

# RESILIENCE OF GREAT SEDIMENTARY BASIN AQUIFERS: WATER SECURITY AND SPAs

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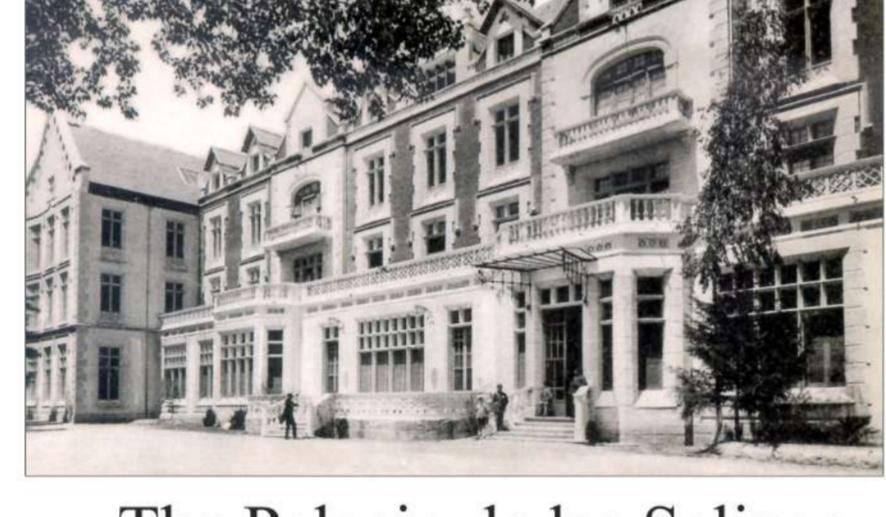
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## 1. Introduction

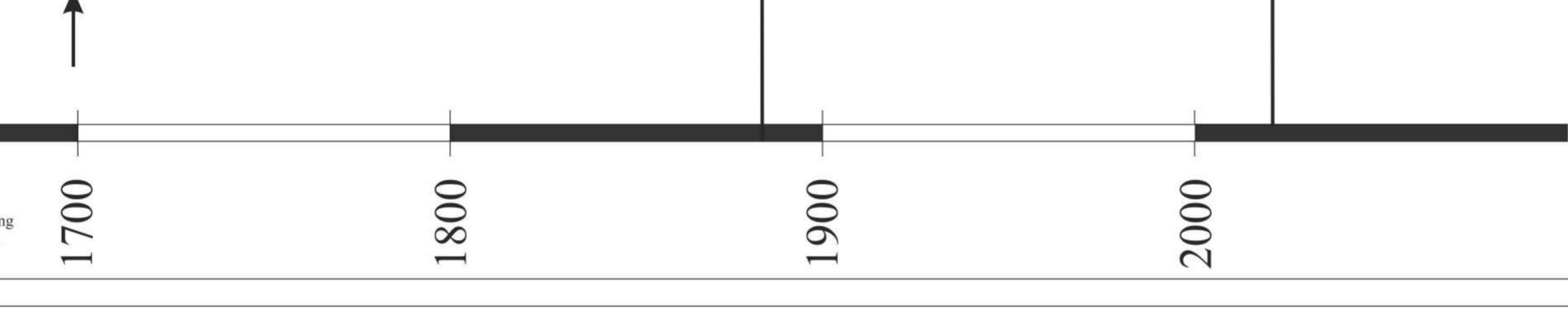
- The resilience of the aquifers is unknown in many cases and it is a key capacity to get a sustainable management.
- In this poster an analysis of the resilience capacity of a great detrital sedimentary basin aquifer is made through the case study of the Las Salinas spring (an old discharge area today disappeared due to the intensive groundwater exploitation).
- The concepts of resilience and water security has an intensive relationship. The resilience of an aquifer is defined as the capacity to deal with perturbations without modifying its structure and functioning. The concept of water security is defined as the reliable provision of quantitatively and qualitatively acceptable water for health, the production of goods and services, and the livelihoods, along with an acceptable level of water-related risks (Gray and Sadoff 2007).



Las Salinas spring. There are references dating from the XVII century reporting the influx of people to this place in search of mud baths.



The Palacio de las Salinas spa was born in 1891.



## 2. Methodology

- Long term trends analysis of quantity and quality data.
- Explorating the aquifer's resilience components.
- The analysis of the resilience of an aquifer implies an in-depth knowledge of the aquifer system, in its physical aspects (geometry, storage volume, etc), but also, fundamentally, in its dynamics aspects, either for qualitative and quantitative processes.
- Case study: Las Salinas spring (Fig. 1), an old discharge area located in Medina del Campo groundwater body, an intensively exploited aquifer since the 1970's (Figure 3, Table 1).

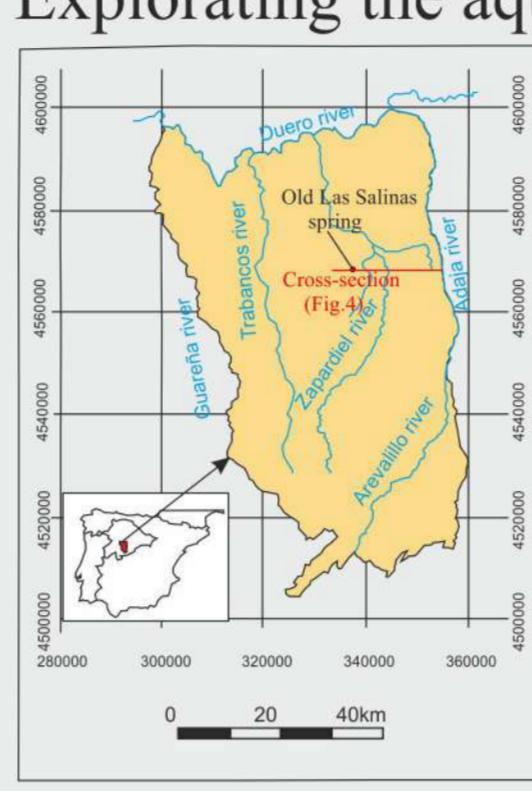


Fig. 1. Location of the old Las Salinas spring in the Medina del Campo GWB and cross-section of Fig. 7.

## 3. Historical evolution



Current shallow well to supply Palacio de Las Salinas spa.

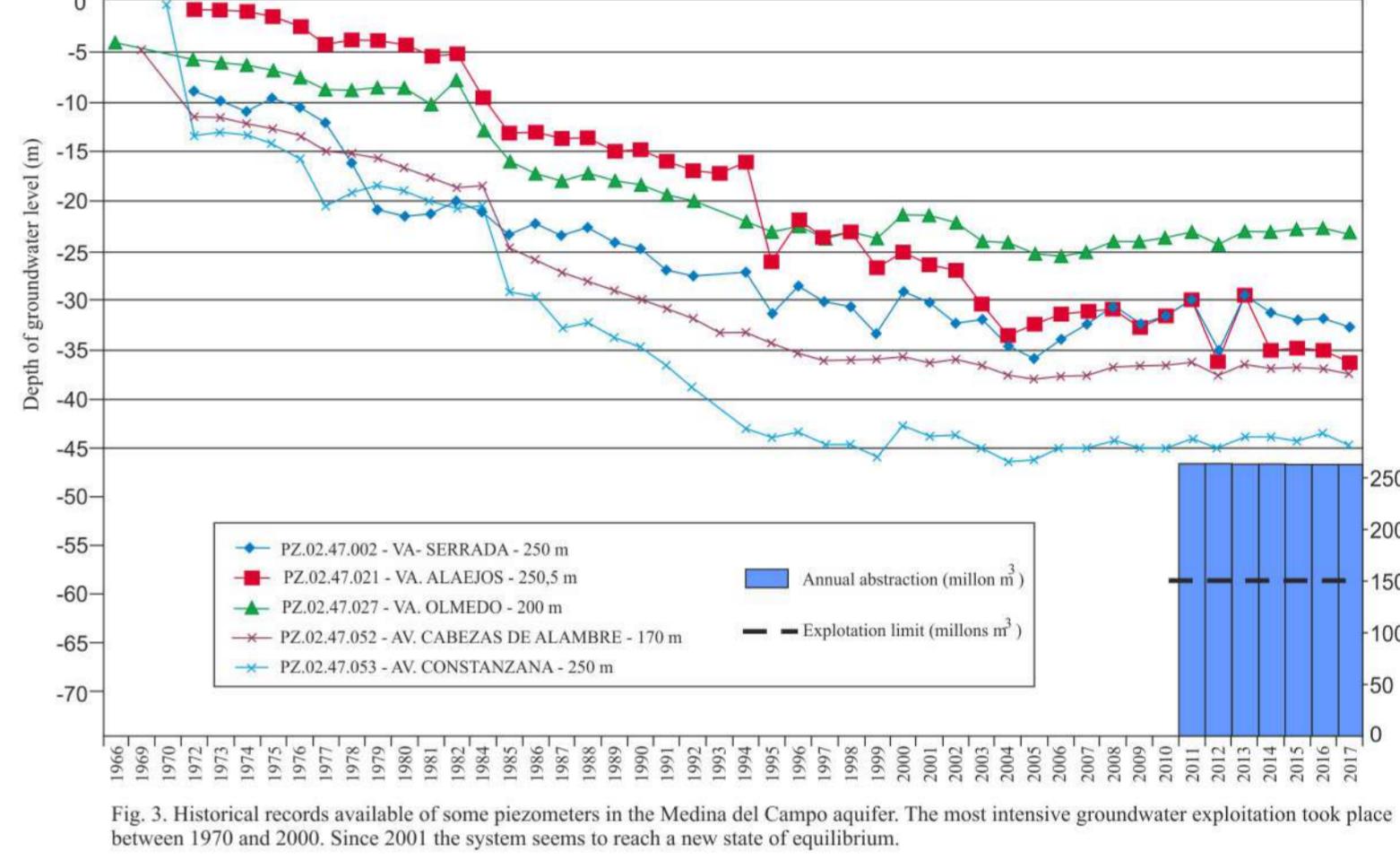


Table 1. Main characteristics and components of the aquifer water balance (for Medina del Campo GWB) (data from MIRAME-Duero, 2020).	
Aquifer extension	3,700 km <sup>2</sup>
Recharge	149 Mm <sup>3</sup>
Estimated pumpings (2011-2019)	273 Mm <sup>3</sup>

## 4. Results and discussion

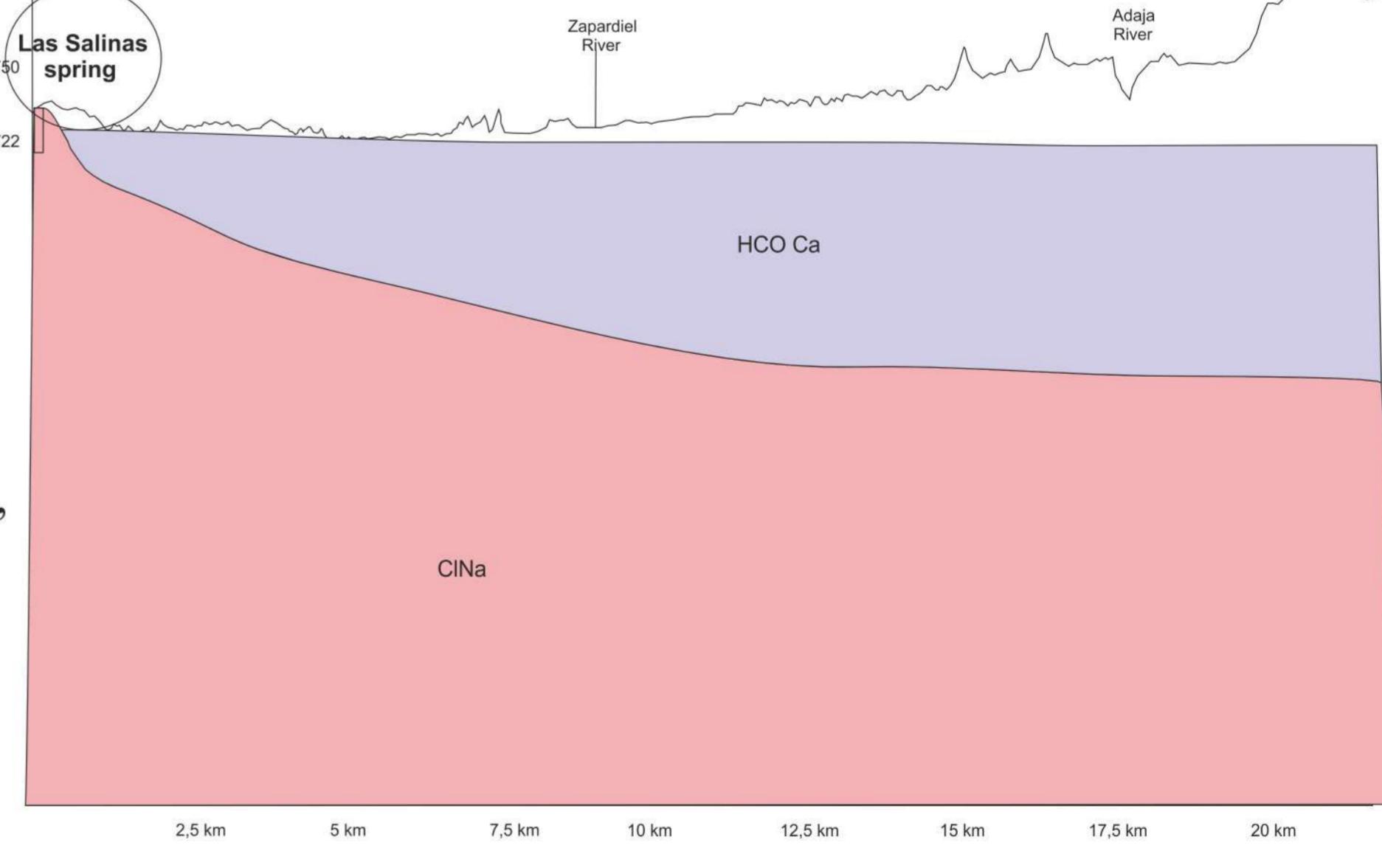


Fig. 4. Graphical scheme of hydrochemical facies in a W-E cross section from Las Salinas spring till Adaja river.

- Large sedimentary basins often host large detrital aquifers whose resilience to various impacts is, a priori, large.
- However, accumulation of shocks at the local level leads to changes at regional level.
- Basis of the resilience analysis: from what to what? From groundwater abstractions (identified as the main impact) to the aquifer.
- This analysis takes into account an integration of previous literature data and reports, and new data obtained by the authors under the NAIAD H-2020 Project.
- Key data: chemical analysis pictures which lead to define the chemical evolution conceptual model shown in Figs 4 and 5.
- The GWB of Medina del Campo may present symptoms of water insecurity, which is a contradiction to its dimensions as an aquifer, and a manifestation of the deterioration of its resilience.

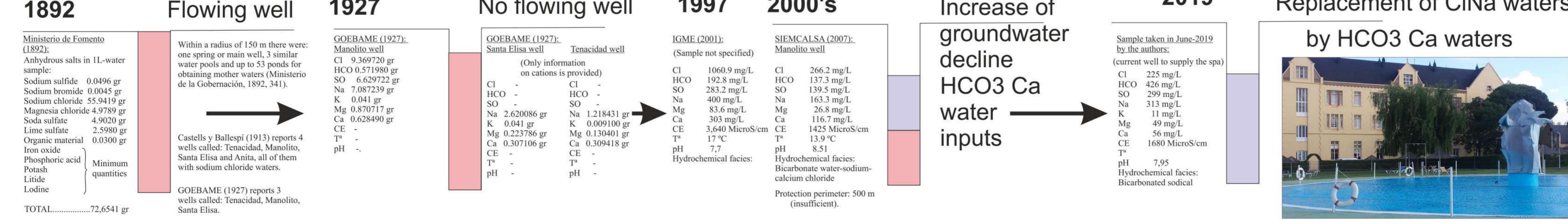


Fig. 5. Key data of chemical analysis of groundwater taken from wells inside the Palacio de las Salinas spa (in different wells and different years).

## 5. References

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## 6. Acknowledgements

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Fig. 6. View of the external pool of the current Palacio de las Salinas spa.