GEOLOGICAL HISTORY OF THE BASQUE-CANTABRIAN BASIN: A SUMMARY

Victoriano PUJALTE
Dept. Estratigrafía y Paleontología. Universidad del País Vasco

The present landscape of the Basque and surrounding areas is the result of a long evolution. About 250 Million years (My) ago, the Iberian Peninsula was part of a giant continent, named Pangea (meaning “All Lands”), which embraced most emergent landmasses of the Earth. Following the breaking-up of this supercontinent, the north margin of the Iberian Peninsula was stretched and began to sink, becoming transformed into a “basin” (so-called Basque-Cantabrian basin), that was to be infilled with a thick pile (>10 km) of sedimentary rocks during the next 200 My. In this process, the main stages were:

From 248 to 230 My (Lower Triassic): The stretching stress created down-faulted trenches (“grabens”), that were filled with siliciclastic sediments (gravel, sand and mud, mostly or wholly made up of quartz grains) brought in by rivers. These deposits now form high relief ridges on the margins of the Basque-Cantabrian basin.

From 230 to 205 My (Upper Triassic): Extremely arid conditions led to deposition of red muds with “evaporitic” minerals (such as gypsum and salt) in local ponds, that have been actively exploited in the past in many localities of the Basque Country.

From 205 to 160 My (Lower-Middle Jurassic): A rise of sea level causes a major marine flooding of the Iberian Peninsula. Marine carbonate sediments (made of sea-borne CaCO₃) accumulate in the Basque-Cantabrian basin. Excellent for manufacturing cement!

From 160 to 121 My (Upper Jurassic-Lower Cretaceous): A sea-level drop, coupled with a new phase of stretching, reactivated the Lower Triassic grabens and increased the influx of siliciclastic sediments. Locally, these deposits are the reservoir of the only onshore producing oil field in Spain (Ayoluengo, in the north of the province of Burgos).

From 121 to 99 My (Middle Cretaceous): This was a very special interval in the evolution of the Basque-Cantabrian basin, characterized by a high-rate tectonic stretching, a moderate sea-
level rise and a tropical or near-tropical climate. Influx of siliciclastic materials increased, but for most of the time it was insufficient to hinder accumulation of thick volumes of limestones, mainly constructed by Rudist, a variety of bivalve mollusc now extinct. Rudist limestones, often called ‘Urgonian limestones”, create some of the most spectacular scenarios of the Basque-Cantabrian basin, and are also of great economic value: in the near past, they hosted the iron ores that help transforming rural Bilbao into a busy industrial area; today, they are priced ornamental rocks, and the main raw building material in the Basque Country. Increased stretching, which also initiated submarine volcanism, caused some parts of the basin to sink too rapidly to be filled with sediments, leading to the creation of a deep marine depression. This is called the “Flysch trough”, because sediments reaching it accumulated in a conspicuous vertical alternation of resistant (conglomerates and/or sandstones) and soft (mudstones) beds, known as “Flysch sequences”.

**From 99 to 83 My (Upper Cretaceous):** Stretching slowed down and sea level rose until it reached the its highest position in the history of the Basque-Cantabrian basin. The whole area, and most of the Iberian Peninsula, were submerged, and mantled by different types of limestones. Indeed, most of Europe was flooded (the famous “Chalks” of the English Channel were deposited in this sea), and was transformed into an archipelago.

**From 83 to 33 My (Uppermost Cretaceous-lower Tertiary):** The Iberian Peninsula, that had been drifting southwards the previous 165 My, “changed it mind”, and began moving northwards, toward Europe. Eventually, this caused a “collision” with southern France, which created the Pyrenees and deformed and uplifted the rocks deposited in the Basque-Cantabrian basin. This process, called “inversion”, (meaning that a former marine basin is transformed into a mountain range) developed slowly. At the beginning, only a few areas become emergent, mostly in the eastern Pyrenees (the first part to collide with France) but the seas still covered most of the Basque-Cantabrian zone. Gradually, more and more areas were inverted, and brought to the surface. Uplifted terranes were subjected to erosion, and a fair proportion of the resulting detritus were transferred to the deep trough, and accumulated as flysch sequences. These are beautifully exposed, in the coast of the Gipuzkoa and Biscay provinces, including the cliffs near S. Sebastian.
33 My - Today (Upper Tertiary-Quaternary): The inversion process advanced, and the former basin was eventually transformed into the present-day hilly countryside around us. These mountains were (and still are) mainly sculptured by the action of rivers, and, for a while, also of the Ice. The sea is also doing its work, modelling the sea front. But that is another story…