased susceptibility to diseases. The high clay content and density of this soil impedes root penetration. Roots cannot grow deep enough to obtain the required amount of water and nutrients. The clay soils dry out in late summer, which leads to delayed ripening of the grapes. The mineral nutrient potential is the one positive factor. Large amounts of plant available nutrients are adsorbed to the clay particles.



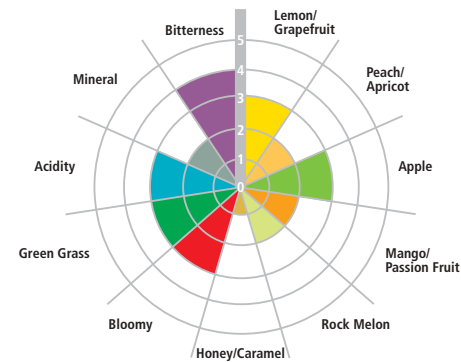
CLAY

Hortic anthrosol formed on tertiary clay – A calcium carbonate poor, base nutrient containing wet site with restricted ripening conditions.

This site is located on the Hattenheimer Boxberg, 140 m above sea level. The west facing, gentle to moderately steep slope receives moderate levels of solar radiation during the vegetation period.

SOIL PROPERTIES

- high soil water capacity but restricted availability
- poor rootability
- restricted aeration, water-logging
- poor warming capacity
- low calcium carbonate content
- moderate to high mineral nutrient potential



Fossils from the Cyrena Marl (named after the brackish water mollusc): Polymesoda and snails (left granololabium, right: Potamides, below: Keepingia)

THE WINE

Heavy clay might be expected to yield a stately, opulent wine. However, the grapes ripen slowly on this cool, pure clay soil. The weak acidity of the soil is indicative of a limited nutrient supply. The resulting wine is less weighty than the heavy soil would lead to expect. The wine possesses a tangy acidity and a reserved aroma of exotic fruits (pink grapefruit) with hints of apple or orange peel. The low calcium carbonate content of the soil means cannot buffer the acidity, yielding a wine that is straightforward, direct and pithy. Clay soil wines are typified by a complex minerality, fine hint of bitterness and a unique salty, tangy aroma.



RIVERDEPOSITS OVER LIMESTONE

Hochheimer Hölle

YOUNG RIVER DEPOSITS, only a few thousand years old, overlie the ice-age gravels of the river valleys. These sandy or silty deposits are nutrient-rich, fertile locations offering best conditions for grapevines if climatic and hydrological conditions permit.

The microclimate of the riparian zones often differs noticeably from the locations along the slopes. On the one hand, cold air descends the slopes and collects in the valleys. The bottom of the valley is cold in the mornings, the humidity is higher and the mists linger in spring and autumn before dissipated by the sun. This can impede shoot growth and ripening. On the other hand, the humidity is elevated in the hot summer weather creating a unique warm humid climate.

The gently sloped vineyard is located 90 m above sea level on the banks of the river Main. Solar radiation is moderate to high, however morning mists reduce the positive effects of this climatic factor. Cold air descending from the upper slopes can delay the ripening process.

The sandy silt Main river deposits are calcareous and rich in nutrients. The subsoil consists of a very dense layer of tertiary limestone debris, which is near impervious to roots. Thus, the root



RIVERDEPOSIT

Hortic Anthrosol formed on calcareous river sands and clays over tertiary limestone debris. A calcium carbonate and base nutrient-containing wet site with good ripening conditions



LIMESTONE FROM THE HOCHHEIMER HÖLLE

The name Hölle (hell) is derived from the old German word for steep slope and has nothing to do with hell.

zone is restricted to the river deposits. Because the site is located several metres above the river level it is not affected by groundwater.

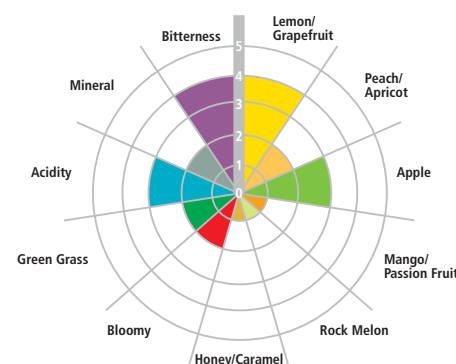
The rootability and aeration of the topsoil is good. The deep plough horizon contains large amounts of added humus and calcareous clay substrate. The raised calcium carbonate content could be problematical.

The clay between the limestone contains large amounts of trace elements. The soil provides the plants with a good and balanced supply of nutrients and water. The microclimate may cause delayed ripening.



SOIL PROPERTIES

- moderate soil water capacity
- good rootability in topsoil
- good aeration
- moderate warming capacity
- high calcium carbonate content in the subsoil
- moderate mineral nutrient potential



THE WINE

The grapevines benefit from the ample supply of water and nutrients to yield a wine that is well endowed with fruity aromas and body. The sandy silt soil in combination with the clay furnishes the wine with a lasting, sustaining taste, which merges into a fine bitterness.

The high extract content of the wine is a direct effect of the clayey calcareous topsoil and the limestone beds in the subsoil. The calcium carbonate also ensures that the elevated acidity of the wine is well-buffered.





Hallgarten



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