Geochemistry of acid sulfate alteration in Panarea (Aeolian Islands, Italy)

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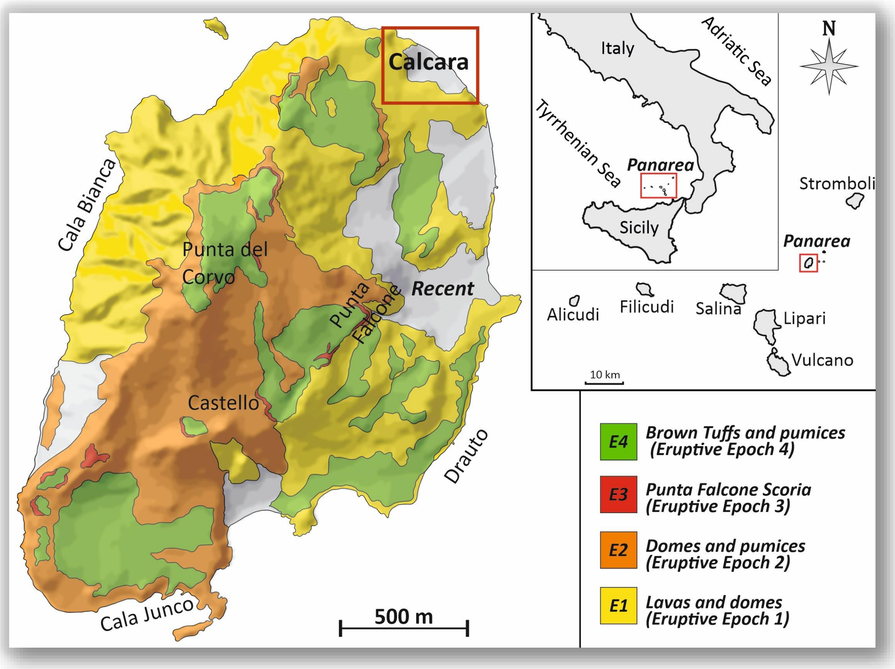
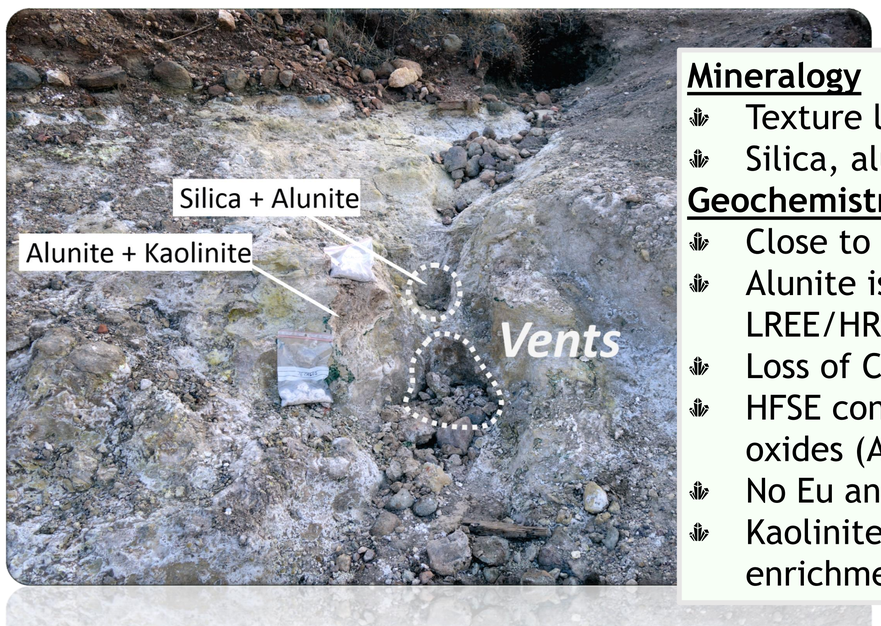


- Panarea is a partially emerged caldera.
- Protolith is calc-alkaline to high-K calc-alkaline andesite & dacite.
- ***La Calcara*** is an active steam-heated environment.
- Fluids typically originate from seawater, modified by complex interactions between boiling volcanic gases and meteoric water[1].
- Chemical composition and $^{3}He/^{4}He$ of Calcara suggest a magmatic system centered on Bottaro islet at relatively shallow depth[2]. Both sites show synchronous variations suggesting a same deep feeding magmatic gas system[2,3].
- Ongoing **Acid-sulfate alteration**

Different alteration textures

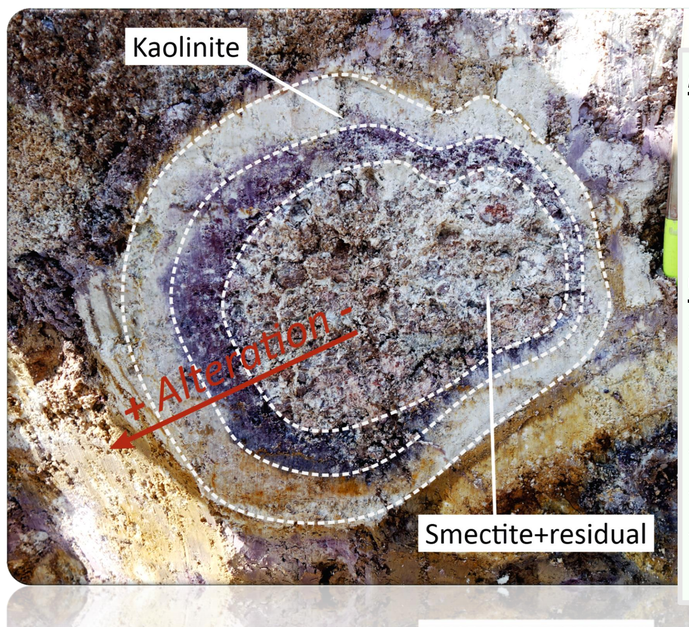
Fumarole



Mineralogy
- Texture loss
- Silica, alunite, kaolinite

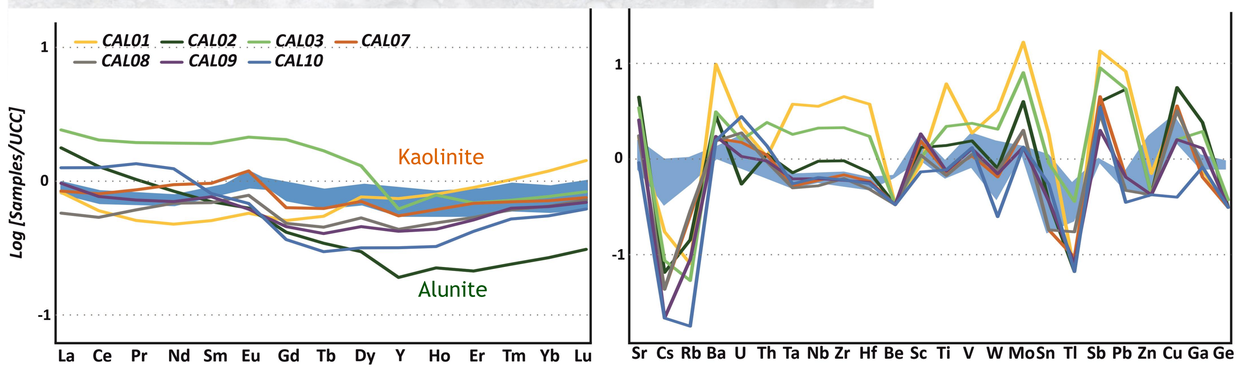
Geochemistry
- Close to protolith values
- Alunite is fractionating LREE/HREE
- Loss of Cs, Rb
- HFSE content varies with Ti oxides (Anatase)
- No Eu anomaly inherited
- Kaolinite displays no major enrichment/depletion

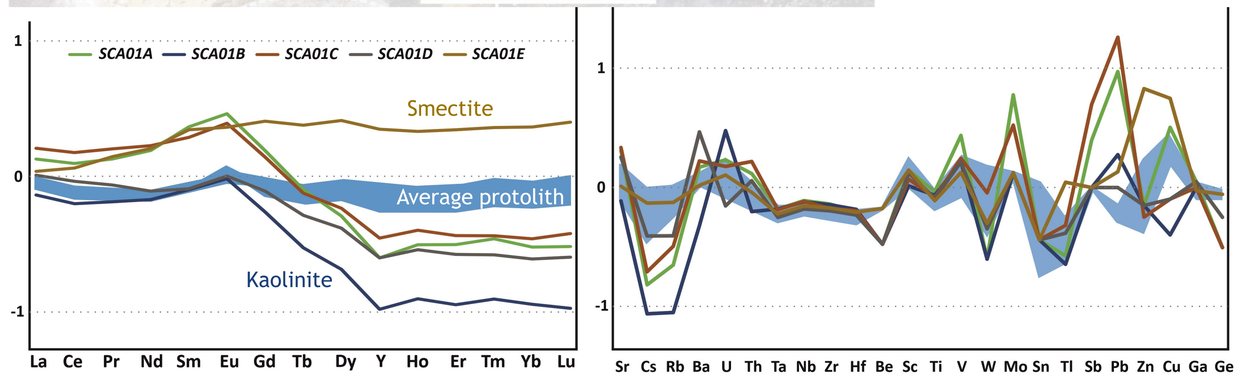
Altered prism



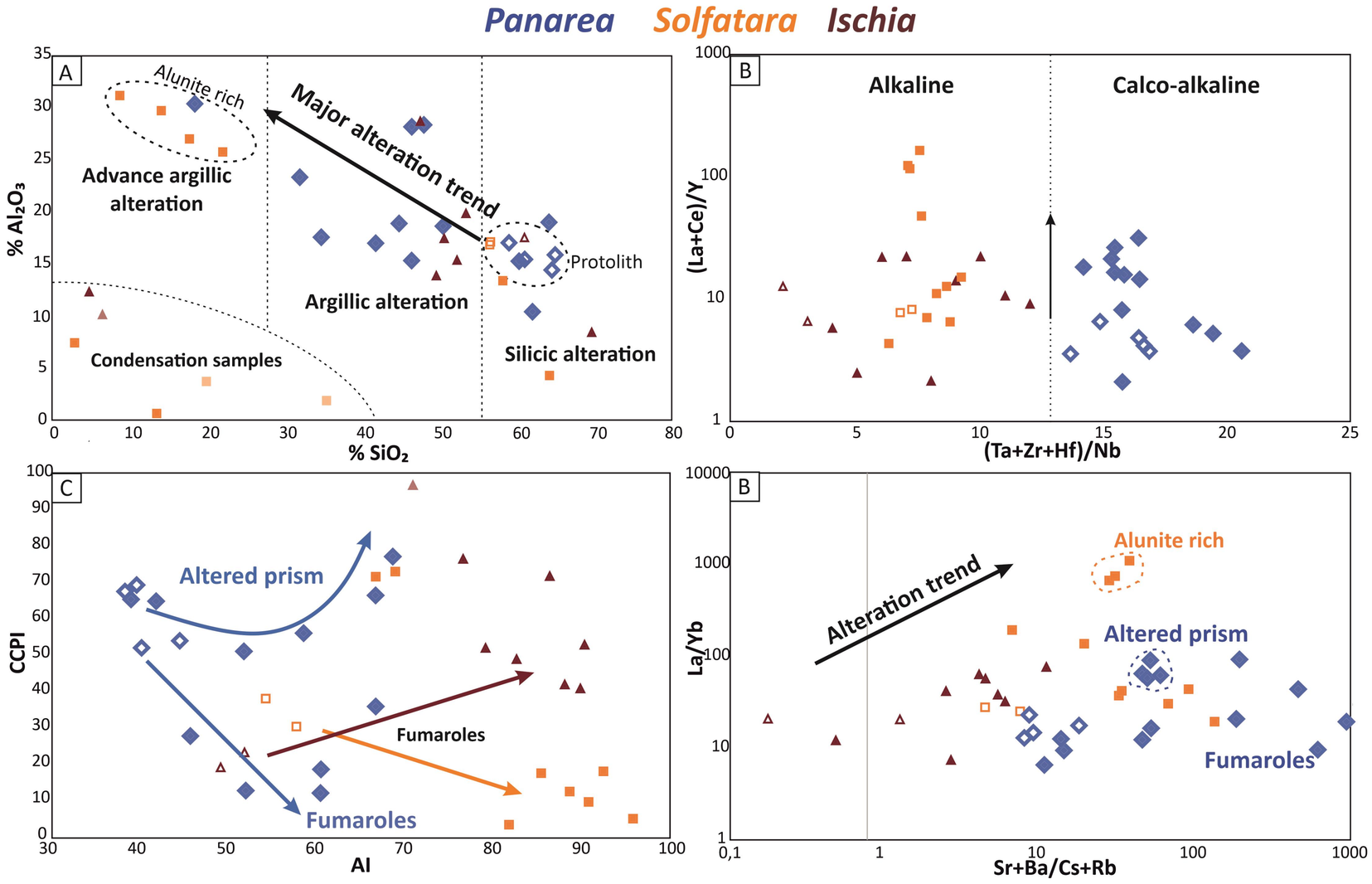
Mineralogy
- Texture preserved, pervasive fluids
- Kaolinite (± alunite), smectite, residual plagioclase

Geochemistry
- Close to protolith values
- Kaolinite is fractionating MREE/HREE
- Loss of Cs, Rb
- HFSE are immobile
- Anomaly + in Eu, inherited from protolith





Comparison with other Italian hydrothermal systems
Global vs local



Conclusions

- Alteration indices and elements ratios distinguish protolith from alterites and some major alteration trends[4].
- **Protolith heritage** in altered samples→ ongoing process of exchange of chemical elements & replacement of primary rock. Alteration products retain Nb and Ta **calco-alkaline or alkaline heritage**.
- Alkali elements loss during hydrothermal alteration.
- Alunite is fractionating **LREE/HREE**. Kaolinite plays various roles in the REE fractionation.
- Acid fluids significantly mobilize REE during the primary rock dissolution. REE concentration is governed by the protolith initial composition.
- The **fractionation between LREE, MREE and HREE** is induced by mineralogy, alteration intensity, pH, Ionic strength and possibly crystallinity of alteration minerals.

References

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