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FRESH WATER LIES BENEATH THE SEAS

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According to recent estimates by the FAO, there are 1,400 million cubic kilometres of water on our planet, of which 2.5%, only 35 million are fresh. To us who open the tap and see it flow abundantly, it seems impossible that it is a rare commodity, distributed unequally: in fact, a fifth of the world's population lives in areas characterised by a scarcity of drinking water. Even the Mediterranean area is showing increasing signs of suffering, with entire regions in water deficit. If at global level, the combination of climate change, loss of biodiversity and pollution is seriously challenging our ability to manage a resource that is fundamental to our very existence, in coastal regions in particular the high population density, combined with the increased demand for water for tourism and other human activities, is further impoverishing the system of natural water reserves.

Since the 1960s, unprecedented scientific studies have focused on a new potential resource: fresh water collected in underground underwater reserves. Offshore Freshened Groundwaters (OFG), with lower salinity than seawater, represent a promising alternative - especially for coastal regions - so much so. that the UN suggested them as an unconventional source of drinking water in 2022.

The existence of fresh water under the seabed has actually been known since ancient times. The Greek geographer Strabo, for example, mentions an underwater spring 4 kilometres from Latakia, Syria, near the island of Aradus in the Mediterranean, whose water was collected from a boat using a lead funnel and a leather tube, then transported to the city for consumption; he then tells how the Phoenicians of the city of Tyre managed to resist the siege of Alexander the Great for several months, thanks to a similar expedient. Pliny the Elder writes of "underwater springs that make fresh water flow like from pipes" along the Black Sea. Famous are the "citri" of Taranto, freshwater springs with an underwater crust.

Anecdotes from the past that are now returning to the attention of the scientific community. Researchers today know not only that fresh water can be found under the seabed in many parts of the world, but also that its volume is potentially larger than initial estimates. In addition to the springs coming from land, there are underground deposits in the sea that originated in the past, trapped following deglaciation, of potentially better quality, because they are not contaminated by human activities.

Underwater fresh water could therefore, represent a new water resource, but obviously this opportunity must also be evaluated with respect to their accessibility and renewability. In some cases, these reserves are connected to inland aquifers, in others, they are isolated and not actively regenerated. Their management must integrate the protection of the marine space, its ecosystems and the various activities that take place there.

The Rescue Project

The Rescue project (Resources in Coastal Groundwater Under Hydroclimatic Extremes - Securing Freshwater Resources for a Sustainable Future) was created for this purpose, funded by the European Partnership Water4All - Water Security for the Planet, and by the European Union under Horizon Europe. The programme, proposed by Claudia Bertoni (researcher at the University of Oxford), also features the participation of the University of Trieste, OGS (the National Institute of Oceanography and Experimental Geophysics), the University of Derby of the United Kingdom, the University of Malta and Ruden AS of Norway. The objective is to develop knowledge of deep coastal aquifers (over 400 metres) and offshore low-salinity aquifers in European coastal areas, to evaluate new water resources and help ensure a constant supply of water to both the population and industry, in times of hydroclimatic extremes.

The project will cover two areas: the area surrounding Great Britain and Ireland, and the northern Adriatic. This region is already the subject of research by Cristina Corradin, PhD student at the University of Trieste who, in collaboration with OGS, is mapping the onshore and offshore aquifers of Friuli and the upper Adriatic. During the last glaciation (from 120 to 20 thousand years ago) much of the seas around these two regions were emerged land, with vast alluvial plains crossed by rivers and rich in aquifers. According to the hydrogeological model on which the research is based, the same aquifers that formed during the glacial periods are still active in the marine subsoil, probably fed by the water systems of the surrounding emerged areas: the Apennines, the Alps and the Dinarides for the Adriatic, and by those of Great Britain, Ireland and Scandinavia for the North Sea. RESCUE will use existing geological data, without drilling, as well as subsurface data collected by the hydrocarbon industry (previously obtained for other purposes), to create large-scale models for water resources in the European Mediterranean coastal regions. Supercomputing will integrate physical and digital data to create a comprehensive model, and stakeholder engagement will enrich the data pool. The project will also analyse the cost-benefit ratio and sustainability of resource extraction, considering population perceptions.

The Iodp3 Project

The International Ocean Drilling Programme (Iodp3) will start in 2025, carrying out the first scientific expedition entirely dedicated to validating the hypothesis that there are extensive reserves of low-salinity groundwater (3 thousand milligrams per litre or less) in shallow sandy aquifers, up to 100 kilometres deep, off the coast of New England (between Rhode Island and Massachusetts, in the United States). It is estimated that the continental shelf here can contain 1,300 cubic kilometres of fresh water, compared to a total annual consumption of the city of New York equal to 1.5 cubic kilometres.

The expedition — in which a researcher from the National Research Council of Pavia, Valentina Rossi, will take part — will be carried out by the European Consortium for Scientific Drilling of the Ocean Floor (ECORD), in which Italy also participates, and will last about 3 months. 4 wells will be drilled with continuous coring, up to a depth of 650 metres below the seabed, continuously sampling the entire sedimentary sequence that hosts the aquifers. The aim is to establish the origin and age of the groundwater to reconstruct its genesis and its underground path.

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