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Linear Discriminant Analysis for groundwater's geochemical fingerprinting in Santiago Island (Cape Verde, Western Africa)

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OUTLINE

1. Study region

2. Main sources of water supply and water quality

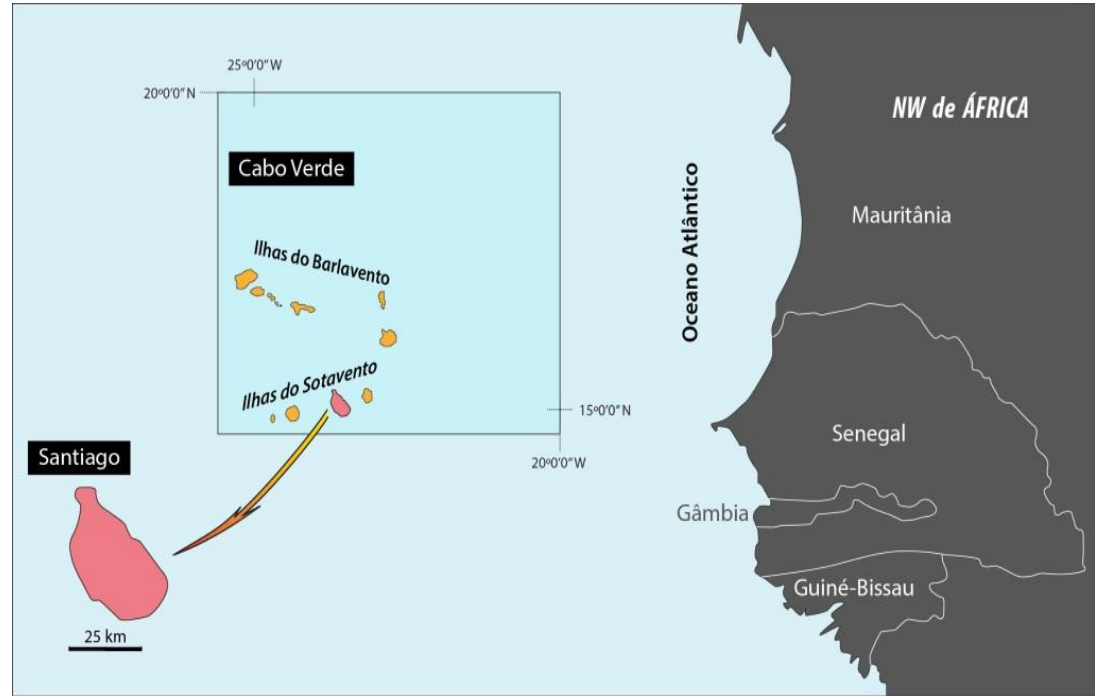
3. Linear Discriminant Analysis (LDA)

4. Results and Discussion

CAPE VERDE AND SANTIAGO ISLAND, W African Cost



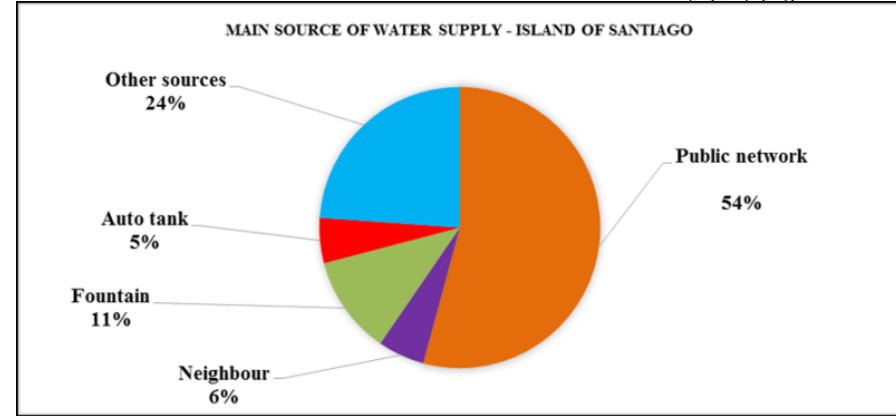
-  Torrential rainfall regime.
-  Irregular distribution of precipitation.
-  Arid climate with two seasons (rain and dry season).



increased demographic trend for implies higher demand for potable water

54% of the population is served by the public network connection,

However 24% of the population is supplied by wells and springs, among others, which can be considered as non-potable sources



OUTLINE

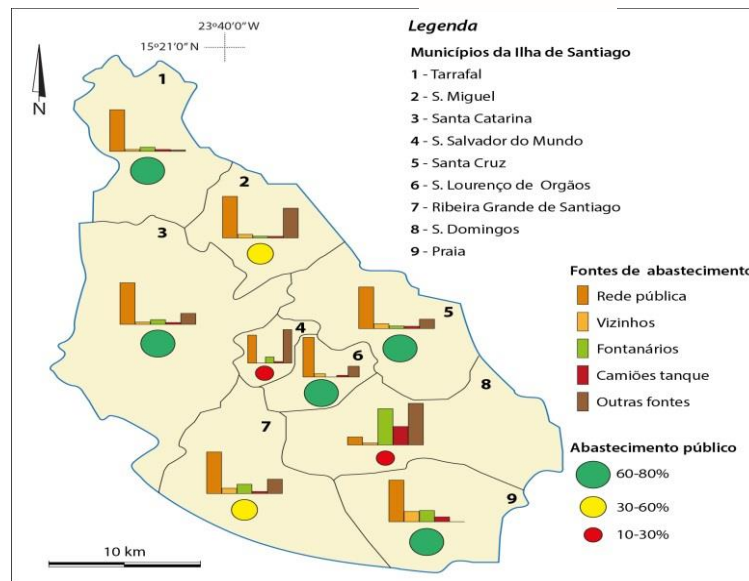
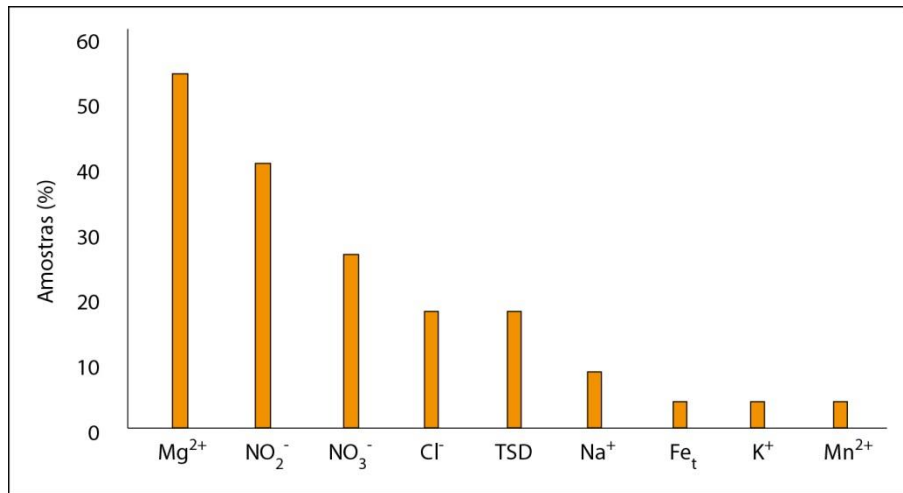
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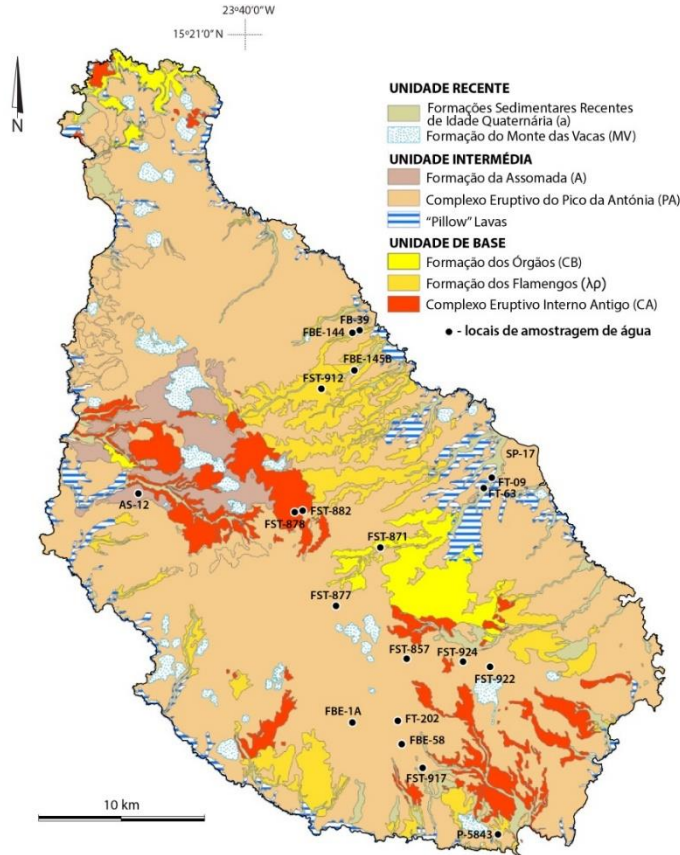
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Distribution of main sources of water supply and water quality issues



Samples exceeding the maximum permissible values (Cape Verde legal framework).
Data from Gonçalves et al. (2015). TSD – Total Dissolved Solids; Fe_t – Total iron



Hydrogeology and sampling points covering different contexts, namely:



lithology



soil use



proximity to line cost

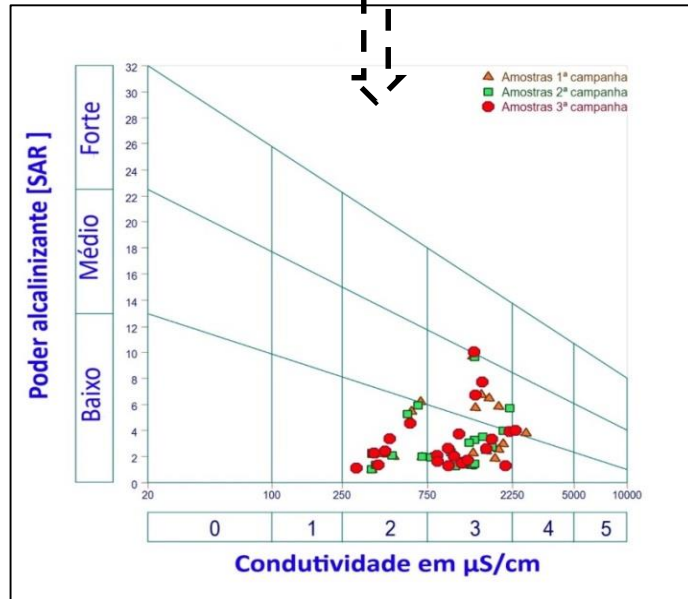


environmental conditions deep

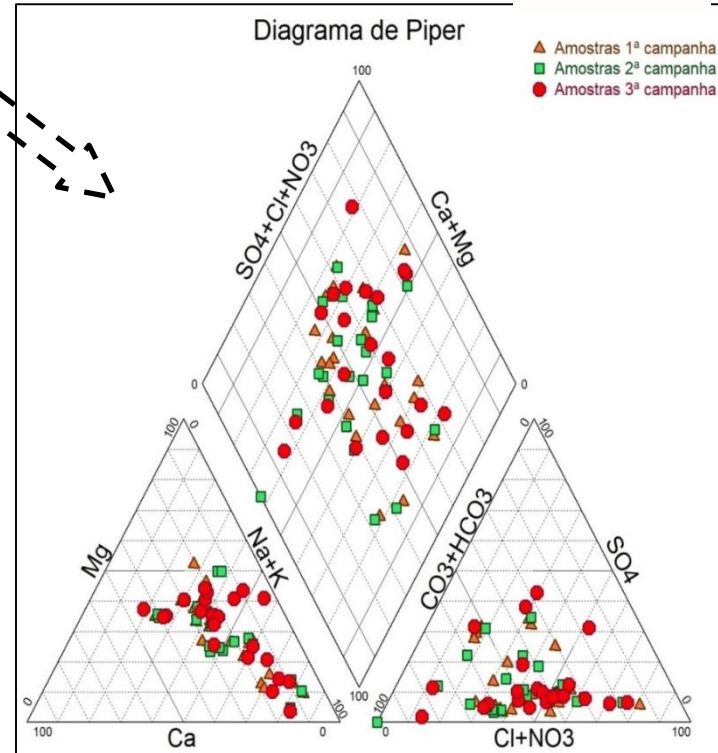
Hydrochemistry

Piper diagram

SAR diagram medium to high risk of salinization



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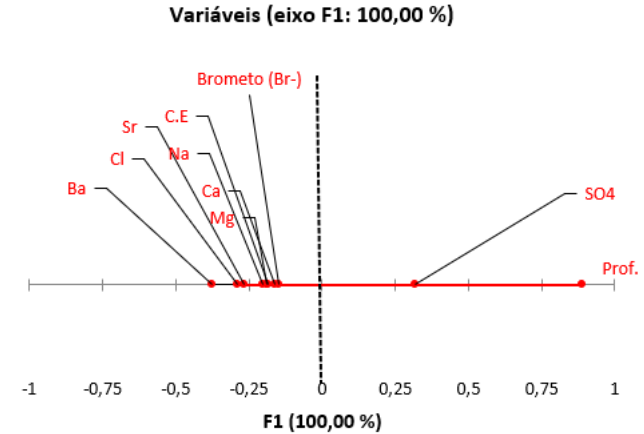
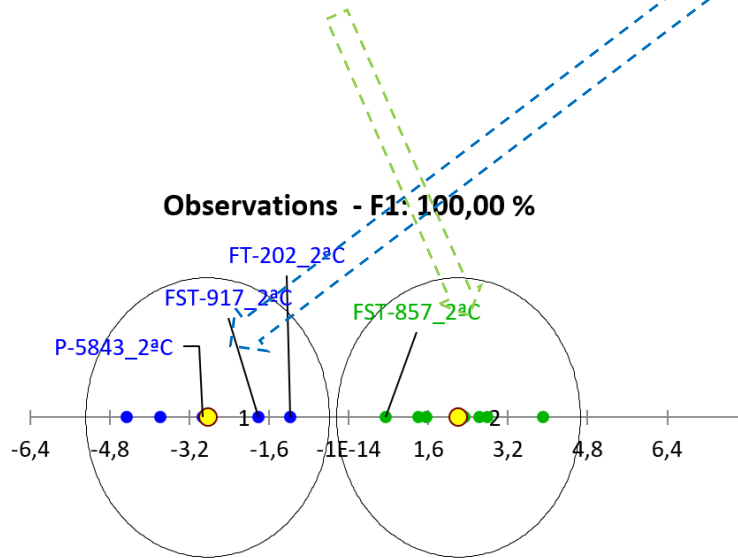
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Linear Discriminant Analysis (LDA)

Used as a supervised pattern recognition technique **and**

to evaluate the variation in water quality with depth as there is geological evidence for the existence of a multi-layered aquifer system

Two groups were considered, the **first (1)** concerning water levels up to 100 m and the **second (2)** to water levels over 100 m.



Seven samples were pre-classified as belonging to group 1 and nine samples as belonging to group 2

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- 💧 Different patterns associated with depth variations were identified.
- 💧 The first group (shallow water) mainly explained by SO_4^{2-} content and the second group (deep water) explained by the content in Ba, Mg, Ca, Na, Sr, Cl^- , Br^- and electrical conductivity.
- 💧 Four samples were reclassified: three from group 1 to group 2. These samples were gathered at water levels between 52-97 m, which lead to conclude that the shallow aquifer system is up to 50 m (and not 100 m, as previously assumed) and the deep aquifer system concerning water levels above 50 m.
- 💧 The results of this study point out to the existence of a multi-layered aquifer system with specific geochemical fingerprinting.
- 💧 The achieved results may be very useful to the local authorities for the management of pollution and decision-making.