SOIL INTO WINE
Digging Deeper into Oregon Pinot Noir

No grape variety is as reflective of site differences as Pinot noir. This in-the-vineyard workshop examines Oregon’s cool-climate viticulture practices and the soils in which we grow wine grapes. Much of Pinot noir’s magic rests in its ability to communicate a sense of the place where it was grown. While soil is not the only factor that gives Pinot noir its sense of place, there is no doubt that the fascinating diversity of Pinot noir wines grown in the Willamette Valley depends in part on the diverse origins of the soils in which our vineyards are planted.

We will focus on the two main soil types most commonly found in Willamette Valley vineyards. Two soil pits have been dug, one of marine sedimentary origin at Adelsheim Vineyard’s Calkins Lane and one of volcanic basalt origin at Penner-Ash Wine Cellars. These provide a close look at the soil characteristics that contribute to sense of place in Oregon Pinot noir. At each soil pit you will taste examples of wines made from that specific site as well as from both sedimentary and volcanic soils at other locations in the Willamette Valley. The two soil pits are interspersed with four other stations (two at each site) that will examine viticulture topics discussed in the Farming for Quality chapter in this binder.

**Points to Investigate:**

- What are the origins and physical characteristics of the different soil types in Willamette Valley vineyards? How do these affect the root system, the vine, and the grapes grown in those soils?

- Can specific flavor characteristics in Pinot noir wines be correlated to specific soil types? How is the wine affected by the nutrient and water resources available to the vine?

- What is the relationship between soil types and AVAs within the Willamette Valley?

**Soil Pit Presenters:**

Adelsheim Vineyard Penner-Ash Wine Cellars

Dave Paige, Adelsheim Vineyard Lynn Penner-Ash, Penner-Ash Wine Cellars
Chad Vargas, Adelsheim Vineyard Mike Hallock, Carabella Vineyard
Part 1: Geological History of the Willamette Valley

Illustration: Willamette Valley Soils Map in the Reference Section

Until about 12 million years ago, western Oregon was on the floor of the Pacific Ocean. Before that, for 35 million years under the sea, it was slowly accumulating layers of marine sediment, the bedrock of the oldest soils in the Willamette Valley.

Starting about 15 million years ago, the pressure created along the coast by the collision of the earth’s Pacific and North American Plates gradually pushed Western Oregon up out of the sea, creating the Coast Range and the intensely volcanic Cascade Mountains further inland. The Willamette Valley thus began as an ocean floor trapped between two emerging mountain ranges.

During this period of uprising, from about 15 million to 6 million years ago, rivers of lava erupting from volcanoes on the east side of the Cascades flowed down the Columbia Gorge toward the sea, covering the layers of marine sediment on the floor of the emerging Willamette Valley with layers of basalt.

The Willamette Valley continued to buckle and tilt under pressure from the ongoing coastal collisions, forming the interior hill chains that are typically tilted layers of volcanic basalt and sedimentary sandstone, such as the Dundee Hills and Eola Hills (see figure 2, page 3).

The next geologic activity to add to our soils was the creation of a layer of windblown silt (called Loess) on the northeast-facing hills west of where Portland sits today. This started as long ago as a million years and may have continued until about 50 thousand years ago. These silts were blown in from the valley floor, but they originated from the severely weathered basalts and sediments.

Much, much later, about 18 thousand to 15 thousand years ago, at the end of the last ice age, the melting of a glacial dam near the location of Missoula, Montana, repeatedly flooded the Willamette Valley, creating a lake up to the 400-foot contour level, with only the tops of the two-tone hills sticking out, and leaving behind deep silts.

Thus we have in the Willamette Valley a complex series of soils with interesting and diverse origins:

- **Marine sediments** that were laid down on the floor of the Pacific Ocean
  Examples: Willakenzie, Bellpine, Chuhulpim, Hazeland, Melbourne, Dupee

- **Basalts** that originated as lava flows from eastern Oregon
  Examples: Jory, Nekia, Saum

- **Windblown Loess**, silt blown up from the valley floor onto northeast-facing hillsides
  Example: Laurelwood

- **Missoula Flood** deposits brought down the Columbia Gorge as the result of a repeatedly melting glacial dam
  Examples: Wapato, Woodburn, Willamette
Geology Provides the Landscape: Rock Layers Tilted Sideways

**Idealized cross section**

Why are we focusing on Volcanic, Marine Sedimentary, and Windblown soils?
Much is said about how and why the Willamette Valley is the perfect place to grow Pinot noir. But once that most fundamental “long-term vineyard decision” has been made, it is important to understand that not every acre in the Willamette Valley is suitable for growing great Pinot noir. Indeed, most of the acres of the Willamette Valley are those deep, rich valley-floor soils brought to us all the way from Montana by the Missoula Floods at the end of the last ice age. These valley floor soils are paradise for a great diversity of crops, but they can spell trouble for Pinot noir. Pinot noir at low elevations is subject to frost damage in the spring, and in such deep soils it becomes overly vigorous, prolifically growing new canes and leaves throughout the growing season and paying little attention to maturing fruit. The end result is that the vine is unable to ripen its fruit properly.

In almost all cases, great Willamette Valley Pinot noir grows on rocky hillsides facing south or southeast, at least 200’ above sea level and avoiding cooler hilltop microclimates over 900’. This is a common factor amongst the six sub-AVAs and other favorable hillside areas for viticulture within the Willamette Valley, regardless of soil types and weather patterns. As it turns out, sites that meet these qualifications are generally found on volcanic, marine sedimentary, or windblown soils, just because of the way the valley was formed in the first place. Favorable sites with windblown soils are found especially on slopes in the northern part of the valley, especially in Washington County.
Part 2: The Soil Pits

“Soil is initially formed when decomposed organic material is encompassed into weathered mineral material at the earth’s surface. The climate, the organisms living in the soil, the type of parent material, the local topography, and the amount of time the soil has been developing all influence the resulting soil characteristics.” Magill’s Survey of Science: Earth Science Series.

Idealized Soil Profile

<table>
<thead>
<tr>
<th>Soil Terms</th>
<th>&quot;O&quot; Horizon</th>
<th>&quot;A&quot; Horizon</th>
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<th>&quot;C&quot; Horizon</th>
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<td>Horizon: a layer of soil material that differs from the layers above or below in physical, chemical, and biological properties.</td>
<td>accumulation of fresh or partially decomposed organic material.</td>
<td>humus (decomposed organic material) mixed with mineral sediments.</td>
<td>zone of accumulation of materials transported down from higher horizons, e.g. minerals.</td>
<td>partially weathered parent material, unaffected by downward movement of material from above.</td>
<td>unweathered parent material, such as basalt, granite, sandstone or limestone.</td>
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<td>Leaching: the dissolving out or removal of soluble materials from soil horizons by percolating water.</td>
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<td>Sediment: rock fragments of various sizes, such as clay, silt, sand, gravel, cobbles.</td>
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<td>Weathering: the mechanical disintegration and chemical decomposition of rocks and sediments by exposure to the elements. The parent material is broken down into many constituents such as soluble salts (leached away in older soils), clays, various oxides.</td>
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Soil is more than just weathered rock. Whether you are looking at volcanic, marine sedimentary, or windblown soils, when you get to the “A” and “O” horizons (see figure above), soil is a living system, a community of organisms that convert nutrients from one form to another, and make them available to plants and to other soil organisms. The soil food web is explored in more depth in the Farming for Quality chapter.

The focus of this workshop is on the physical characteristics of the soil. Soil pits at two different locations will compare the physical characteristics of soils derived from different parent rock material, and explore the effect of these characteristics on viticulture and wine style.

Questions to explore:

- How does the structure of the soil affect root penetration, drainage, moisture storage capacity, fertility, erodibility?
- Why do volcanic soils warm up later, hold moisture longer, ripen more slowly?
- Why do sedimentary soils warm up faster, dry out faster, ripen earlier?
- What are the specific farming characteristics of windblown soils?
- How does viticulture respond to these different soil characteristics?
- How does fruit development respond to these soil characteristics?

**Part 3: Taste the Difference**

The opportunity today is to try to taste whether differences in the soil type in which the grapes are grown produce distinct and consistent differences in the wines made from them. Obviously, stylistic winemaking variability, as well as vintage variation, make definitive judgments impossible with small samplings, but the thread of soils differences should still be of interest and will hopefully prompt you to further investigate the comparisons with your own tastings.

The selection process for this tasting started with a request to all 2013 OPC wineries to submit samples of Pinot noir wines made from a single soil type, either volcanic or marine sedimentary (the most common soil types in Willamette Valley vineyards). In order to taste the differences attributed to the soil type, we controlled for as many other factors that might affect wine style as possible. In general we selected wines made by the same winemaker fermented in the same manner from the same clone. We avoided wines aged in new barrels. As much as possible, we found wines made from sites located as close as possible to control for temperature and weather variables. “Terroir” is a complex concept and it is not possible to only change the soil type while keeping every other factor constant. Our goal was to minimize the confounding factors to most clearly reveal the role played by the soil type.

Over the past eight years, hundreds of Pinot noir wines were submitted for consideration from more than 50 wineries. The wines were divided by their soil type: “volcanic” and “marine sedimentary” along with a more limited number of Loess or “windblown”. The wines were separated by vintage and then tasted blind by the workshop tasting panelist and OPC campers. These are the descriptors commonly used to describe the wines:

- **Volcanic soil wines:** “lush” “perfumy” “pure” “sweet” “pretty” “succulent” “soft” “candy” “bright red” and “mixed berry”
Marine Sedimentary soil wines: “bold” “chewy” “big tannin” “black pepper” “spicy” “truffle” “licorice” “black fruit”

Windblown soil wines: “blueberries” “licorice” “plum” “briary” “chocolate cherries” “spices” “expansive, round tannins”

We then incorporated those descriptors with broader descriptions of texture and balance. Here is the general description of how soil type affects Pinot noir in Oregon:

Pinot noir wines from Volcanic soils
Usually exhibiting a style that accents the high-toned, floral, and “perfumed” aromatics with brighter and expressive red and dark red fruits flavors layered with sweeter baking spices and softer, round, and succulent tannins. Can retain good acidity even in warm years.

Pinot noir wines from Marine Sedimentary soils
Usually exhibiting a style showing the voluptuous and denser dark red berry and blue/black fruit with darker floral, earth tones, and bigger, heavier, and chewier tannins.

Pinot noir wines from Windblown soils
Usually exhibiting a style that shows mixed berry fruits, exotic spices, licorice, cedar, and briary components. Can show a round, voluptuous tannin structure. Generally these fall midway between the Volcanic and Marine Sedimentary soil descriptors.

**Relationship between soil types and AVAs**
There is not a direct correlation between specific soil types and the six sub-appellations of the Willamette Valley. This can be clearly seen on the Willamette Valley AVA map in the Reference Section. Some have one predominant soil type; others have two or three different types. Additionally the depth of the soil over parent material and the specific type of parent material varies between the AVAs. For most AVAs, the geographic and climatic factors are as important as soil type in defining the unique characteristics of the appellation.

- **Dundee Hills AVA** – mostly basaltic but marine sedimentary at the lower elevations on the western and northern slopes. Vines are often planted on very deep soils. This area is more insulated from daytime heat in the central Willamette Valley by the Willamette River just to the east. Further from the Van Duzer Corridor, it also cools more slowly. Generally a “gentler” place to grow Pinot noir.

- **Eola-Amity Hills AVA** – mostly basaltic but marine sedimentary at the lower elevations on the western and northern slopes. Vines are usually planted on thinner soils strongly affected by late afternoon winds blowing through the Van Duzer Corridor. Also moderated by daytime temperatures by the Willamette River just to the east.

- **Chehalem Mountains AVA** – basaltic and marine sedimentary on the southern and western slopes; windblown on the northeastern slope. This is the AVA with the most diverse soils, exposures, and environmental variability, making it impossible to generalize.
• **Yamhill-Carlton AVA** – marine sedimentary predominant. This “upsidedown u”-shaped group of hills has no exposure to central valley heat being mostly surrounded by other hills.

• **Ribbon Ridge AVA** – entirely marine sedimentary separated from the Yamhill-Carlton AVA by a narrow valley. Some areas can be very droughty in late summer, advancing grape maturity compared to the other AVAs.

• **McMinnville AVA** – primarily marine sedimentary with some basalt and alluvium. The AVA lies above a large hot valley just to the south that radiates heat into the hills during the day. It is the most strongly affected by late afternoon winds blowing through the Van Duzer Corridor as it forms the northern mouth of the Van Duzer as it opens into the valley. One of the warmest areas in the day, it cools very quickly as the sun sets.

A more complete description of the geography and geology for each the six AVAs is provided at end of this section.

**Questions to investigate and discuss:**

• Are there consistent similarities among wines from the same soil type?
• If yes, how can those similarities be described?
• Are there significant differences between wines from the same soil type but from different AVAs – e.g. volcanic soils in the Dundee Hills vs. volcanic soils in the Eola Hills?
• Are wines that express site characteristics more interesting than those that don’t?
Appendix: Willamette Valley Sub-AVAs

Dundee Hills
The first grapes in the Willamette Valley were planted in the Dundee Hills. It remains the most densely planted locale in the valley and state. The 6,500 acres of this almost exclusively basaltic land mass run north-south and overlook the Willamette River to the south and the Chehalem Valley to the north, rising to 1,067’ in elevation. It is approximately 30 miles to the southwest of Portland and 40 miles east of the Pacific Ocean, with protection from the ocean climate provided by the higher Coast Range of mountains.

Dundee Hills soils are reddish, silt, clay, loam soils derived from Columbia River basalt flows and, as such, are easily decomposed to provide moderately rich, deep, and good water-holding soils. Soils and climate differentiate this AVA. The hillside planting regions above 200’ provide good water and air drainage, good frost protection, moderate fertility, and moderate temperatures for adequate ripening, but with acid retention.

Pinot noir from this AVA is characteristically red to dark-red fruited, with raspberry to black cherry ranges, offering bright floral, cola, sweet earth, truffle, and perfume aromatics and flavors, with sweet spice notes and a core of juicy, bright fruit on the palate and supple, round, and integrated tannins.

Eola-Amity Hills
The name of this AVA is derived from a ridge of hills adjacent to the Willamette River. The ridge is actually composed of the Eola Hills, straddling the 45th latitude on the southern end, and the Amity Hills on the northern spur. The proposed minimum elevation for the AVA is 200’.

Two of the predominant influences on the characteristics of wines from the Eola Hills are shallow soils and the Van Duzer Corridor. The soils of the Eola Hills contain volcanic basalt from ancient lava flows. The basalt is combined with a preponderance of marine sedimentary rocks and/or alluvial deposits. These soils: Nezia, Woodburn, and Steiwer, are generally much shallower and rockier relative to most other Oregon AVAs. These shallow well-drained soils tend to produce smaller grapes with greater concentration.

The Van Duzer Corridor essentially provides a break in the Coast Range that allows cool ocean winds to flow, dropping temperatures dramatically, especially during late summer afternoons. These late afternoon and evening breezes help provide the cool nights that keep acids firm and are essential for optimal ripening.

The wines tend to be bigger, more full-bodied wines. The fruit components tend toward raspberry, blackberry, black cherry, and plum contrasted with raspberry, strawberry, and cherry flavors, which may predominate in wines from deeper soils. The mineral content of the terroir is often present both on the nose and on the palate. The wines often display considerable focus and clarity of fruit. They also favor primary fruit character over spice, tending toward the darker black fruit spectrum (black cherries and blueberries). Compared to other North Willamette Valley regions, the wines often exhibit brighter acidity and firmer structure, along with considerable longevity. This is due to the cooling effect of the Van Duzer Corridor. Wines from lower elevations tend to lean more toward plum and bramble fruit, showing slightly more
secondary flavors such as earthy, mineral, and spice/herbal tones (e.g. white pepper and dried flowers).

**Chehalem Mountains**
The Chehalem Mountains AVA is a single uplifted landmass southwest of Portland in the northern Willamette Valley, extending 20 miles in length and 5 miles in breadth. These mountains stretch from the town of Wilsonville in the southeast, snake between Sherwood and Newberg, and reach almost to Forest Grove in the northwest. They include several discrete spurs, mountains, and ridges, such as Ribbon Ridge and Parrett Mountain. The highest point within the Willamette Valley is the Chehalem Mountains’ Bald Peak, at 1,633’, which affects weather for the AVA and helps to distinguish it from the adjoining grape-growing hillsides and surrounding lowlands, less appropriate for grape growing.

The geography and climate largely differentiate this AVA from others; that notwithstanding, the variety of soils within the AVA helps to play host to different grape varieties. Soils on the southern and western slopes are basaltic (including Saum and Jory) and marine sedimentary (including Melbourne and Willakenzie). Soils on the north face of the mountains are windblown Loess (Laurelwood). Inappropriate heavier alluvial soils are largely excluded from the AVA by virtue of its minimum elevation of 200’.

A wide range of Pinot noir can be produced in this AVA, from more lightly red-fruited, elegant and balanced stylings, to black-fruited, briery, earthy, and highly structured wines carrying brown spice and wood notes, plus most gradations in between.

**Yamhill-Carlton**
North of McMinnville the land slowly rises to the hamlets of Carlton and Yamhill. Low ridges surround the two communities in a horseshoe shape. The free-flowing North Yamhill River courses through the center of a lush patchwork quilt of nurseries, grain fields, and orchards. The neatly combed benchlands and hillsides of the Yamhill-Carlton AVA are home to some of the finest Pinot noir vineyards in the world.

Historically nourished by forestry and farming, this area is rapidly emerging as a global center of Pinot noir production. This pastoral corner of Oregon’s northern Willamette Valley creates a unique set of growing conditions. The Coast Range to the west soars to nearly 3,500’, establishing a rain shadow over the entire district. Additional protection is afforded by Chehalem Mountain to the north and the Dundee Hills to the east.

The coarse-grained, ancient marine sediments native to the area are the oldest soils in the valley. These soils drain quickly, establishing a natural deficit-irrigation effect. Thus, the vines stop vegetative growth earlier here than elsewhere, leading to more complete ripening, even in cooler growing seasons. This allows Pinot noir to develop deep ruby colors and broad, silky tannins. The mouth-filling wines exude powerful fruit aromas of raspberry, blackberry, and black cherries complexed by minerality reminiscent of pipe tobacco, espresso, clove, and dark chocolate and accented by scents of rose, violet, lavender, and sweet wood smoke. These are alluring, complex, supple gems of Pinot noir to sip and savor.
McMinnville
The McMinnville AVA sits due west of Yamhill County’s wine country home, the city of McMinnville. It extends approximately 20 miles south-southwest toward the mouth of the Van Duzer Corridor, Oregon’s lowest Coast Range pass to the Pacific Ocean. The AVA is a blend of geo-climatic factors that make it unique among Yamhill County’s AVAs. Specifically, the appellation encompasses the land above 200’ and below 1,000’ in elevation on the east and southeast slopes of these foothills of the Coast Range Mountains. Geologically, this region is dramatically different in soil profile from other winegrowing areas in Yamhill County. The soils are primarily uplifted marine sedimentary loams and silts, with alluvial overlays. Beneath is a base of the uplifting basalt. Clay and silt loams average 20”–40” in depth before reaching harder rock and compressed sediments, shot with basalt pebbles and stone. The uniqueness of the soils for winegrowing is in the 20”–40” depth.

Climatically, this AVA is, again, in its own class. These primarily east and south facing slopes sit in a protected weather shadow of the Coast Range Mountains. Rainfall is lower (33” annually) than sites only 12 to 20 miles to the east. The foothills also provide protection from chilling winds in the unstable air conditions of spring and fall. Winegrowers also have the option of placing vineyards on more southerly facing sites to take advantage of the drying winds from the Van Duzer Corridor. Of greatest note are the flavor qualities of the Pinot noir wines from this area. Unlike the wines from hillsides to the east, the Pinot noir from these soils are highly pigmented, with a strong backbone of tannin and acidity and a massive palate of black fruit and earthy flavors.

Ribbon Ridge
Ribbon Ridge is a very regular spur of ocean sediment uplift off the northwest end of the Chehalem Mountains, comprised of a relatively uniform five square miles (3,350 acres) of land in a breadloaf-like shape. The AVA is distinguished by uniform ocean sedimentary soils and a geography that shows that it is protected climatically by the larger and taller landmasses surrounding it. Paucity of aquifers forces many vineyards to be dry farmed. The AVA’s elevation minimum is 200’, with its highest point at 683’.

Pinot noir characteristics from Ribbon Ridge include predominantly black fruit (black cherry, blackberry, and black currant), moderate to high structure sometimes bordering on rustic, good acidity especially in higher elevations, and good extraction. Wines contain fine tannins, a range of brown and wood spices, fresh-turned earth and chocolate dependent on vintage. Wines are thought to ultimately age very well.
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Soil Pit Presenters

Mike Hallock
Geologist and winemaker Mike Hallock is the founder of Carabella Vineyard, located on the southeast flank of Parrett Mountain. After a graduate degree in climatology and 25 years as a consulting geologist, he did obligatory coursework at UC Davis and became a winemaker in Colorado (really!). Twelve years of vineyard site study resulted in the planting of the 49-acre vineyard in 1996; the final 9 acres were planted in 2007. Primary focus at Carabella is Pinot noir. Most of the vineyard is devoted to individual blocks featuring seven different clones designed to bring complexity to a site driven blend. Two blocks of Dijon 76 Chardonnay and two clones of Pinot gris also have a devoted following. The gypsy winemaking life of commuting from Colorado for crush ended in 2002 when Mike and his family relocated to Oregon to concentrate full-time on the vineyard and wines of Carabella. The wines are created in shared winery space near the vineyard.

Dave Paige
Dave Paige developed his interest in wine while working at a wine shop in Ohio. He moved to California to enroll in the Viticulture and Enology program at U.C. Davis, where he earned his Fermentation Science degree in 1989. Dave’s diverse experience has included time at wineries in the Sierra Nevada foothills, the Napa Valley, Australia, and Monterey.

While making Pinot noir at two wineries in Monterey, CA, Dave traveled to Oregon many times to compare wines and ideas with other Pinot producers. On one such trip in 2001, he and David Adelsheim discussed their shared belief that restrained winemaking methods lead to greater complexity and balance. Dave joined Adelsheim as Winemaker in September of that year, just in time for harvest. He has brought an open-minded approach and a willingness to combine new and old techniques in pursuit of classic, elegant wines. He continues to enjoy the collaborative, pioneering spirit of the Oregon wine industry.

Lynn Penner-Ash
Lynn grew up in the Washington, D.C. area, so when it came time to choose a college she decided to explore her options on the opposite coast. The University of California at Davis provided the perfect answer and it was there that her love of winemaking was born. While at Davis, Lynn worked several vintages at Domaine Chandon and one for Chateau St. Jean. After four harvests she was hooked and she changed her major to fermentation science. A post-graduation job offer from Stag’s Leap Wine Cellars sealed her fate and Lynn spent the next four years working as their enologist and off-site (Hawkcrest) winemaker. In 1988, Paul Hart, then owner of Rex Hill Vineyards, offered her the job of winemaker. Fourteen years later in 2002, Lynn left her position at Rex Hill to pursue full-time, with her husband Ron, the dream of owning a winery and vineyard. Penner-Ash Wine Cellars’ gravity flow winery has been showcased by Practical Vineyard and Winery Magazine, in addition to numerous other industry publications. Lynn and her family have traveled and tasted their way through the vineyards of Burgundy, Australia, New Zealand, Tasmania, Germany, and Switzerland, and most recently with the thought of global climate change in mind, went trekking in search of potential vineyard sites at Base Camp on Mt Everest (18,500 ft) and Kilimanjaro (19,400 ft).
Chad Vargas
Chad got his start in agriculture working on his father's research farm in Jerome, Idaho, where he learned to setup randomized block design experiments on various row crops. He obtained a B.S. in Crop Science from the University of Idaho and an M.S. in Plant Pathology from Texas A&M University. He was able to set up a joint project between Texas A&M and the Pierce's Disease Task Force at UC Davis for his M.S. work, which led to a move to California in 2000. After completing his degree, Chad took a job conducting efficacy research with UC Davis, continuing his research of testing potential treatments for Pierce’s Disease. In 2003, he accepted a Pest Control Advisor position with Crop Care Associates in Yountville, California where he gave general viticulture and pest management recommendations to winegrowers located in Monterey, Sonoma, and Napa Counties. In 2005, Kendall Jackson Estates offered him a chance to work as a viticulture and pest management consultant on 1,500 acres between Sonoma and Napa. In the fall of 2006, Chad began talking with David Adelsheim about his need for a viticulturist. He currently holds the job of Vineyard Manager and Viticulturist for Adelsheim Vineyard.