

Exploring the unknown diversity of the South American coast

From fieldwork to application: the sponge research of Dr. Willenz

The world of sponges

The interest of Dr. Philippe Willenz, researcher at the Royal Belgian Institute of Natural Sciences in Brussels, is dedicated to sponges from different habitats. These organisms spend their life filtering water for bacteria and microscopic organic matter. Although sponges are the most primitive animals, with a rather simple structure without actual tissues or organs, they have contributed to our understanding of life on Earth. Their constantly moving cells are able to recognize each other and help, for example, understanding complex immunological mechanisms of higher organisms. Sponges occur in all seas of the world, but also in freshwaters and present a large diversity of sizes, shapes and colour. Their physiology, morphology and phylogeny fascinate therefore researchers looking for new pieces in the jigsaw puzzle of evolution.



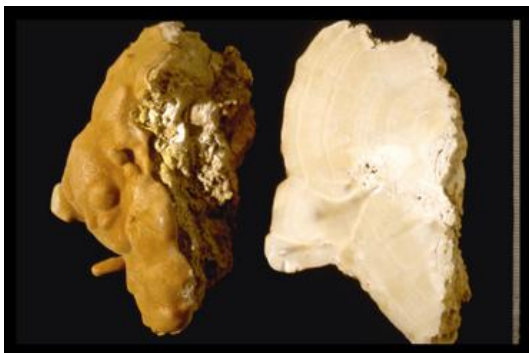
Dr. Willenz on field work in Peru. Photo: N. Mostajo Berropsi

The answer lies in the skeleton

The three classes of the phylum Porifera (sponges) are differentiated by the composition and geometry of the tiny elements of their mineral skeleton. In addition, to recognise sponges, taxonomists also use the cellular and fibrous organisations of their living tissues. To Dr. Willenz the sponge skeleton tells even more: With geochemists from different institutions, he focused his research on a particular group of tropical sponges producing a massive basal skeleton (hypercalcified sponges), that can indicate climate changes through time or even indicate pollution! Analysis of cross sections through the massive skeleton of these organisms, correlated with the age of the sponge, indicates water temperature or salinity changes and even lead contamination of the oceans. Dr. Willenz supervises now two PhD students preparing thesis on the mineralisation mechanisms developed by these sponges, a fundamental step to understand how sponges can contribute to predicting probable scenarios for the environment.



Ceratotoporella nicholsoni, in situ, one of Dr. Willenz study organisms labeled in the field. Photo: Ph. Willenz



Cross section through the hypercalcified sponge *Ceratotoporella nicholsoni*. From an underwater cave on the North coast of Jamaica at -30 m. Photo: Ph. Willenz

From Brussels to the undiscovered fjords in Chile

Brussels – master thesis and PhD

Philippe Willenz decided during his biology studies to focus on sponges. This decision was influenced by his preference for the marine environment and the sympathetic atmosphere of the sponge laboratory at Brussels University. His master thesis dealt with a physiological comparison of fresh water sponges along their life cycle and his PhD thesis, which received the award of the Royal Belgian Academy of Science, was about the ultrastructural aspects of sponge nutrition (detailed analysis of cell structures observed by electron microscopy).

Yale – Post doctoral studies

During his thesis, motivated by these fascinating organisms, Dr. Willenz took a sponge summer course in Jamaica. This initiative turned out to be an important step in his career: One of the course leader, Professor W.D. Hartman invited him to conduct his post doctoral studies at Yale University, on the biology and ultrastructure of an intriguing small group: Hypercalcified sponges, the ancestors of which were important reef builders 600 millions years ago. Well known as fossils by palaeontologists, they were believed to be extinct until recently as they had been overgrown by the rise of corals. Dr. Willenz spent thus more than three years in this inspiring and well equipped research environment, with regular field work in the Caribbean Sea.



In some Fjords of Chilean Patagonia, the sponge biodiversity is quite high and new species are frequently found in those poorly explored waters. Here two specimens of a new *Oceanapia* sp. in the foreground, *Cliona chilensis* in the background and a new *Haliclona* sp. on the right of the picture. Photo: Ph. Willenz



A new species discovered in Chile: *Leucaltis nuda*. The description can be seen in the publication below. Photo: Ph. Willenz

Establishment as researcher in Brussels

Even though the research atmosphere in the USA is tempting, decided family Willenz to move back to Belgium. Here received Dr. Willenz a position as curator of a biomedical fungi and yeasts culture collection. Sponge research had to be carried out on the side, in the evenings and on weekends. However, after some years is Dr. Willenz able to obtain a permanent position at the Royal Belgian Institute of Natural Sciences instead and to focus entirely on sponge research again.

Chile, Peru, ...

Dr. Willenz is now in the position to organise workshops himself. The international workshop on sponges held at the RBINSc in 1995 leads to a fruitful collaboration with South American colleagues. Since 2004 participates Dr. Willenz intensely to collecting expeditions in southern America, mainly Chile and Argentina, where he and his colleagues explore the unknown benthic fauna. Today, in the frame of the Development and Cooperation with the Southern countries, he leads a project along the Peruvian coast to make the first inventory of the sponge fauna of this country. There, in collaboration with his Peruvian partner and a Brazilian colleague, he is assisting young researchers to embark on taxonomical research on sponges, a promising field.

The sponge biodiversity - a treasure for the pharmaceutical industry

Why making so much fuss about sponge taxonomy? Sponges produce a large variety of substances acting as a defence against predators. During the last two decades many of these compounds were found to have as well bioactive effects for human health, against tumours, malaria, tuberculosis or even AIDS. As such, they form an important and inspiring source for the pharmaceutical industry. New endemic species from remote areas contain often unknown chemical substances which might lead to new and better drugs. Taxonomists collecting and describing new species fulfil then an indispensable role in helping biochemists to find new drugs that are then tested in the pharmaceutical research.



Dr. Willenz taking under water pictures.



The international research team in Chile (Dr. Willenz from left to right: fifth person in back row)

Web links related to Dr. Willenz work

Blogs about the expeditions of the collaboration team ESPER in Peru:

www.esper2009expedition.blogspot.com/

www.esper2008expedition.blogspot.com/

www.esper2007.blogspot.com/

The website of the Huinay field station in Chile, where Dr. Willenz stays during field work: www.fundacionhuinay.cl/

Articles about the adventurous field trips in South America by Willenz & colleagues:

"Finding more missing pieces of a puzzle in a maze"

"Marine Sponges Biodiversity"

A selection of scientific papers of Dr. Willenz on different topics about sponges

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- WILLENZ, Ph. (Ed.). 1996. Recent Advances in Sponge Biodiversity Inventory and Documentation. Proceedings of the Xth Workshop on Atlanto-Mediterranean Sponge Taxonomy. Brussels, April 25-30, 1995. *Bulletin de l'Institut royal des Sciences naturelles de Belgique. Biologie*, 66 (Supplément): 242 pp.
- ROSENHEIM, B.E., SWART, P.K., THORROLD, S.R., WILLENZ, Ph., BERRY, L. & LATKOCZY C. 2004. High-resolution Sr/Ca records in sclerosponges calibrated to temperature in situ. *Geology* 32(2): 145-148.
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- BRÜCK, W.M., SENNETT, S.H., POMPONI, S.A., WILLENZ, Ph., MCCARTHY, P.J. 2008. Identification of the bacterial symbiont *Entotheonella* sp. in the mesohyl of the marine sponge *Discodermia* sp. The ISME Journal, 2: 335-339.
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- AZEVEDO, F., HAJDU, E., WILLENZ, Ph. & KLAUTAU, M. 2009. New records of Calcareous sponges (Porifera, Calcarea) from the Chilean coast. Zootaxa 2072: 1–30.
- HERMANS, J., DUBOIS, Ph., ANDRÉ, L., VACELET, J. and WILLENZ, Ph. 2009. Growth rate and chemical features of the massive calcium carbonate skeleton of *Petrobiona massiliana* (Baeriida: Calcaronea: Calcispongiae). Journal of the Marine Biological Association of United Kingdom 90: (DOI 10.1017/S0025315409991081).
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