

# GEOLOGY AND WINE

*Elizabeth Devon*

Following his extremely interesting, entertaining and informative lecture, 'Geological and Climatic Controls on British Viticulture' given for the Society on 1st June, ten Bath G.S. members met Professor Richard Selley on the following Saturday morning at Denbies Vineyard in Dorking, Surrey.

Wild vines have grown in Britain for over 50 million years. It was during the Eocene, a time when it is believed that CO<sub>2</sub> concentrations reached 2000 ppm and it was warm and wet in Britain with rainforest everywhere. There was no ice at the Poles and average global temperatures could have been as high as 25°C. Only in the Ice Age of the last 2 million years have vines retreated from Britain during the glacials, returning during warmer interglacials, such as the present one.

In marginal climatic conditions such as those of modern Britain, great care must be taken in finding favourable vineyard sites. The Romans introduced viticulture into this culture and Surrey, in general, and Dorking in particular, has a long association with wine. Several vineyards flourished in the county during the Little Ice Age of the 17th and 18th centuries, notably at Painshill, Albury and Deepdene. In the last century vineyards were planted near Dorking at Thorncroft and Denbies, *photograph 1*. Denbies covers some 104 hectares (260 acres) and is believed to be the largest privately-owned vineyard in Europe. It is planted with 19 different cultivars, and produces a range of red, white and sparkling wines. It was established on the recommendation of Prof. Selley who, applying the French concept of 'terroir', recognised the favourable combination of topography and geology, coupled with the beneficial effects of global warming.



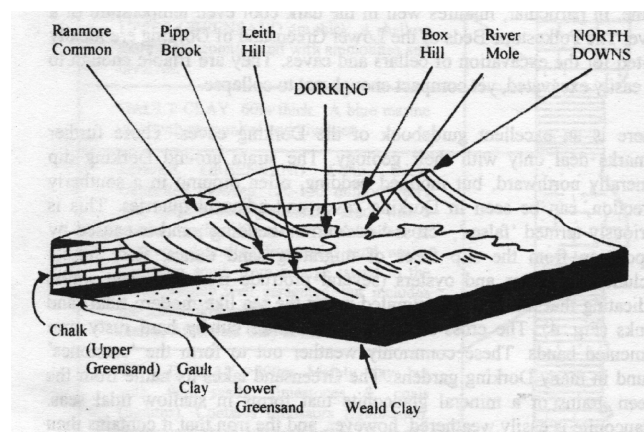
*Photograph 1: Denbies winery surrounded by part of the extensive vineyard.  
The scar from a landslip can be seen on the Chalk hill in the background.*

Soil character, landscape and macro-climate are most important and geology controls these factors. This statement brings to mind the American philosopher Will Durant's comment "*Civilisation exists by geological consent, subject to change without notice*".

The winelands of Britain are defined by their geology. Examples include the Pleistocene terrace gravels of the Thames and other rivers, the chalk Downs with their sunny southern slopes and sheltered dry valleys, and, to quote Prof. Selley "*the Palaeozoic rocky rivieras of Wales and the West Country*".

The Cretaceous chalk, on which Denbies is largely planted, crops out in the Champagne area of France, and is noted for its dual pore system of fractures and intercoccolithic shelter porosity. The fractures ensure that the vines are always well-drained, but in the dry season they may obtain moisture from the microporosity between the fractures.

Dorking lies where the River Mole has cut a gap in the North Downs, separating Ranmore Common in the west, from Box Hill to the east, *diagram 1*.



*Diagram 1: Block Diagram showing relationship between geology and scenery around Dorking,  
(thin Upper Greensand is omitted)  
Diagram by Professor Richard Selley*

The North Downs define the northern edge of the anticline of sedimentary strata of the Weald, and the southern limb of the large syncline of the London Basin. The North Downs are formed from a resistant ridge of Cretaceous Chalk, (deposited between 100 - 65Ma). The Chalk overlies the thin Upper Greensand, which has little effect on the landscape. At the foot of the North Downs, an east-west aligned valley was eroded in the soft, impermeable Gault Clay, over which the River Mole flows towards Dorking from the east, and the Pipp Brook from the west. Beneath the Gault Clay is the Lower Greensand, the uppermost unit of which, the soft rusty yellow sands of the

Folkestone Beds, crops out in a series of quarries through Dorking. Beneath the Folkestone Beds the Lower Greensand is better cemented and more resistant to weathering, giving rise to the chain of hills that include the Deepdene, the Nower and Leith Hill. The Lower Greensand overlies the heavy sticky Weald Clay.

Having assembled in Denbies winery car park, one mile north of Dorking (TQ163511) we proceeded into the town for a tour of Dorking caves. Most English towns have cellars and extensive caves that were excavated in the underlying rocks. These were used to store a wide range of goods. Wine, in particular, matures well in the dark cool even temperature of a cave. The caves beneath Dorking were carved into a tidal sand body of the Folkestone Sand, (top of Lower Greensand, Cretaceous, formed c.140 Ma). These sands are ideally suited for the excavation of cellars and caves. They are friable enough to be easily excavated, yet compact enough not to collapse; not too often anyway.

The sandstone also demonstrates dramatic cross-bedding from mega-ripples. This is caused by deposition from the slip faces of migrating sand dunes. Rare fossils include ammonites and oysters, of which several protrude from the cave walls. These indicate that these dunes migrated under the sea like modern tidal sand banks. The cross-bedding is sometimes cut by hard, rusty iron-cemented bands.

The Greensand takes its name from the green grains of a mineral glauconite that forms in shallow tidal seas and when first cut the sand appears green. Glauconite is easily weathered, however, and the iron that it contains then contributes to the rusty colour of the sandstone and occasionally precipitates out in the irregular carstone bands. The iron precipitates as limonite along fractures and as 'liesegang ringen'.

The cave system may date back to Medieval times. It was certainly used in the 17th century and was probably dug for wine storage. The cellars are divided by brick into 42 bins. As well as hundreds of wine bottles, the cellars were also used for barrels. Various items of pottery have also been found, dating from 1740, including some good quality Chinese pottery. There was also evidence for hand-blown bottles of about 1750.

Two 17th century well shafts were visible and many carved graffiti, some more enigmatic than others, *photograph 2*. We then descended the staircase which winds its way around an old well where we could see the old water table marked by iron stain. We descended to the mystery chamber where we found more strange symbols carved into the walls. The origin of the chamber, which is circular and has a seat all round, is unknown; maybe it was used for religious ceremonies or maybe as a folly?

After this very interesting visit to the Caves, we walked through the town to Dorking Museum to see, according to Professor Selley, 'Lord Ashcombe's teeth'! The collection was made by Lord Ashcombe in the late 19th century. The



*Photograph 2: One of the enigmatic carvings  
Any ideas?*

teeth mentioned belonged to mammoth, *photograph 3*. In fact, there is a very good display of specimens from the Rover Mole Pleistocene gravels including an elephant femur and rhinoceros humerus. There are also lots of Cretaceous fossils including fish teeth and scales and some truly spectacular mineral specimens.



*Photograph 3:  
Part of the  
collection of  
Lord Ashcombe's  
teeth. This is a  
mammoth tooth*

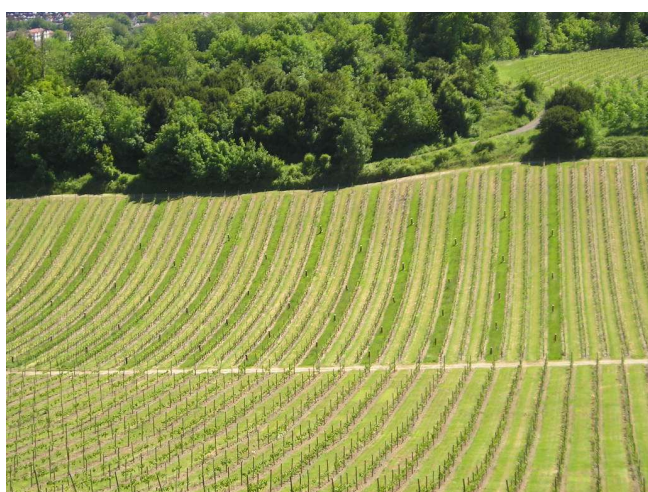
Ranmore Common on the North Downs was the site of our lunch stop with excellent views over the Wealden anticline to the South Downs. From here we could see the sites of abandoned Little Ice Age (1600 - 1700) vineyards of the Surrey Hills.

We then walked along the rim of the North Downs and turned north to enter the Mole Valley. Slowly, we descended through Denbies vineyard to the winery about 2.5 miles away, *photographs 4 and 5*.





*Photograph 4: View over the Vineyard from the north.  
Box Hill can be seen in the distance.*



*Photograph 5: Rows of Vines.  
Black heaters can be seen between the rows.  
Frost is a danger in late spring.*

In the winery we enjoyed an IMAX film about the geology of the vineyard and then toured the winery on a ‘train’, *photograph 6*. This terminated at the cellars where we enjoyed a short talk accompanied by the tasting of three of Denbies wines.

During this extremely enjoyable day there were many discussions including the future of viticulture in Britain and global warming. There is much evidence that the Earth has experienced global climatic change many times, alternating between greenhouse and icehouse conditions. The planet has been cooling for the last 60 million years or so and for the last two million years we have been plunged into in ice age. During this ice age there have been glacials (cold periods) and interglacials (warm periods). During glacials the area south of a line roughly from the Severn to the Thames, experienced tundra conditions with herds of mammoth and reindeer and yet in the interglacials the same area was the habitat for hippopotami, hyenas and hominids.

A remarkable feature of the climate curve is the thermal stability of the last 10,000 years, an almost unique event in the record. It follows that a climatic fluctuation is imminent, but will it be hot or cold? Since we are now in the middle of an ice age, in a warm interglacial, it is reasonable to suppose that the next change will be a drop in temperature and the return to another glacial.

In the last 10,000 years, however, there have been fluctuations in temperature. It was warm in Roman and Medieval times, with an intervening Saxon drop. Some 2000 years ago Saserna attributed the northward migration of viticulture across the Roman Empire to global warming. Is nothing new? During the Little Ice Age from mid-15th to mid 19th centuries, temperature dropped by nearly a whole degree. And now we are experiencing the Industrial Revolution warm phase. At the moment, however, temperatures have only just got back to where they were in Roman and Medieval times.

The prediction at the moment, however, is that we are experiencing a runaway greenhouse effect caused by man’s activities and the Polar ice caps are melting. It is estimated that sea level rose 5m per century at the end of the last glaciation (Hanebuth et al. 2000). This would drown the vineyards of Bordeaux in the Gironde estuary.

What of the future of British viticulture? If the climate cools, either because of a new glacial or because the Arctic ice caps melt and the fresh water shuts off the Gulf Stream, then viticulture in this country is doomed. However, if global warming continues then the future is bright; throughout this Industrial Revolution warm phase, vineyards have extended from southern England up to a line from the Severn estuary to the Humber. They now reoccupy the old Roman and Medieval winelands. From consideration of geology and resultant landscape and soil, Professor Selley has identified four winelands in Britain:-

1. ancient winelands that have been abandoned and never replanted, (Côtes ancienne abandonnée)
2. ancient winelands that have been abandoned and replanted, (Côtes ancienne renaissance)



*Photograph 6: Train ride through the winery*

3. virginal (Industrial Warm Phase) winelands, (Côtes virginale)

4. future winelands if global warming continues, (Côtes de futur). It may not be many decades before vineyards are established on south-facing slopes of the Derbyshire Peak District where Carboniferous limestone produces terrain and soil like those of parts of Greece. Another area could be well-drained slopes of the fractured slates and volcanic tuffs of the Lake District; the northwest shores of Wast Water and Ullswater where southeasterly slopes will enjoy the effects of solar radiation from the lake waters below.

There may also be Scottish vineyards (Côtes d'Ecosaise). Will wine replace whisky? The Lower Palaeozoic slates and greywackes of the south-facing slopes of the Southern Uplands seems ideal, or maybe the Dalradian metasediments on south-facing slopes of the Grampians? Prof. Selley went further to add that he thought the prime Scottish estates would be along the north slopes of the Great Glen where the geology is similar to the Cape vineyards of South Africa. He thinks there will be tourist wine trails; luxury cruises will sail along the lochs and the linking Caledonian Canal between Inverness and Oban and there will be even more sightings of the Loch Ness monster.

Our thanks to Professor Selley for a thoroughly enjoyable dual event of lecture and fieldtrip. We think of both as we enjoy the purchases of the day.

#### **References:**

Selley, R.C., 'The Winelands of Britain: Past, Present and Prospective' 2004

Selley, R.C., 'Geology of Dorking and its Caves', Dorking & District Museum



[www.denbiesvineyard.co.uk](http://www.denbiesvineyard.co.uk)

The following book is thoroughly recommended:-

## **THE WINELANDS OF BRITAIN: PAST, PRESENT & PROSPECTIVE**

**Richard C. Selley**

Published by  
Petravin,  
P.O. Box 425  
Dorking  
Surrey  
RH5 4WA

£10.00

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### **FROM THE REVIEWS**

**'Wine on the web'** There are two features of Professor Selley's book which immediately recommend it - his sense of humour and his ability to communicate geology in layman's terms. I am not a geologist but his hypothesis regarding the future of Britain's winelands is both eminently readable and well documented.

**'GeoTimes'** 'The Winelands of Britain' does a wonderful job depicting the terroir of Britain, an overlooked wine producing country. For anyone interested in the history of grape growing or the potential of vineyards in Britain, today and in the future, this book is a must read.

**'Down to Earth'** This is a highly informative book, but it is also very interesting and highly readable. Perhaps best enjoyed