

New Scripps Oceanography Project to Study Sediments and Ecosystem Restoration in Venice Lagoon

Research will provide a glimpse of past and vital information for the future of city's efforts to maintain its historic lagoon

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Scripps Institution of Oceanography at UCSD, in conjunction with Italy's Venice Water Authority, Consorzio Venezia Nuova and Thetis SPA, has launched a multifaceted scientific program aimed at providing fundamental information about the effects of sediment translocation in Venice lagoon, a vital facet of the historic city of Venice, Italy.

The new effort, a two-year, \$1.5 million project for Scripps, is part of Italy's broad commitment to safeguard Venice and its lagoon, the coastal wetland that surrounds the city and links directly with the Adriatic Sea through inlets.

A team of scientists with SIOSED (Scripps Institution of Oceanography SEDiment research group) will dissect and analyze key elements of Venice Lagoon's sediment through a program integrating geochemical, physical, microbial, toxicological and ecological science. This multidisciplinary approach, the project's leaders say, will provide valuable data about the lagoon and the dynamics involved in sediment movement.

The SIOSED team will be part of a Scripps-Venice working group that will include scientists from Scripps, Thetis, the National Research Council Institute of Marine Science of Venice and the Marine Biology Laboratory of Trieste and promises to integrate Scripps' scientific expertise with knowledge of the lagoon provided by the Italian partners.

Although Venice has been studied extensively by scientists, SIOSED researchers will provide decision makers with further information for assessing geochemical and microbial processes involved in sediment movement-whether natural or manmade-and their effects in such a sensitive ecosystem.

"SIOSED is an exciting and important new project that clearly emphasizes the value of interdisciplinary science in an international partnership," said UCSD Chancellor Marye Anne Fox. "This collaboration is an excellent example of how UCSD and Scripps are increasingly applying leading scientific expertise to global frontiers."

"The overall goal of the SIOSED project is to provide integrated, interdisciplinary, state-of-the-art science that addresses sediment management in the context of ecological improvement of the Venice lagoon," said Dimitri Deheyn, SIOSED principal investigator and the project's scientific coordinator for Scripps. "Venice is one of the most popular cities in the world and Italy's safeguarding measures-including the Mose floodgates system for the defense against high tides-are considered some of the most ambitious projects of the 21st century. So being part of this lagoon preservation effort is being part of history."

"Scripps has a long history of collaboration with the scientists and citizens of Venice," said John Orcutt, deputy director of research at Scripps. "These projects extend from (Scripps Research Professor) Walter Munk's recommendations of gates to limit the effects of flooding at Venice in the early '70s, to nondestructive cleaning of statuary with lasers and (Scripps Research Geodesist) Yehuda Bock's use of global positioning system technology to measure the actual rate of sinking, to today's understanding of the implications of sediment removal and transplantation. This is a wonderful opportunity to extend this history into important studies of biological and toxicological implications of major public works in Venice and elsewhere."

The field experiment phase by SIOSED scientists will include sediment dredging and transplantation to build six 35-meter-long and 10-meter-wide subtidal banks inside the lagoon. The banks will allow the researchers to test how the chemical content and biodiversity of the lagoon respond to such a local change. The researchers will conduct assessments by extracting short and long sediment cores, which will be analyzed for geochemical and biological parameters. Deheyn says that such an analysis is a fundamental precaution.

"In SIOSED we will be extracting cores about two meters deep, and that could take us several centuries back in time. Because the sediment is so old, you could expect metals and organic contaminants to be present," said Deheyn, whose experience includes using biological indicators to test for toxins and pollutants in San Diego Bay.

As in San Diego's waters, when studying Venice's lagoon Deheyn will use luminous brittle stars, a cousin species of starfish, to determine whether contaminants in the Venice Lagoon are bioavailable (the amount of contaminants locally present and shown to be accumulated by the organism) and could potentially induce stress on the local ecosystem.

"This will be an integrated research project that will provide many valuable insights into several different aspects of environmental toxicology and environmental quality assessment," said Deheyn. "It will be extremely interesting and unique to address the many different angles of a single problem."

Scripps scientists and SIOSED research areas include:

• **Dimitri Deheyn:** bioavailability and toxicity of contaminants • **Joris Gieskes** and **Anthony Rathburn:** geochemistry and benthic foraminifera ecology • **Lisa Levin:** biodiversity of benthic communities • **Bradley Tebo:** sediment microbial communities and metal biogeochemistry • **Douglas Bartlett:** pathogen analysis • **Farooq Azam:** water column microbial communities and carbon cycle • **Osmund Holm-Hansen:** viability and photophysiology of autotrophic micro-organisms • **Hany Elwany:** currents, sediment resuspension and turbidity plumes associated with experimental subtidal banks

Lisa Shaffer, Scripps director of policy programs and international relations, is serving as the project coordinator and managing the external peer-review process for Scripps.

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