PART 1: The Elements

1. Rivers are active and very dynamic natural elements. Not only do they change from day to day and from year to year, depending, for example, on rainfall, they change over thousands of years.
2. If we obstruct the path of water that comes out of a tap, for example by placing our hand on its path, almost immediately we see that the water is redirected to drain, readjusting itself. Now, although on a large scale (both geographic and temporal), the same happens with rivers, which adapt and readapt to the obstacles (natural or artificial) that they encounter on their way.
3. The Sizandro River is no exception. In fact, its mouth, located in Praia da Foz, offers us not only a landscape of particular beauty and the opportunity for good sunbathing and refreshing dives but also the rare possibility to see, along a beautiful walk as a family, how the river's interaction with other natural elements determines its course.
4. Sand accumulations are also very dynamic. We often find, for example, that beaches change in width or shape from one bathing season to another. In fact, they also change on much shorter scales, for example daily, as well as much longer, for example, millennials. Therefore, sand constructions are extremely short-lived. If, after a day of playing on the beach, we return the next morning to the same place, there is a great probability that, from our accumulations of sand, no trace will remain.
5. A considerable part of the loose sands is in rapid transit, being carried to other places by the energy of waves or wind. This transport can end for several reasons, highlighting the consolidation of these sands in rocks (sandstones) and the effect of vegetation. On the one hand, plants facilitate the immobilization of sands by the effect of protection against atmospheric agents, and on the other hand, plants facilitate the fixation of loose materials in areas consolidated by their roots. It is not by chance that the most stable and well-developed dunes generally have a vegetation cover. Plants help to stabilize and protect the sands against the action of atmospheric elements.
6. In the dunes that go from Praia Azul to Praia da Foz, the most extensive of the entire coast between Peniche and Cascais after those of Praia da Consolação, this relationship is quite noticeable: the largest dunes are those that are associated with more vegetation. In fact, the more vegetation the greater the sand retention and the greater the stability of the sand the greater the possibility of vegetation to be installed.
7. Compared to the water of a river or the loose sands of a beach, the rocks evolve much more slowly and in a way much more difficult to be perceived on a human scale. This is true for all rocks, although rocks vary widely in terms of susceptibility to change.
8. The rocks on which Praia do Foz do Sizandro is installed and which can be seen in the cliffs that delimit the beach, were deposited in the Upper Jurassic, about 150 Ma ago. They are essentially constituted by consolidated clays and marls (that is, clays with abundant calcium carbonate), which indicates that the sea covered the area for a long time.
9. On the other hand, geological studies show that in the recent Quaternary (7000 years ago) the sea penetrated through the valley of the Sizandro River up to 17 km inland, that is, Torres Vedras was bathed by marine waters and the river flowed a few kilometers before. At that time, the river had, therefore, a very different configuration than it has today and the valley we see today was a large gulf or a coastal lagoon. The coastline only receded to approximately its current position some 6500 years ago, at which point the current beach started to form very slowly. The dunes, much more recent, should not be more than 4000 years old.

PART 2: The Walk

Now that we know a little about the place we are going to visit on this geological tour, let's start our journey.

1. After parking the car, we are greeted by the river, which flows from North to South and, in the distance, beyond the dunes, by the promise of the ocean that comes through the smell of the sea. The bridge, which allows us to cross the river and enter the beach, is a privileged point of observation. To the North, we follow the river until it disappears on the horizon, in a sharp curve towards the East that, in the distance, we do not clearly distinguish. We will call this deviation the North deviation.
2. Still using the privileged view that the bridge allows, if we now turn South, towards the mouth, we will see something similar to what we saw in the North: the river continues to flow from North to South, always parallel to the coast, until be lost from our sight, when it deviates to the West, towards the sea. We will call this deviation the South deviation.

3. It is a curious journey, because, before reaching Praia da Foz, the river flowed from East to West, on the shortest route to the sea - the path that Nature, in general, chooses. However, suddenly, the river radically changes direction, starting to flow perpendicularly to the direction in which it flowed, thus following the longest path to the sea. As our hand interrupts the flow of water coming out of the tap, the diversion of the river water from its natural course will necessarily be caused by some obstacle.
4. Let's start by investigating the North. Crossing the bridge and arriving at the beach, we descend until close to the riverbed and head upstream, along its bank, enjoying a charming landscape, populated by abundant birdlife. To our left, as we walk, we see that the dunes are becoming progressively wider, higher and increasingly colonized by vegetation.
5. Arriving at the North diversion, a careful observation quickly shows that it is here that the dunes offer the greatest obstacle to the river's crossing. When the river's flow meets the dune cord, which reaches 25 m in altitude in this sector and which is particularly stable and well developed due to vegetation cover, the river is forced to deviate its course.
6. In fact, if we look towards the bridge from the North deviation, it will be easy to see that the sharp curve that the river makes occurs in the encounter with the dune cord and that, from that point the river continues to fit behind the dunes, unable to transpose them practically until it flows into the sea.
7. Let’s investigate now to the South. Making the way back to the bridge, crossing it and heading south along the cliff, we see that the rock wall (about 25 m high), offers a much more insurmountable obstacle than the dune cord which, incidentally, gradually decreases in size towards the mouth and completely loses the vegetation cover. Anyway, the river will find front and to its left Jurassic rocks, being forced to cross the dune cord (the smallest obstacle), deviating to the West. In summer, with lower flow, the transposition can be punctual or even non-existent. In winter, when the flow increases, the overflow towards the sea occurs to a greater extent.
8. The obstacle that the dunes represent was not always present, however, given that the dunes are much more recent than the current position of the coastline. For this reason, geologists consider that the direct route towards the sea was probably the route that the river followed for about 2500 years, until it was forced to deviate its terminal route.
9. Upon returning from the investigation of the southern deviation, the cliff itself, with good exposure of the succession of sedimentary layers that tell part of the history of the marine and coastal dynamics of the region in the upper Jurassic, invites observation. There, it is especially easy to identify and observe very beautiful convoluted structures in the claystones, which testify to the deformation caused by the weight of the layers above, when all these sediments were still watery and soft, at the time of their accumulation.
10. Scientists continue to study how the Sizandro River has changed over time, in response to the evolution of the region and the planet. It is known, for example, that, in its terminal kilometers, the river changed its course successively to the South, at least in the last 200,000 years. It is also known that, in some periods, for example, 8000 years ago, the slowing down of the sea or its descent exposed sandy barriers that led to the formation of large lagoons. The large amount of sediments of continental origin today accumulated on the seabed, also suggests that the various rivers and streams in the West may have integrated a much larger river and, therefore, with much more transport capacity.
11. One thing, however, is certain. Just as the water that comes out of the tap will fall vertically following the law of gravity and the shortest route towards the center of the Earth, unless it is diverted, so the rivers, unless they encounter an obstacle, will follow the laws of physics, flowing from the highest to the lowest altitudes until they reach the sea, always favoring the shortest route.
12. Understanding the layout of river beds and their evolution over time depends, therefore, on an integrated view of how natural elements contact, condition and evolve in solidarity.