

Conceptual hydrogeological model of Alpine Corsica metamorphic formations from a pluridisciplinary, multi-scale approach

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Montpellier, France
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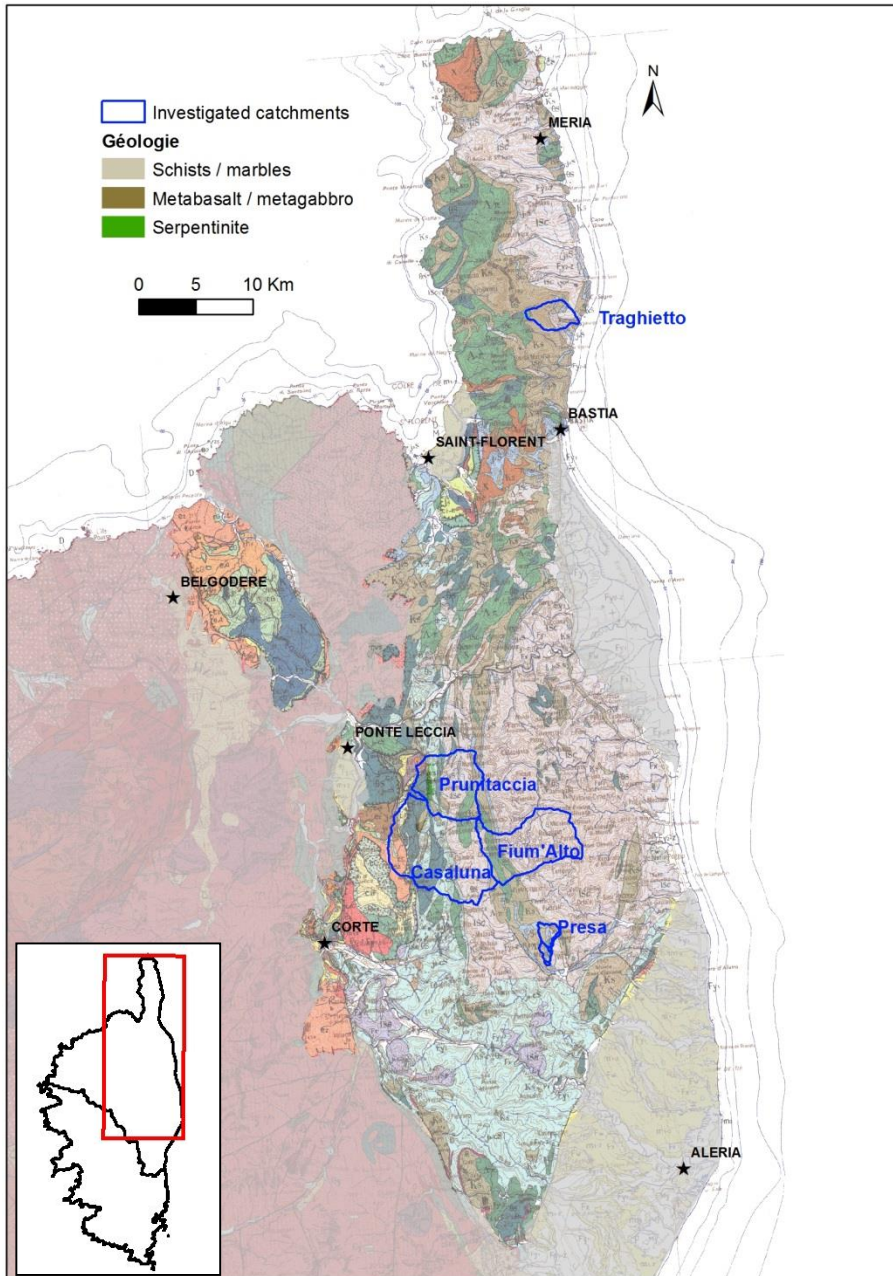


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Abstract n°2278

Alpine Corsica metamorphic formations



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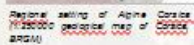
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Background

- The Alpine Corsica groundwater body is a key water source for drinking supply:
 - it represents nearly 25% of the groundwater withdrawal in Corsica.
- However, the geological and hydrogeological properties of these formations are poorly known and differ from those of granite:
 - Available resource?
 - Best geological contexts for a sustainable management of the water resource?

Objectives of the studies which have been implemented:

- Define the role of the lithology and the tectonic in the groundwater circulations and in the distribution of the aquifers.



- Develop a conceptual hydrogeological model of the Alpine Corsica metamorphic formations.

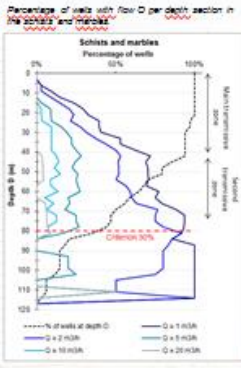
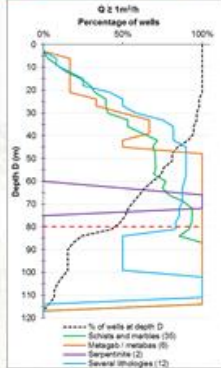
Alpine Corsica geology

- A stack of variably metamorphosed units → intensely folded and faulted rocks.
- The meta-ophiolite unit (mainly consists in metabasalt, metabasalt and serpentinite).
- The "Schistes Lustrés" complex (formed of metasediments such as calcischists or marbles).



Statistical analysis on sixty borewells cumulated air-lift flows

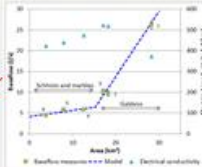
- Air-lift flow measurements done during drilling provide a qualitative characterization of the vertical distribution of permeable zones (Dewandel et al., 2005).
- The statistical analysis method of these flow rates is based on the probability of obtaining a given flow rate for a given depth section.
- Permeable zones mainly located within the first 40 m from the ground surface.
- It may reaches up to 70 – 80 m deep in schists and marbles.



Statistic on borewells cumulated air-lift flows according to 12 different ophiolite rock types for a flow of 1 m³/s.

Analysis of differential stream-flow measurements during base-flow periods in five catchments

- Highlighting of the permeability contrasts between the different lithologies and their impact on the stream flow.
- Estimating of the permeability of the aquifer(s) concerned at catchment scale using the hydrogeological profiles and an analytical solution (Dewandel et al., 2004).
- Schistes and marbles:
 - Wide variability of the estimated hydraulic conductivity with a ratio of 1 to 5 – from $1.4 \cdot 10^{-2}$ to $4.2 \cdot 10^{-2}$ m/s → local dissolution of marbles increases the permeability.
 - For some catchments, y-intercept is positive in the hydrogeological profile → it reflects the heterogeneous and compartmentalized characters of these aquifer systems and that underground catchment must be different from surface catchment (karstification?).
- The meta-ophiolite unit: estimated hydraulic conductivity are homogeneous – between 1.10^{-2} and 2.10^{-2} m/s → the hydrogeological model of these formations is similar to the "classical" granite model.



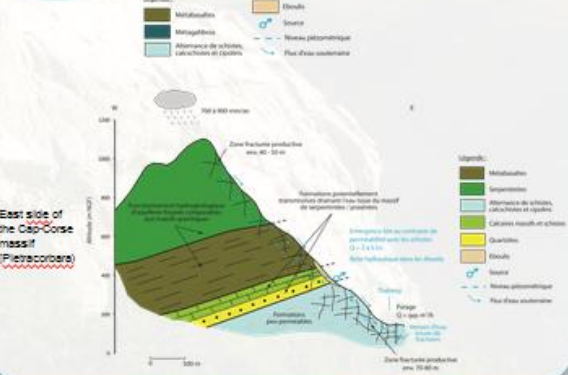
Prunettaccia catchment

Results: Conceptual hydrogeological models of the groundwater circulations inside the Alpine Corsica metamorphic formations

- Lithology and tectonic determine the groundwater circulations inside the Alpine Corsica massif.
- The geological and thus the hydrogeological properties of the Alpine Corsica metamorphic formations differ from those of classical hard-rock aquifers (weathering profile).
- The productivity of these aquifers is limited (fast discharge, low storage capacity).
- Wide variability of the hydrogeological properties within a same catchment due to the variability of the geological formations:
 - Heterogeneity well expressed in the schistes and marbles (karstification).
- The meta-ophiolite unit: the hydrogeological model of these formations is similar to the "classical" granite model.



The Castagniccia region between the Monte San Pastore, and the Monte Sant'Angelo.



Key references: Dewandel B., Ladouche B., Ouan S. (2005) – Apical measurements of stream baseflow in relation with the hydrogeological characteristics of the aquifers: application to the ophiolite body of the Ouan catchment, Corsica. *Journal of Hydrology* 308: 1-12.
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