

Nove publikacije - New Publications

Decrouez, D., Finger, W., Haldimann, P., Hofstetter, J.-C., Kündig, R., Meyer, C., Mumenthaler, T., Sieber, N., Spescha, R., Testaz, G. et al. (eds.), 2018: **Stein und Wein: Entdeckungreisen durch schweizerischen Rebbauggebiete**, AS Verlag & Grafik, Zürich: 612 p.

Stone and Wine

Discovery tours through Swiss vineyards

Starting from the initial observation that enthusiasm for wine is widespread among geologists, the core of Swiss geologists came to the conclusion that they could contribute with their knowledge and personal efforts to resolve the open technical questions about the influence of rocks on the quality of wine. The Department of Earth Sciences at ETH Zurich, with the Swiss Geotechnical Commission, recently renamed the Expert Group on Earth Resources, which has been active there since 1899, is credited with launching the project. The company 'Verein Stein und Wein' was set up and Reiner Kündig, Executive Director of the Swiss Geotechnical Commission, became Editor-in-Chief of the planned publication.

A ten-member editorial board coordinated the work of a 63-strong team of authors and a team of more than 40 graphic designers, illustrators, technical consultants and translators for a decade. In order to cover the necessary breadth and complexity of the subject, geologists were joined by experts in other branches of geosciences, and wine experts and winegrowers were also consulted. The result is a 612-page publication comprising a main book with 15 chapters and 10 regional volumes. Each of these presents a single geological region or landscape in more detail. The work was published simultaneously in German and French. I received the German version of this work from Dr Markus Felber, one of the co-authors, and I refer to it only in my assessment.

As early as the 12th century, Benedictine and Cistercian monks dissolved the soil in water and tasted the resulting water solution to determine the suitability of a site for planting vines. The site appropriate according to the taste of solution was then referred to as 'climat' (from the ancient Greek 'klíma': the slope of the sun). Even in modern times, wine reviewers often write about wines with a 'mineral' taste. With thousands of minerals, this is rather vague. Apparently, it is supposed to be possible to identify and smell rock materials such as gypsum, metamorphic, schist and volcanic tuff.

Kamen in vino

Odkrivaljska popotovanja skozi švicarske vinske pokrajine

Ob izhodiščni ugotovitvi, da je navdušenje nad vini med geologi splošno razširjeno, je cvet švicarskih geologov prišel do sklepa, da lahko s svojim znanjem in osebnim prizadevanjem prispeva k razrešitvi odprtih strokovnih vprašanj o vplivu kamnin na kakovost vina. Oddelku za znanosti o Zemlji ETH Zürich s tam od leta 1899 delujočo Švicarsko geotehnično komisijo, pred kratkim preimenovano v Strokovno skupino za zemeljske vire, gre zasluga za začetek projekta. Ustanovili so družbo 'Verein Stein und Wein', izvršni direktor Švicarske geotehnične komisije Reiner Kündig pa je postal glavni urednik načrtovane publikacije.

Desetglavi redakcijski odbor je celo desetletje usklajeval **delo 63-glave avtorske skupine in več kot 40-glave skupine grafikov, ilustratorjev, strokovnih svetovalcev in prevajalcev**. V njej so se zaradi potrebne širine obravnave in kompleksnosti tematike geologom pridružili še strokovnjaki drugih vej geoznanosti, kot svetovalci pa še vinogradniki ter vinarji. Rezultat je 612 strani obsegajoča publikacija, ki obsega glavno knjigo s 15 poglavji in 10 regionalnih zvezkov. Od teh vsak podrobneje predstavlja posamezno eno-geološko regijo oziroma pokrajino. Delo je izšlo sočasno v nemški in francoski verziji. V last sem od dr. Markusa Felberja, enega od soavtorjev, dobil nemško verzijo tega dela, zato se v svoji oceni sklicujem le nanjo.

Že v 12. stoletju so benediktinski in cistercijski menihi za ugotavljanje primernosti neke lege za sadnjo vinske trte v vodi raztapljali njena tla in okušali nastalo vodno raztopino. Po okusu te raztopine primerni legi so nato sicer rekli 'climat' (po starogrškem 'klíma': nagib lege sonca).

Tudi v modernem času vinski ocenjevalci vina pogosto pišejo o vinih z 'mineralnim' okusom. Pri tisočih mineralov je to precej nejasno. Očitno naj bi bilo mogoče prepoznati in vonjati kamninske materiale, kot so mavec, metamorfik, skrilavec in vulkanski tuf. Celu izkušeni geologi pa enako

Even experienced geologists, however, find it as difficult as the rest of us to make the connection between such rock concepts and the sensation of tasting wine. On the other hand, the geological conditions in the vineyards undoubtedly have a significant influence on the quality of the grapes. After all, sun exposure, the water regime, the microclimate and the composition of the soil are also a reflection of geological development.

In the 20th century, the term 'terroir', derived from the French word 'terre' (soil), was coined to refer to vineyard sites, but it means much more than the native soil. The question remains: what all and to what extent? In 1997, the Swiss magazine *Vinum* published an article entitled 'Terroir - the last secret', which was met with a very divergent response. „What geological factors can be traced and guessed in wine?“ is therefore a challenging question. The authors of this work cannot be faulted for tackling an irrelevant topic.

težko kot preostali ljudje vzpostavijo povezavo med takšnimi kamninskimi pojmi in občutkom okušanja vina. Po drugi strani pa geološke razmere v vinogradih nedvomno pomembno vplivajo na kakovost grozdja. Navsezadnje so tudi izpostavljenost soncu, vodni režim, mikroklima in sestava tal odraz geološkega razvoja.

Za vinske lege se je v 20. stoletju uveljavil iz francoske besede 'terre' (tla) izveden izraz 'terroir', ki pa pomeni veliko več kot rodna tla. Odprto je pa ostalo vprašanje: kaj vse in v kolikšni meri? Leta 1997 je tako švicarska revija *Vinum* objavila članek 'Terroir – poslednja skrivnost', ki je bil deležen nadvse divergentnih mnenjskih odzivov. »Kateri geološki dejavniki se lahko zasledijo in uganemo v vinu?« je torej zahtevno vprašanje. Avtorjem tega dela ni možno očitati, da so se lotili irelevantne teme.

Povsem logično je bilo, da so se najprej spopadli s samim pojmom »terroir«. Kasneje je



It was only logical that they first tackled the very notion of 'Terroir'. Later, the Office International du Vin gave an officially binding definition: „Terroir encompasses the specific characteristics of soil, relief, climate, landscape and biodiversity“ (OIV 2010). Unfortunately, they have forgotten about people and later revised it. It now reads: "Viticultural terroir is a site-based concept whereby a common knowledge is acquired (and defined) for a given site of the interactions between the identifiable physical and biological factors and the viticultural techniques used there that give the products of that site their uniqueness". These are obviously very important definitions in marketing terms. Unfortunately, they have not helped to resolve the question with which the authors of 'Stone and Wine' were grappling.

The chapter on 'Terroir' is therefore followed by fourteen more steps in which the authors attempt to approach the question by means of an oeno-geological approach. The first eight steps correspond to the titles of the chapters that are also relevant to non-Swiss lay readers: Time, Depth, Topography, Soil, Water, Elements, Climate, Vines, and, Wine. These are followed by five more Swiss-specific chapters: Underground, Loose Underground, Solid Underground, Assemblages, and, Wine Regions/Provinces. These chapters are also of broad methodological interest to geologists.

'Time' tackles the relativity of the perception of time and the circulation of matter. It offers a fascinating temporal comparison of the evolution of geological and palaeontological events from the Big Bang to the present day, and of the evolution of the vine from its first known seeds 80 million years ago and from the first traces of human wine production in the Caucasus, 8,000 years ago, to the present day. It also parallels the annual growth cycle of the vine with the cycling of rock material from volcanism through erosion, sedimentation, diagenesis, subduction, metamorphism, magmatism and orogenesis. It also establishes geological (stratigraphic) time archives and time archives of vintages. Through the binoculars of time, it also peers into the temporal development of the formations and soils characteristic of the wine-growing part of Switzerland.

'Depth' parallels the deep structure of the earth, the lithostratigraphic column characteristic of Switzerland, the structure of the soil from the surface of the earth to the bedrock, and the development of the vine root system. The latter often extends into the bedrock. In conclusion, he notes that it is the nature of the bedrock that determines the depth range of the vine roots.

Office International du Vin (Meddržavni urad za vino) podal uradno zavezujočo definicijo: »Terroir zajema posebne značilnosti tal, reliefa, podnebja, pokrajine in biotske raznovrstnosti.« (OIV 2010). Žal pa pri tem pozabil na ljudi, zato jo je kasneje popravil. Zdaj se glasi: »Vinogradniški terroir je koncept, ki temelji na območju, pri čemer se za zadevno območje pridobi (in opredeli) skupno znanje o interakcijah med prepoznavnimi fizikalnimi in biološkimi dejavniki ter tam uporabljenimi vinogradniškimi tehnikami, ki dajejo proizvodom s tega območja njihovo edinstvenost.« Gre za marketinško očitno zelo pomembni definiciji. Žal pa nista prispevali k razrešitvi vprašanja, s katerim so se spopadali avtorji dela 'Kamen in vino.'

Poglavju »Terroir« zato sledi še štirinajst korakov, v katerih se poskušajo avtorji z eno-geološkim pristopom približati odgovoru na obravnavano vprašanje. Prvih osem korakov ustreza naslovom tudi za ne-švicarske laične bralce pomembnih poglavij: Čas, Globina, Topografija, Tla, Voda, Elementi, Klima, Trta, in, Vino. Tem pa sledi še pet za Švico specifičnih poglavij: Podlaga, Nevezana podlaga, Trdna podlaga, Sklopi, in Vinske regije/pokrajine. Za geologe pa so metodološko širše zanimiva tudi ta poglavja.

»Čas« se spopade z relativnostjo zaznavanja časa in kroženja snovi. Ponuja zanimivo časovno primerjavo razvoja geoloških in paleontoloških dogajanj od velikega poka do danes in razvoja vinske trte od njenih prvih znanih semen pred 80 milijoni let in od prvih, 8.000 let starih, sledi človeške pridelave vina na Kavkazu do danes. Tudi kroženju kamninskega materiala od vulkanizma preko erozije, sedimentacije, diageneze, subdukcije, metamorfizma, magmatizma do orogeneze ponuja vzporednico letnega rastnega kroga vinske trte. Vzporeja še geološke (stratigrafske) časovne arhive in časovne arhive vinskih letnikov. Skozi časovni daljnogled pa pokuka še v časovni razvoj za vinorodni del Švice značilnih formacij in tal.

»Globina« vzporeja globinsko zgradbo Zemlje, za Švico značilni litostratigafski stolpec, zgradbo tal od površja zemlje do kamninske podlage, ter, razvoj trtnega koreninskega sistema. Slednji pogosto seže še v kamninsko podlago tal. Za sklep ugotavlja, da prav značilnost kamninske podlage določa globinski domet korenin vinske trte.

»Topografija« je specifično švicarska. Za tiste, ki smo hodili v šole še preden so na njih predavali o tektoniki plošč, pa je hkrati splošno zanimiva. Podaja na tektoniki plošč utemeljen razvoj švicarskega ozemlja, Alp, Molase in Jure. Z na tektonsko karto Švice vrisanimi vinorodnimi legami se

'Topography' is specifically Swiss. Yet, for those of us who went to school before they taught plate tectonics, it is also of general interest. It traces the evolution of the Swiss territory, the Alps, Molasses and Jura, based on plate tectonics. It then asks whether vines have tectonic preferences, and consequently preferences linked to erosion and glacial and fluvial accumulation, by means of Swiss vineyard sites drawn on a tectonic map of Switzerland. All this has shaped and defined the current topography of Switzerland. Of course, it cannot avoid considering the effects of solar radiation and winds, especially the Föhn.

After an introductory general explanation of soil pedogenesis, 'Soils' focuses on the Swiss soil types. More specifically, the soil types typical of Swiss vineyard sites. Of general interest, however, are the discussion of soil minerals and, of great interest for the soil's ability to retain moisture and for its ability to grow plants, the chapter on 'Clay - the 'Protoplasm' of the soil'. Agronomists and soil scientists are well aware of the role of clay minerals, but not all geologists.

'Water' gives first a general picture of the surface and underground water cycle, and then its features of relevance to Switzerland. It also looks at mineral waters as carriers of dissolved salts. However, it is worth highlighting the book's objective-oriented chapter on 'What does water do in the vineyard? The water cycle in the unsaturated and saturated zones of some characteristic geological and soil substrates is explained in a lucid manner. For a selected soil example, the depth evolution of the soil water status and the corresponding densities and thicknesses of the vine root system are given, which is rarely illustrated. The illustration allows the relationships to be understood and the situation to be extrapolated to other soil types.

'Elements' focuses on the chemical composition of bedrock, growing soils and wine. The starting point is an interesting comparison of the elemental composition of the Earth from the core to the surface crust, paralleled by the elemental composition of wine (major elements, trace elements and ultra- or micro-trace elements). The vines are seen to store potassium, phosphorus, sulphur, chlorine and carbon, which are rare in the Earth, in the grape berries. Silicon, iron and aluminium, which are very abundant in the Earth, are stored only in traces. The table, which gives an overview of the elemental composition and rock-forming minerals of the different types of bedrock, takes into account the types of bedrock present in Switzerland only. However, it is a good basis for an interesting illustration of the elements essential to the

nato sprašuje, ali ima vinska trta tektonske, posledično pa še z erozijo in z ledeniško ter rečno akumulacijo povezane preference. Vse to je namreč oblikovalo in opredelilo sedanjo topografijo Švice. Seveda se ob tem ne more izogniti obravnavi vplivov osončenja in vetrov, še posebej föna.

»Tla« se po uvodni splošni razlagi pedogeneze tal posvečajo predstavitvi švicarskih talnih tipov. Bolj specifično še za švicarske vinogradniške lege tipičnih talnih tipov. Splošno zanimivi pa so razprava o mineralih v tleh in za sposobnost tal za zadrževanje vlage in za njihovo rastno sposobnost zelo zanimivo poglavje »Glina – 'Protoplazma' tal«. Agronomi in pedologi se te vloge glinastih mineralov dobro zavedajo, geologi pa ne čisto vsi.

»Voda« poda najprej splošno sliko površinskega in podzemnega kroženja vode, nato pa njegove za Švico pomembne značilnosti. Posveti se tudi mineralnim vodam kot nosilec raztopljenih soli. Izpostaviti pa velja k ciljem knjige usmerjeno poglavje »Kaj dela voda v vinogradu?« V njem je na poljuden način sijajno pojasnjeno kroženje vode v nezasičeni in zasičeni coni nekaj značilnih geoloških in talnih podlag. Za izbrani talni primer je podan sicer redko prikazani globinski razvoj stanja talnih vodnih zalog in temu prilagojene gostote in debeline trtnega koreninskega sistema. Prikaz omogoča razumevanje odnosov in ekstrapolacijo razmer na druge talne tipe.

»Elementi« se posvečajo kemijski sestavi kamninske podlage, rastnih tal in vina. Izhodišče je zanimiva primerjava elementne sestave Zemlje od jedra do površinske skorje, vzporejena z elementno sestavo vina (glavni elementi, sledni elementi in ultra- oziroma mikro-sledni elementi). Vidi se, da trta v grozdne jagode skladišči v tleh redke kalij, fosfor, žveplo, klor in ogljik. V tleh zelo zastopane silicij, železo in aluminij pa skladišči le v sledeh. Tabela, ki podaja vpogled v elementno sestavo in kamninotvorne minerale posameznih tipov kamninske podlage upošteva sicer le v Švici prisotne vrste kamninske podlage. Je pa dobra osnova za zanimiv prikaz, katere za vinsko trto bistvene elemente ji ponuja posamezni talni tip in kakšne so s tem v zvezi njene elementarne potrebe. Vinska trta je sicer skromna rastlina, a brez dveh snovi ne more: vode in ogljika. Prvo zagotavljajo padavine in ustrezna struktura tal, drugo pa v tleh prisotne organske substance. Z vidika kroženja snovi in fiziologije vinske trte je izjemen slikovni in tekstovni prikaz z naslovom »Elementno- in prehranjevalno- gospodinjstvo vinske trte«. V njem so z vidika izmenjave snovi prikazani vsi ključni procesi: fotosinteza nad tlemi (CO_2 , O_2 , H_2O), v tleh pa sodifikacija (Na,

vine and its elemental needs. The vine is a modest plant, but it cannot do without two substances: water and carbon, the former provided by rainfall and the appropriate soil structure, the latter by the organic substances present in the soil. From the point of view of the cycling of substances and the physiology of the vine, the pictorial and textual presentation entitled 'The elemental and nutritional household of the vine' is remarkable. It shows all the key processes from the perspective of material exchange: photosynthesis above ground (CO_2 , O_2 , H_2O), sodification in soil (Na, Cl), bacterial metabolism (NH_3 , NO_2) and the physiological role of roots and water related to mineral weathering and element uptake. Finally, it is worth noting also the interesting picture of the distribution of chemical substances from the deeper core of the grape berry and the pips to its surface skin and stalk. It shows that polyphenols (colouring agents, tannins) are only found in the skin, pips and stalk. This is why, after pressing, red wine can be coloured mainly only in contact with the grape skins.

Temperature fluctuations are then shown in more detail for the period of human evolution from the beginning of the Middle Stone Age to the Roman Optimum (labelled the 'Vine Age'), and on a modified time scale from then to the present. The medieval temperature optimum and the Little Ice Age of the last thousand years are clearly visible. Finally, for the last 160 years, the fluctuation of directly measured air temperatures is shown for Geneva. It shows the temperature maximum in 1944, the cooling between 1944 and 1973 and the subsequent rise. The latter now exceeds the temperatures measured in 1944 by a good degree Celsius. The effects of climate change on vineyard sites and vines and the resulting necessary changes in Swiss viticulture are presented. This debate is certainly of interest to a wider audience, as wine-growers in Slovenia are also facing similar problems and resorting to similar considerations.

'The Vine' gives the history of the human cultivation and spread of the 'European' grapevine and its spread to continental Europe in the Roman Empire. It cannot, of course, pass over the catastrophe caused in the second half of the 19th century by the introduction of 'American' vines from America, which brought the vine louse and, even earlier, the fungal diseases peronospora and oidium. European and Swiss viticulture recovered in the 20th century, however, thanks to the grafting of European vines onto American rootstocks. But it is no longer possible to raise and plant grafts and spray the vines without protective agents. Most of this chapter is therefore devoted to a description

(Cl), bakterijski metabolizem (NH_3 , NO_2) in s pre-perevanjem mineralov in prevzemom elementov povezana fiziološka vloga korenin in vode. Navsezadnje velja omeniti tudi zanimivo sliko porazdelitve kemijskih snovi od globljega jedra grozdne jagode in pešk do njene površinske kožice in peclja. Kaže, da so polifenoli (barvila, tanini) le v jagodni kožici, peškah in peclju. Prav zato se lahko rdeče vino po stiskanju obarva večinoma le v stiku z grozdnimi kožicami.

»Podnebje« ob spremenljivem časovnem merilu najprej prikaže nihanje temperature ozračja od začetka kambrija do danes. Nihanje temperature je nato prikazano podrobneje za obdobje človekovega razvoja od začetka srednje kamene dobe do rimskega optimuma (označenega kot 'vinski čas'), ter v spremenjenem časovnem merilu od tedaj do danes. Lepo sta vidna srednjeveški temperaturni optimum in mala ledena doba v zadnjih tisoč letih. In končno je za zadnjih 160 let za Ženevo prikazano še nihanje neposredno merjenih temperatur zraka. Kaže temperaturni maksimum v letu 1944, ohladitev med leti 1944 in 1973 in kasnejši dvig. Ta zdaj že za dobro stopinjo presega v letu 1944 izmerjene temperature. Podani so iz klimatskih sprememb izhajajoči vplivi na vinogradniške lege in trto in iz njih izhajajoče potrebne spremembe v švicarskem vinogradništvu. Ta razprava je gotovo zanimiva tudi širše, saj se tudi v Sloveniji vinogradniki spopadajo s podobnimi problemi in zatekajo k podobnim razmišljanjem.

»Trta« podaja zgodovino človekovega gojenja in razširjanja »evropske« vinske trte in njeno razširjenje v kontinentalno Evropo v rimskem cesarstvu. Seveda ne more mimo katastrofe, ki jo je v drugi polovici 19. stoletja povzročila z vnosom »ameriške« vinske trte iz Amerike prenešana trtna uš, še prej pa od tam izhajajoči glivični bolezni peronospora in oidij. Sledil je popoln zlom evropskega vinogradništva in vinarstva. Evropsko in švicarsko vinogradništvo sta si v 20. stoletju s pomočjo cepljenja evropske trte na ameriške podlage sicer opomogla. A brez vzgoje in sadnje cepičev ter škropljenja vinske trte z zaščitnimi sredstvi več ne gre. Večina tega poglavja se zato posveča opisu za švicarske talne in klimatske razmere potrebnih podlag, prikazu današnje sortne sestave njihovih vinogradniških regij, ter, novih sort, ki naj bi švicarskemu vinogradništvu pomagale ekonomsko preživeti v prihodnje. Za slovenske geologe in vinogradnike pa je zanimivo poglavje z naslovom »Ko vinograd plazi.« Opisan je zdrs v Opalinski glini, kjer je zdrselo 8.000 m² terena oziroma 70.000 m³ materiala. Sam sem v mladih letih videl v vinogradih v Sloveniji kar nekaj plazov, ki so sicer precej

of the rootstocks needed for the Swiss soil and climate conditions, an illustration of the present-day varietal composition of their wine-growing regions, and the new varieties that should help Swiss viticulture to survive economically in the future. Of interest to Slovenian geologists and viticulturists is the chapter entitled „When the vineyard creeps“. It describes a slip in the Opalin clay, where 8 000 m² of terrain or 70 000 m³ of material slipped. I myself saw a number of landslides in vineyards in Slovenia when I was young, and although they were much smaller in size, they were no less horrific for the affected growers.

‘Wine’ pursues the goal of tasting the ‘stone’ in the wine: it therefore devotes itself first to training our tasting skills. It is common knowledge from our culture that the human palate includes the senses of sweet, sour, bitter and salty. From Japanese culture, there is a fifth taste, ‘umami’, which is sensitive to glutamic acids and their salts. Its senses have since been medically proven in humans. It is therefore necessary to accept that we have senses for five tastes, two of which are not very well activated in the perception of wine under normal conditions. ‘Wine’ therefore introduces the method of the wine sensory expert Hans Blattig, who takes into account the three senses of taste (sweet, sour, bitter) and smell when tasting wine. Blattig thus identifies primarily four building blocks in wine: 1) the soft complex (sweetness, alcohol, glycerine); 2) the acid structure; 3) the tannins or tannic structure; and, 4) the aromatic blanket. He then graphically identifies their occurrence and duration on the time course of a single wine tasting: 1) 0-2 seconds: initial tasting, 2) 0-4 seconds: two-thirds tasting, 3) 0-6 seconds: three-phase tasting, and 4) 6-12 seconds: after-tasting or finish; after 6 seconds, the wine sample to be tested must be either swallowed or spat out. The soft complex is tasted immediately, the acid structure is delayed and full within 4 seconds, and the tannins are delayed and full within 6 seconds or even later, extending with the acids into the aftertaste. The aromas are special in that they develop immediately but, due to man’s unusual physiological capacity for retro-nasal olfaction, extend far into the aftertaste. All the results of the tastings can therefore be presented in terms of taste in a sweet-sour-bitter or sweet-sour-tannin triangle.

And this is where the undeniable creativity and innovation of the authors of this work begins: they draw the SAND/silicate - CLAY/silicate - LIME/carbonate ‘rock triangle’ from the ETH scripts (ETH 1988). Taking into account the relative proportions of carbonate, quartz and clay, practical-

zaostajali po velikosti, za prizadete vinogradnike pa niso bili nič manj grozljivi.

»Vino« sledi cilju okušanja ‘kamna’ v vinu: zato se najprej posveti šolanju naših degustacijskih sposobnosti. Splošno je iz naše kulture znano, da obsega človeški okus čutila za sladko, kislo, grenko in slano. Iz japonske kulture je znan še peti, na glutaminske kisline in njihove soli občutljiv, okus ‘umami’. Njegova čutila so bila medtem pri človeku medicinsko dokazana. Treba je torej sprejeti dejstvo, da imamo čute za pet okusov izmed katerih pa se dva pri zaznavanju vina v normalnih razmerah ne aktivirata kaj prida. »Vino« zato predstavi metodo vinskega senzorika Hansa Blattiga, ki pri poskušanju vina upošteva tri vrste čutil za okus (sladko, kislo, grenko) in čutilo vonja. Blattig tako v vinu določa prvenstveno štiri gradnike: 1) mehki kompleks (sladkoba, alkohol, glicerini); 2) Kislinna struktura; 3) Tanini oziroma taninska struktura; in, 4) Aromatična odeja. Nato pa na časovnem poteku posamične degustacije vina grafično opredeli njihovo pojavnost in trajanje: 1) 0-2 sekundi: začetno okušanje, 2) 0-4 sekunde: dvetretjinsko okušanje, 3) 0-6 sekund: trifazno okušanje, in 4) 6-12 sekund: pookušanje; pri čemer je treba po 6 sekundah preskušani vzorec vina bodisi pogoltniti, bodisi izpljuniti. Okušanje mehkega kompleksa se pojavi takoj, kislinne strukture z zamudo in polno v 4 sekundah, taninov pa z zamudo in polno v 6 sekundah ali še kasneje ter sega skupaj s kislinami še v pookus. Posebnost so arome, ki se razvijejo takoj, a segajo zaradi človekove nenavadne fiziološke zmožnosti retro-nazalnega voha še daleč v pookus. Vse rezultate degustacij je torej glede okusa možno predstaviti v trikotniku sladko-kislo-grenko oziroma sladkoba-kislina-tanini.

In tu se začenja nesporna kreativnost in inovativnost avtorjev tega dela: Iz skript ETH potegnejo ‘kamninski trikotnik’ PESEK/silikat - GLINA/silikat - APNO/karbonat (ETH 1988). Vanj je možno, ob upoštevanju relativnih deležev karbonata, kremenca in glin umestiti praktično vse švicarske kamnine (peščenjaki, graniti, gnajsi, silikatni vulkaniti, laporni peščenjaki, skrilavci, apnenci, laporni apnenci, glinasti apnenci, apneni peščenjaki, laporni apneni peščenjaki, itd.). Hkrati potegnejo iz najnovejše literature ‘trikotnik okusov’, ki ga je v letu 1995 objavil C. Sitter. V njem je izenačil pesek s kislostjo, apno s polnostjo in glino z adstringentnostjo. Sitter v svojem trikotniku okusov opredeli še 39 različnih oznak okusa, pri čemer za območje z najmanj 20 % vsake od treh kamninskih komponent določi notranji trikotnik ‘harmonično uravnoteženih okusov’. Avtorji dela

ly all Swiss rocks (sandstones, granites, gneisses, siliceous volcanics, lacustrine sandstones, shales, limestones, lacustrine limestones, clayey limestones, calcareous sandstones, lacustrine calcareous sandstones, etc.) can be placed in it. At the same time, they draw on the most recent literature the 'triangle of flavours' published by C. Sitter in 1995. In it, Sitter equated sand with acidity, lime with fullness and clay with astringency. He defines 39 different flavour codes in his triangle of flavours, identifying an inner triangle of 'harmoniously balanced flavours' for an area with at least 20 % of each of the three rock components. The authors of 'Stone and Wine' first rotate Sitter's triangle of flavours by 60 °, so that in the rock triangle, sour lies between limestone and sandstone, tannic between limestone and claystone, and sweet between claystone and sandstone. They then maintain a central area of harmony and reduce the number of too many flavour notes to just three: strong towards clay, fresh towards sandstone and structured towards limestone. With this apparatus, they then set about systematically tasting the Swiss wines. The testers are all co-authors of this work and many invited winemakers and experts. In the Blattig method, the intensity of the flavours is plotted on a timeline of the development of the flavours on the ordinate axis and the results are rigorously evaluated at the end.

Through their testing method, the authors demonstrate that the rock bed has an undeniable influence on the characteristics or flavour of the wine. However, they acknowledge that this influence is sometimes quite pronounced and sometimes barely perceptible. In his review of the work, Thomas Vaterlaus, Editor-in-Chief of the Swiss wine magazine *Vinum*, therefore concludes: 'Stone and Wine' brings us closer to the important links, clarifies them for us, which ultimately contributes to making Swiss wines even more enjoyable in the future, because we will all drink 'with understanding'. But the magic remains."

"Underground', based on the links identified in the 'Wine' chapter, present the 'Oeno-geological map of Switzerland', derived from the geotechnical map of Switzerland. It covers 8 types of solid rock, 4 types of loose rock, 2 types of assemblages (molasses and flysch) and all Swiss vineyard sites. The distribution of the underground basement rock types in each of the oeno-geological regions or areas is also shown. The chapter on 'Underground' is followed by chapters on 'Loose Underground', 'Solid underground' and 'Assemblages', which give a more detailed picture of the nature and distribution of the different types of bedrock.

'Kamen in vino' najprej zasučejo Sitterjev trikotnik okusov za 60 °. Tako, da leži v kamninskem trikotniku kislo med apnencem in peščenjakom, taninično med apnencem in glinovcem, sladko pa med glinovcem in peščenjakom. Nato ohranijo središčno območje harmonije in zmanjšajo število preštevilnih oznak okusa na vsega tri: močno v smeri glinovca, sveže v meri peščenjaka in strukturirano v smeri apnenca. S tem aparatom se nato lotijo sistematičnega poskušanja švicarskih vin. Preizkuševalci so vsi soavtorji tega dela ter mnogi povabljeni vinarji in strokovnjaki. Pri Blattigovi metodi nanašajo ob tem na časovni diagram razvoja okusov na ordinato še njihovo intenzivnost in na koncu rigorozno vrednotijo rezultate.

S svojo preizkuševalno metodo avtorji dokažejo, da ima kamninska podlaga nedvomen vpliv na značilnosti oziroma okus vina. Priznavajo pa, da je ta vpliv včasih povsem izrazit, včasih pa komaj zaznaven. Glavni urednik švicarske vinarske revije *Vinum* Thomas Vaterlaus v svoji oceni dela zato ugotavlja: „Kamen in vino“ nam približa pomembne povezave, nam jih razjasni, kar na koncu prispeva k temu, da nam bodo švicarska vina v prihodnosti nudila še več užitka, saj bomo vsi pili „z razumevanjem“. Toda magija ostaja.

»Podlaga« na osnovi v poglavju »Vino« ugotovljenih povezav podaja iz geotehnične karte Švice izvedeno »Eno-geološko karto Švice«. Zajema 8 vrst trdnih kamnin, 4 vrste nevezanih kamnin, 2 vrsti sklopov kot bolj ali manj ciklično plastovitih formacij (molasa in fliš) in vse švicarske vinogradniške lege. Prikazana je tudi porazdelitev kamninskih tipov po posameznih eno-geoloških regijah oziroma območjih. Poglavju »Podlaga sledijo še poglavja »Nevezana podlaga«, »Trdna podlaga« in »Sklopi«, ki še natančneje predstavijo značaj in razširjenost posameznih vrst kamninske podlage.

»Vinske regije« so zaključno inovativno poglavje tega dela. Avtorji na osnovi svojih v poglavjih »Vino« in »Podlaga« prikazanih dognanj opredelijo v Švici obstoj 10 eno-geoloških vinskih regij ter te regije kartografsko prikažejo v zadnjem poglavju. To je precejšnja novost. Zakonsko so v Švici namreč določene le tri vinske regije: a) Regija zahodne Švice, b) Regija nemške Švice, in, c) Regija italijanske Švice. Po politično-kulturnih kriterijih pa ločijo 6 vinskih regij. Geologi so torej zdaj njihovo število na osnovi eno-geoloških kriterijev povečali na 10.

Vinskim regijam se posveča 10 regionalnih zvezkov (zaradi jasnosti ohranjam imena izvirnika): Jura Nord, Mittelland, Alpenseen, Alpenrhein, Tessin, Wallis, Chablais, Balcon lémanique,

'Wine Regions' is the final innovative chapter of this work. Based on their findings in the chapters 'Wine' and 'Underground', the authors identify 10 oeno-geological wine regions in Switzerland and map these regions in the final chapter. This is a significant innovation. Only three wine regions are legally defined in Switzerland: a) the Western Switzerland Region, b) the German Switzerland Region, and c) the Italian Switzerland Region. The 6 vine regions are separated by political-cultural criteria. Geologists have therefore now increased the number of regions to 10 on the basis of oeno-geological criteria.

The wine regions are the subject of 10 regional volumes (for the sake of clarity, I am retaining the original names): Jura Nord, Mittelland, Alpen-Seen, Alpenrhein, Tessin, Wallis, Chablais, Balcon lémanique, Genf, and Drei-Seen-Land. They are wonderful geological, viticultural and cultural guides through these regions. Anyone who wants to go through them as a geologist - even if they are not a wine lover - will certainly find them a valuable guide. However, wine lovers may find themselves in trouble by too much tempting information.

What to add in conclusion? What I find immensely fascinating about the main book is the approach, starting in each chapter with a popular explanation of the most general concepts of science. Then, through technically and technologically relevant explanations, it gets to the regional data and characteristics that are important for Swiss viticulture. The book is therefore a very interesting encyclopaedic source of general natural science and specific viticultural knowledge, even for non-Swiss readers. As a geologist or hydrogeologist, I am fascinated by both the clarity of the lay scientific presentations and the scientific rigour in the approach to uncovering the links between wines and the bedrock for wine tasting. As someone who was born at the Maribor Vineyard and Wine School as the son of a later university professor of viticulture and winemaking, and who has grown up and lived with vines and wine all his life, I was also touched by the clarity and precision of the presentation of the physiology of the vine and wine tasting.

I judge 'Stone and Wine' to be a magnificent monument to Swiss geology, viticulture and winemaking. It can be a model for all those who do not yet have something similar.

Dr. Miran Veselič Prof. Emeritus UNG

Genf, in, Drei-Seen-Land. Predstavljajo čudovite geološke, vinogradniško-vinarske in kulturološke vodnike skozi te regije. Kdor se želi skozi njega podati kot geolog - celo če ni ljubitelj vina - mu bodo gotovo dragocen vodnik. Kdor je ljubitelj vina, se pa utegne znajti v težavah zaradi prevelikega števila vabljivih informacij.

Kaj dodati za zaključek? Pri glavni knjigi me neizmerno očara pristop, ki v vsakem poglavju izhaja od poljudno prikazanih najbolj splošnih naravoslovnih pojmov. Nato pa preko tehnično-tehnološko pomembnih razlag pride do za švicarsko vinogradništvo pomembnih regionalnih podatkov in značilnosti. Knjiga je zato tudi za ne-švicarske bralce nadvse zanimiv enciklopedični vir splošnih naravoslovnih in specifičnih vinogradniško/vinarskih znanj. Kot geologa oziroma hidrogeologa me fascinirata tako jasnost poljudno znanstvenih prikazov kot znanstvena rigoznost v pristopu k odkrivanju povezav med vini in kamninskimi podlagami namenjenim vinskim degustacijam. Kot nekoga, ki je bil na mariborski vinogradniško-vinarski šoli rojen kot sin kasnejšemu univerzitetnemu profesorju vinogradništva in vinarstva, in, ki je vse življenje rasel in živel s trto in vinom, pa se me je dotaknila tudi jasnost in natančnost predstavitev fiziologije vinske trte in vinskih degustacij.

Sodim, da je delo »Kamen in vino« veličasten spomenik švicarski geologiji, vinogradništvu in vinarstvu. Lahko je vzor vsem tistim, ki česa podobnega še nimajo.

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