Projet SaltScience II: getting students closer to science through the study of sodium chloride

M. Clara Magalhães (mclara@ua.pt), Jorge Saraiva, Betina Lopes, Solange Burri, Vanessa Resende and Amorosa Mendes, Universidade de Aveiro, Aveiro,
José Alberto Costa and Guida Bastos, Escola Secundária José Estêvão, Aveiro
Paula Ornelas, Agrupamento de Escolas Soares de Basto, Oliveira de Azeméis
Anabela Viegas, Escola Secundária de Estarreja, Estarreja,
Silvia B. Fernandes and Jesuína Pereira, Escola Secundária António Damásio, Lisboa
Ana Paula Vieira, Agrupamento de Escolas de Mira, Mira

Abstract. *In this talk we present some activities (centred in fieldtrips) conducted during the project SaltScience II, which is an interdisciplinary study-research network around sodium chloride, commonly known as Salt.*
The project involves secondary school students and teachers from five Portuguese public schools, the Portuguese Chemical Society and a team of researchers, and other specialists, from the University of Aveiro and the Mãe d'Água.

Keywords. Field Trips, Portugal, Salt, Secondary Schools, Science.

1. Introduction

Sodium Chloride, commonly known as salt (NaCl), is one of the most important chemical compounds to the history of humans and life in general. In fact, the value of salt is timeless. It was crucial in the development of past civilizations because of its use in food preservation. It has applications at present day, not only in the domestic activity, but also in industry. There are also investigations that consider the salt and its derivatives in electronics and high-performance materials, among others. In the past, salt was an expensive resource since it was difficult to obtain. Presently, this compound is much cheaper, but not less important. Therefore it constitutes an excellent study object to introduce high school students to science in the context of several disciplines such as: Biology, Geology, Physics, Chemistry and Mathematics. These are the basic reason why the project SaltScience was born.

2. Previous chapter of this 'story': Projet SaltScience I

Project SaltScience II is not the beginning of the story. Actually the first project SaltScience was developed in 2006 and 2007 involving the Aveiro city council through the Aveiro City Museum, and three secondary schools, besides the University of Aveiro. This first project was centred in the development of laboratory activities around the sodium chloride. The final product of this first project was the creation of the interactive CD-rom called "Lugar ao sal – A place in the Salt" that is available from the site http://sal.spq.pt/.

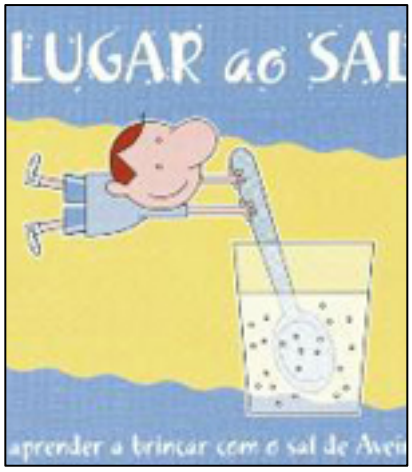

Figure 1. "Interactive CD-rom" – a place in the salt

3. Projet SaltScience II: main aims

SaltScience II is a project that aims to create a network around the study of salt, seawater and brine, using knowledge from different scientific areas.

The ultimate goal is that students understand that in Science any question can be observed by many different angles, and that each perspective is a partial approximation towards understanding the whole phenomena, which is always more complex than the sum of its parts.

Considering the above, the project has the following specific aims:
- Develop experimental activities in the classroom and in the field, involving seawater and brines, as well as other materials containing salt, and which are related to the curriculum guidelines for secondary education of Chemistry, Biology , Physics and Geology;
- Promote visits to salt evaporation ponds, e.g. sea salt in Aveiro (Troncalhada and Santiago), or rocksalt in Rio Maior, as well as Portuguese industries using sodium chloride as raw material;
- Promote conferences and workshops around the use of sodium chloride and its substitutes in food;
- Publicize the activities and the materials, created during the making of the project to the educational community.

Figure 2. The logo of SaltScience II[a]

4. Project SaltScience II: main activities conducted until now

So far, the following activities were undertaken:

- 'Thinking, making and living science' (Secondary School Dra. Maria Cândida, Mira);
- Salt Day celebrated at the 9th May 2014 (Secondary Schools of José Estêvão, Aveiro and Soares de Basto, Oliveira de Azeméis);
- Workshops (Secondary Schools of Estarreja, Estarreja, José Estêvão, Aveiro and Soares de Basto, Oliveira de Azeméis);
- Field trips to the Troncalhada salt evaporation pond in Aveiro and the rocksalt in Rio Maior (Secondary Schools of José Estêvão, Aveiro, Soares de Basto, Oliveira de Azeméis and António Damásio, Lisboa).

Testimonies and photographs of all events will be available at the web page: http://sal.spq.pt/.

5. "The world can be your classroom"[2]: getting closer to science through 'salty' field trips

Science field trips are one of the most popular hands-on-science activities, since they entail many learning benefits [1]. They foster curiosity, promote active learning and student interaction. Indeed, if adequately planned and sustained by field trip guides, this type of science education strategy may get students closer to research work. After all, field trips are one of the most common data gathering methods in several scientific areas.

Considering the above it was only natural to include in the Project SaltscienceII field trips, for instance in the context of mini-research projects or assisted by specific field trip guides.

The main activities included:

- Collection of salt (Chemistry and Mathematics) for further study of weight variation with temperature and drying time (constant weight). The obtained material was used for the analytical determination of the composition of the salt (use of atomic absorption at the university). The same crystals are used in studies of crystal structure and properties of ionic solids. Besides working with microscopes in schools far-visits to the electron microscope at the University of Aveiro were realized.
- Collection of saltwater and some examples of local vegetation to study the salt tolerance of different plant species involving macroscopic and microscopic observations of plants from plant cells (see, as an example the field trip

guide “Visit to Troncalhada” replicated further on this section);
- Photographic record of the fauna and flora associated with saline and collecting feathers for biodiversity studies (Biology) and study of the influence of salt in the physiology of those living beings;

Field trip guides, Testimonies and photographs will be available at the web page: http://sal.spq.pt/.

In this talk we will focus on two specific field trips, namely to the salt evaporation pond “Troncalhada” in Aveiro (5.1.) and the Rock salt in Rio Maior (5.2.).

5.1. A visit to the to the salt evaporation pond Troncalhada (Aveiro, Portugal)

Troncalhada, is a recovered salt evaporation pond that was constituted in the 90 as an outside-eco-museum where salt production is undertaken according to artisanal methods [2].

Considering the importance of field guide trips we replicate here one of the possibilities:

Guião de Visita (Troncalhada sea salt evaporation pond visit guide)

1- Gramata branca	2 - Junco	3 - Salicórnia

1- Marca no mapa, com o número respectivo, dois locais onde: encontraste cada uma das plantas das figuras.
2- Descreve um dos locais, Em que compartimentos existem plantas?

_____

3- Como se chamam os compartimentos de onde se retira o sal?

_____

4- Indica no mapa, junto da rosa dos ventos, a direção e o sentido do vento.

5- Vê nos cartazes informativos as salinidades dos diferentes compartimentos da salina e regista:

Viveiros: _____

Algibés: _____

Caldeiros: _____

Sobrecabeceiras: _____

Meios de baixo: _____

Meios de cima: _____

6- Como é constituído o fundo dos compartimentos da salina

_____

7- Investiga e indica porque é que a água não drena.

_____

_____

8- Como se chamam os instrumentos da figura e para que servem?
_____
_____

9- Assinala as aves que encontraste na salina:

Andorinha do mar anã _____

Borrelho de coleira interrompida _____

Corvo marinho _____

Flamingo comum _____

Gaivina _____

Gaivota de asa negra _____

Guincho _____

Perna longa _____

Pilrito _____

Outros, Quais _____

10- Que fatores influenciam a produção de sal?

5.2 Field Trip to the salt rock in Rio Maior (Portugal)

Near to the Portuguese location, Rio Maior, and approximately 30 km away of the sea, exists a salt rock which has been exploited since pre-historic times[(c).]

The salt rock deposit was formed million years ago as a consequence of the sea´s retreat which once occupied the region. The calcareous nature of the geological substrate allows the infiltration of rainwater which is then extracted seven times more salty than seawater.

6.4. Concluding Remarks

All activities of SaltScience II can be considered successful combination of formal and non-formal science education, since the topics of study were all embedded in the current Portuguese curriculum proposals for secondary science education (Chemistry, Physics and Biology). Therefore it is expected that the project raises awareness of the importance of Science to every day live.

7. Acknowledgements

This project is financed by the Portuguese program Ciência Viva

8. References (and Notes)

[1] Ramsey-Gambert, L. (1997). Science beyond the classroom. *The Elementary School Journal*, 97(4), 433-450.

[2] Gomes, A. & Mota Marques, G. (no date). The articulation of Portuguese salt with worldwide routes: past and new consumption trends. Available at: http://ler.letras.up.pt/uploads/ficheiros/7959.pdf

(a) The logo was designed by one of the participating students, from Escola Secundária de Mira

(b) Statement taken out from: http://www.learnnc.org/lp/pages/1824

(c) http://ecosal-atlantis.ua.pt/index.php?q=pt-pt/content/salinas-de-rio-maior