THE "*CAREOS*" FROM ALPUJARRA (GRANADA, SPAIN), AN HISTORICAL EXAMPLE OF PREVIOUS TO XIII CENTURY ARTIFICIAL RECHARGE SYSTEM APPLICABLE TO THE XXI CENTURY. CHARACTERIZATION AND INVENTORY.

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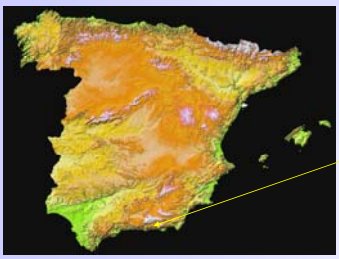
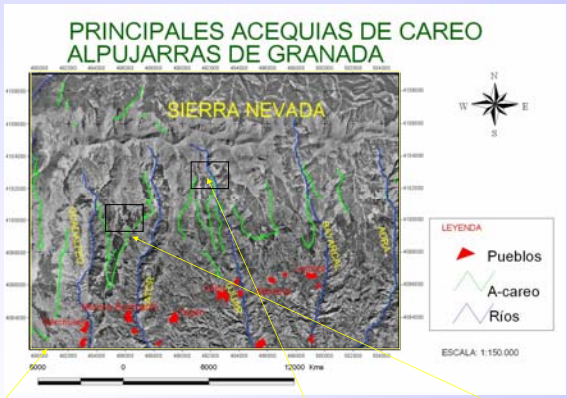
The "*careos*" system canals constitute one of the first devices for artificial recharge of aquifers of the Iberian Peninsula. Operative from the Muslim period, they present a construction system and distribution still operative at the present what constitutes an example to keep in mind on groundwater management. This poster present a bibliographical recompilation of their origin, construction and operation. We had upgraded the inventory on the field and finally present practical recommendations in order to the design and management of systems of superficial artificial recharge of aquifer. This paper arise from the pH Thesis of the first author.



Granada views



Introduction

The "*careos*" canals, traditionally dug in soils or rock, are used like a technique for artificial recharge of aquifers in the Alpujarra area, mainly by mean of meltwaters coming from Sierra Nevada range. Although their origin goes back, at least a year 1139, its most extensive employment was reached in the last centuries of the Muslim time, XIII to XV centuries, when it was developed an intricate canalisation system for the maximum use of the water.

According to the inventory of the year 2000 *(in Cano-Manuel and Group Tragsa, 2000)*, the *careos* canals are more frequent and more important in East side of Sierra Nevada, area where the smallest altitudes in the mountain range are located. Therefore, smaller precipitation are registered and consequently, the necessity of regulation of the water is bigger (see Fig.1).

In the year 2000 the Autonomous Organism of National Parks, National Park of Sierra Nevada, carried out an inventory and reconstruction of *careos* canals, work executed by the Company of Agrarian Transformation (TRAGSA) of Granada (see Fig. 2).

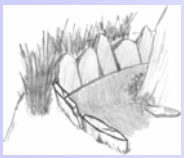


Fig. 2. Drawings of hydraulic masonry (for courtesy of Cano Manuel and Group Tragsa of Granada). A). Structure of the channel protected by stones buried in tracts of great slope and subject to a strong erosion B). Flagstones protecting the external border of the channel.

Their recovery and maintenance has demonstrated that they help to maintain a vegetation of great interest, they serve for support to a particular fauna and collaborate from a very important way to regulate the hydrological cycle of the region, conditioning a future line of unavoidable performances to be envisaged by the agents of the National Park.

Inventory

They have been classified and defined a total of 23 *careos* canals from 127 inventoried (Table 1). According to the function that they carry out, we find two types of canals:

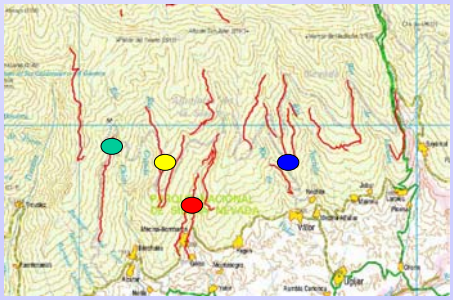
<u>*Careo* canals.</u>
They facilitate the infiltration of the water. For it, the water of the rivers and streams, is diverted by these canals during the winter and the spring, to the flat areas where it finally infiltrate *(Fig. 3)*.

<u>Irrigation canals.</u>
They transport the water, generally from the streams to terraces lands.

Table 1. Inventory of "careos".

Name	Diverted river	Community Users	Observations
Del Espino	Chico de Bérchules	YES	Well conserved
Bérchules	Trevélez	YES	Almost abandoned
Mecina	Grande de Bérchules	YES	Well conserved Urban water supply
De la Mogea	Nechite	YES	Well conserved
Del Horcajo	Mecina	YES	Well conserved
Yegen	Mecina	YES	Sealed by concrete Irrigation and *careo*
De los Vadillos	Valor	YES	Well conserved
Del Monte	Valor	YES	Well conserved. Irrigation and *careo*
De la Loma	Valor	YES	Well conserved. Earth
De la Fuente del Espino	Nechite	YES	Well conserved
Del Boy	Laroles	YES	Well conserved Concrete and earth
Nueva de Bayarcal	Bayarcal	YES	Very well conserved
De las Hoyas	Andarax	YES	Well conserved Small *careo* made by earth
Del Pecho	Andarax	YES	Well conserved. Small *careo* made by earth
Del Maguillo	Río del Pueblo	YES	Well conserved. Close the line, there is a pathway
Del Prado Llano	Río del Pueblo	YES	Well conserved
Del Prado Largo	Río del Pueblo	YES	Well conserved
De *careo* de Beires	Andarax y Ohanes	NO	Fair conserved. Stability problems
Del Garbanzal	Ohanes	NO	Fair conserved
Del Canal	Ohanes	NO	Well conserved. Partly it takes advantage of an old channel of hydropower station.
De Tices	Ohanes	YES	Whit careless
Del Corazón	Alhorí	YES	Abandoned recently.
Del Jaral	Alhorí	YES	Well conserved

Figs. 3-6. Examples of careo´s morphology. Lanjarón and Mecina sites.



Conclusions

-The *careos* canals constitute a specific system of artificial recharge of aquifers. The most important are those of Trevélez, and Bérchules, Mecina-Bombarón and Valor. These arise from the XII-XIII centuries.

- They have a joint administration with a person in charge "the acequiero" who is responsible for the floodgates. In general, the Communities of Users, main protectors of the system of canals, have scarce resources for their maintenance, so a part of the conservation expense is supported by the National Park.

-In the study area, the best favourable geologic materials for the artificial recharge by mean of *careos* are the limestone and permeable detrital formations in crop areas.

-It would be important to preserve and to maintain these systems of *careos*, given their high historical and environmental value.

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