



SO277 (GPF 19-2_012)



1. Weekly report, 14th - 16th August 2020

SO277 OMAX contributes to two science projects. The emphasis is on acquiring the necessary geophysical, geochemical, and seafloor surveying data for the Helmholtz European Partnering project SMART that is concerned with the investigation of offshore groundwater systems with the aim to develop sustainable usage scenarios for this precious resource. Furthermore, we will investigate the dynamics of the flank of Mt Etna to assess the geohazards posed by a potential collapse of this volcano and ensuing tsunami. This work will be carried out for the project MA-PACT.

SMART is a collaboration between GEOMAR Helmholtz Centre for Ocean Research Kiel and the University of Malta. Apart from addressing the scientific objectives on groundwater research an overarching motivation for this project is capacity building in South and Eastern Europe and promotion of Helmholtz research.

That there are freshwater occurrences below the seafloor has been known since antiquity when roman ships replenished their drinking water at offshore springs off Syria. There divers were sent to the seafloor to fill leather hoses with fresh water. However, such vigorous springs are extremely rare and it was thought that the occurrence of freshwater below the seafloor was the exception. Over the last two decades, however, chance discoveries of freshwater in offshore hydrocarbon wells made it clear that there are large quantities of fresh water below the seafloor. Present estimates suggest that there are 100 years-worth of human consumption. With increasing global population and global warming water is ever becoming scarcer and it is likely that coastal states will tap into this resource soon. Therefore, it is necessary to understand better the distribution of offshore groundwater and its connectivity to onshore aquifers. This is paramount for devising strategies how this resource can be used sustainably and without threatening the natural environment.

A major impediment to mapping, quantifying, and understanding these system is the fact that it was not possible to map the occurrence of offshore freshwater apart from drilling which is prohibitively expensive. Therefore, our development of geophysical methods for the mapping of offshore groundwater was a major breakthrough. By a smart combination of electromagnetic and seismic methods it is possible to map freshwater with research vessels – a technology that we have successfully developed and tested off the south island of New Zealand in 2017. Within the SMART project we will develop these techniques further and we will apply them to a new target.

Malta is one of the most water starved nations per capita in the world and its geology is a type example for the geological setting of the Mediterranean. In addition, there is a solid understanding of the onshore hydrology and some offshore wells. This is why

we chose Malta as the perfect study site. While the study off New Zealand looked at sandy sediments, most of the Mediterranean seafloor consists of carbonate rocks which are more difficult to image. In a small-scale pilot study last year we have shown that it is feasible to apply our techniques also here and the OMAX cruise is the first major expedition that will test this and assess the groundwater resources off Malta.

Originally, it was planned to conduct the cruise in two legs in December 2020 using the research vessel Meteor, However, because of the coronavirus all German research vessels had to return to Germany and all expeditions have to start and finish in Germany now. This implied cancellation of all the expeditions that were scheduled to take place in remote places and expeditions that could be undertaken from Germany were brought forward. For this reason the two legs of OMAX were combined and also the work for MA-PACT was added to OMAX making it very long, i.e. 51 days in total.

Because of coronavirus a number of severe precautions were taken by the ship's operators. This includes PCR tests for the coronavirus for all the crew and scientific participants and a quarantine to ensure that no transmission takes place between the test and the availability of the results. Furthermore, the coronavirus guidelines of Lower Saxony are applied for the first 14 days of the cruise including social distancing, masks in close working conditions, and closure of the gym. For this reason the participants had to arrive in Leer already on the 9th and 10th of August before they were allowed onto the research vessel SONNE in Emden three days later, i.e. on the 12th and 13th of August, respectively.

Loading of the scientific equipment took place on the 12th and 13th of August before we were ready to depart from Emden at noon on the 14th of August. Since then, we have been on transit through the North Sea and the English Channel and we just entered the northern part of the Bay of Biscay. During the transit we are preparing the laboratories and make most of the time to prepare for the upcoming work. We expect to arrive at the first study site off Sicily on the 26th of August.

On board everybody is well and we are looking forward to begin with the scientific programme.

On behalf of all on board,

Christian Berndt

(Chief scientist, GEOMAR)