

of the mountain chain began their intense erosion (which of course is still happening today), while in the lower parts, those eroded sediments were deposited over tens of millions of years, forming younger nearby basins usually associated with big rivers and, consequently, a lot of wine regions: Spain's Duero Basin, whose river, the Duero, is surrounded by vineyards for almost the entirety of its extensive run through Spain and Portugal, where the Portuguese call it, *Douro*; the Ebro Basin to the south of the Pyrenees, known in Spain as the *Pirineos*, among other Spanish dialects, and *Pyrenées*, in French; and the Aquitaine Basin in France, on the north side of the Pyrenees. More recently, during the ice ages (the last few million years) the erosion in the higher altitude areas began to carve out U-shaped valleys due to the action of glaciers.

While there can be found igneous and metamorphic rocks in the Eastern part of the Pyrenees and in some parts of the Cantabrian Range, the type of rock most present toward the south of the Pyrenees, in the depressions of the Basque-Cantabrian Basin (the northeastern most section of the greater Ebro Basin), home to the Navarra and Rioja, are largely of sedimentary origin, some marine sedimentation and other non-marine, continental rock depositions.

Navarra Overview

The geology of Navarra shows a great diversity in rock type as well as the age of their formation. Geologists divide this region into five geological units, and Navarra's subregions are also five. To keep it clear, the Navarra's DO subregions are in red and italicized.

Navarra's largest geological zone is the Ebro Massif, which is connected with all of the Navarra DO subregions, but the *Ribera Alta* and *Ribera Baja* subregions are entirely within this geological unit. Here, the landscape is covered by a thick layer of young Cenozoic sediments. During the middle part of the Cenozoic (35 to 25 million years ago) a huge shallow lake was present over this area and extended from Rioja to the east through the Ebro Basin, which led to the formation of rocks, mainly mudstones, often rich in salt. Non-marine calcareous rocks are also present but in less proportion compared to Navarra's vineyards further north. More recently, the activity of the Ebro River formed fluvial terraces along its course, with abundance of sand, silt, and clay originating from continental erosion with little influence from marine sediments, resulting in more rounded wines compared to those grown on more rocky soils further north.

On the eastern end of Navarra is the geological unit known as the Pyrenean Zone and also the northern part of Navarra's *Baja Montaña* subregion. Prior to the Alpine Orogeny, this area was a tropical sea with different depths which developed an extensive variety of calcareous rocks formed by the calcium-carbonate skeletons of the organisms living in those environments, rocks like limestones, marls, sandy limestones, etc. Unique to this Navarra subregion are numerous valleys that run north-south, perpendicular to the Pyrenees.

The southernmost part of the geological unit connected to Navarra is called the *Transition Zone* and corresponds to the northern part of the *Valdizarbe* subregion. Here, characteristics from both the Pyrenean Zone and the Basque-Cantabrian Zone are present. The westernmost limit is in the Estella-Elizondo area, which gradually changes to the Pyrenean Zone towards the east. Like Baja Montaña, Valdizarbe has a great diversity of calcareous rock formations.

The northern part of Navarra's western *Tierra Estella* subregion continues along the limestone Cantabrian Range where the Rioja subregion, *Rioja Alavesa*, ends. This area is what geologists refer to as the Basque-Cantabrian Zone (an extension of the Basque Arc/Basque Mountains).