

Case Study: Drilling for the lost city of Atlantis!

At the end of September 2015, Vincent and I had the opportunity of travelling to Seville, in the South of Spain, to train members of staff from the Spanish Geological and Mining Institute (IGME) in the use of a Window Sampling System, Stitz Sampler and a Lost Cone Drilling Set.

A young but very expert team of scientists led by Dr. Claus Kohfahl, a north German professor, were looking to monitor water contamination in the National Park of Doñana. Earlier this century the Doñana National Park was in the news following devastating tsunamis which drew attention to a new claim that researchers had found the lost city of Atlantis — buried in mud on the southern tip of Spain. Scientists said they had found proof of a 4,000-year-old civilization that was buried by a tsunami. Doñana Park is a huge natural reserve, with marshes, shallow streams and sand dunes, where the Guadalquivir River finds the Atlantic Ocean. It has a very large biodiversity, with tens of bird species that find a shelter during their migrations. When driving around the park, we understand the importance of keeping this area as a reserve: mining activity is very important in the north of the park, upstream the river, and some heavy metals are present in the groundwater, from natural origin. To keep it under some certain limits

makes life for plants and animals possible. In addition, the surroundings also hold an important agricultural industry: side by side to the park fence, we can see large extensions of greenhouses where strawberries are intensively grown (the first ones that can be eaten in Europe every spring), with high demand of water coming from the ground, and to the east of the park, rice and cotton fields alternate their colours with the blue from the sky and the chalk white from small buildings, spotted about that area. In a region where sun seems to be closer to us, it produces a very clear light year round and all natural and artificial colours seem to agree to provide nice pictures to pro and amateur photographers.

The trip from Seville to Doñana is also the way for one of the more popular pilgrimages in the South of Spain: El Rocío. About one million people follow dusty lanes every spring to worship the Rocío Virgin. I am sure that, together with the Chinese Wall, it is possible to see from the Moon the cloud of dust that pilgrims create!

The team from the IGME is investigating, as part of their research into water levels, also quality and the extent of contamination, which is caused, aside from heavy metals also by Doñana's proximity to an oil



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pipeline that runs between Estremadura and the port of Huelva. The water table problems are exacerbated by heavy abstraction for irrigation to maintain water-intensive crops such as rice and more recently strawberries. The latter are grown in greenhouses, with an estimated area under plastic of between 4,500 and 6,000 hectares in the Doñana area, producing over 60% of the Spanish strawberry crop. The strawberry farms threaten to cause damage to the park by depleting the surrounding groundwater as well as creating pesticide pollution and plastic waste which accumulates in local creeks surrounding this area of outstanding natural beauty.

The problem for the team undertaking the research is the type of soil which is very sandy and difficult to sample. Collecting an undisturbed samples for analysis was proving almost impossible, hence the supply and training on using our Window Sampling Set, Stitz Corer and a Lost Cone Drilling Set.

The main purpose of using our equipment was to collect undisturbed samples to a depth of about 6 to 8 metres. What happens is that the sampler cutting shoe compacts the sand, converting it in a very hard to penetrate material. And, if that wasn't problematic enough, every time we recovered the sampler, the borehole collapsed. In the end we did recover samples from about 4-5 m, which was the deepest yet.

I was really impressed with the ritual when the sample was recovered above ground: the moment that Antonio, the expert driller, had the core sampler in his hands, Fernando and Natalia, in a perfect and silent choreography retrieved the sample from inside, labelled, sealed and stored it – no messing, no words necessary, complete and utter concentration on the task in hand, to retrieve a viable sample that they can then analyse in the lab, under, Claus' supervision.

Our next challenge was installing new groundwater monitoring wells, quickly and non-destructively, using the lost cone drilling set. This set comprises steel casings in sections

of 100cm, with at the base a cast iron cone. It is called "lost cone" because it is left in the ground. The casings are driven into the ground to the depth required, a 1-inch HDPE monitoring well is lowered inside the casing which is then retrieved, leaving the perfect well in place. The shape of the cone makes it easy to penetrate the different layers of the soil. The cone did its job well, masterly driven by Antonio and we installed a nice 6m well and, due to the high recharge rate of that sandy site, after a few minutes we were able to start the peristaltic pump and test the quality of the water.

While we were onsite Vincent insisted on the convenience of adding another piece of equipment to their research fleet: a Stitz Sampler. It consists of a piston-like sampler, driven by a percussion hammer to take us as deep as we need to sample and to obtain a good profile of sediment.

So two weeks later we were onsite again this time with the Stitz Sampler. More complex to use than standard gouge augers, but with added suction strength (greater than gravity force) the equipment was scrutinised and improvements proposed by Fernando to help avoid collapsed material falling into the sampler. The recovery of expensive gouges and rods was one of the main concerns of the team and Antonio was adamant that he had to have two breakfasts to make the extraction work! People from Andalucía are famous because of their good mood and their superlative comparisons, and Antonio is a great and fun example of this. To save on breakfasts they opted for the hydraulic extraction unit and so, we started the generator, connected the hydraulic hoses and let it do its thing. While Antonio was driving the lever, his colleagues were watching with wide eyes at how easy it was to extract the equipment with no real manual effort.

I must confess that at the end of our site visits, I was a little disappointed. I had watched some reports about the presence of Atlantis below Doñana and I had expected to listen to some fantastic stories about the findings of our customers during their groundwater research: some medals, amphorae, a bit of a large building something that, I am sure, they found but now they choose to keep secret! We will have to continue to watch the National

Geographic channel, read fantastic stories about Atlas and Atlantis to find out more about the secrets that Claus, Antonio, Fernando and Natalia keep to themselves, under the excuse of water contamination in Doñana's groundwater. They are so good at keeping secrets that even a delicious meal with "pescaito frito" (fried fish) in front of a brisk Atlantic Ocean in Matalascañas was not enough to destroy their defences and make them talk.....

Anyway, thanks to Claus Kohfahl, Antonio Martínez, Fernando Ruiz and Natalia Fernández for their hospitality, keeping the Atlantis secret and sharing their sampling and drilling challenges in sandy sediments.

