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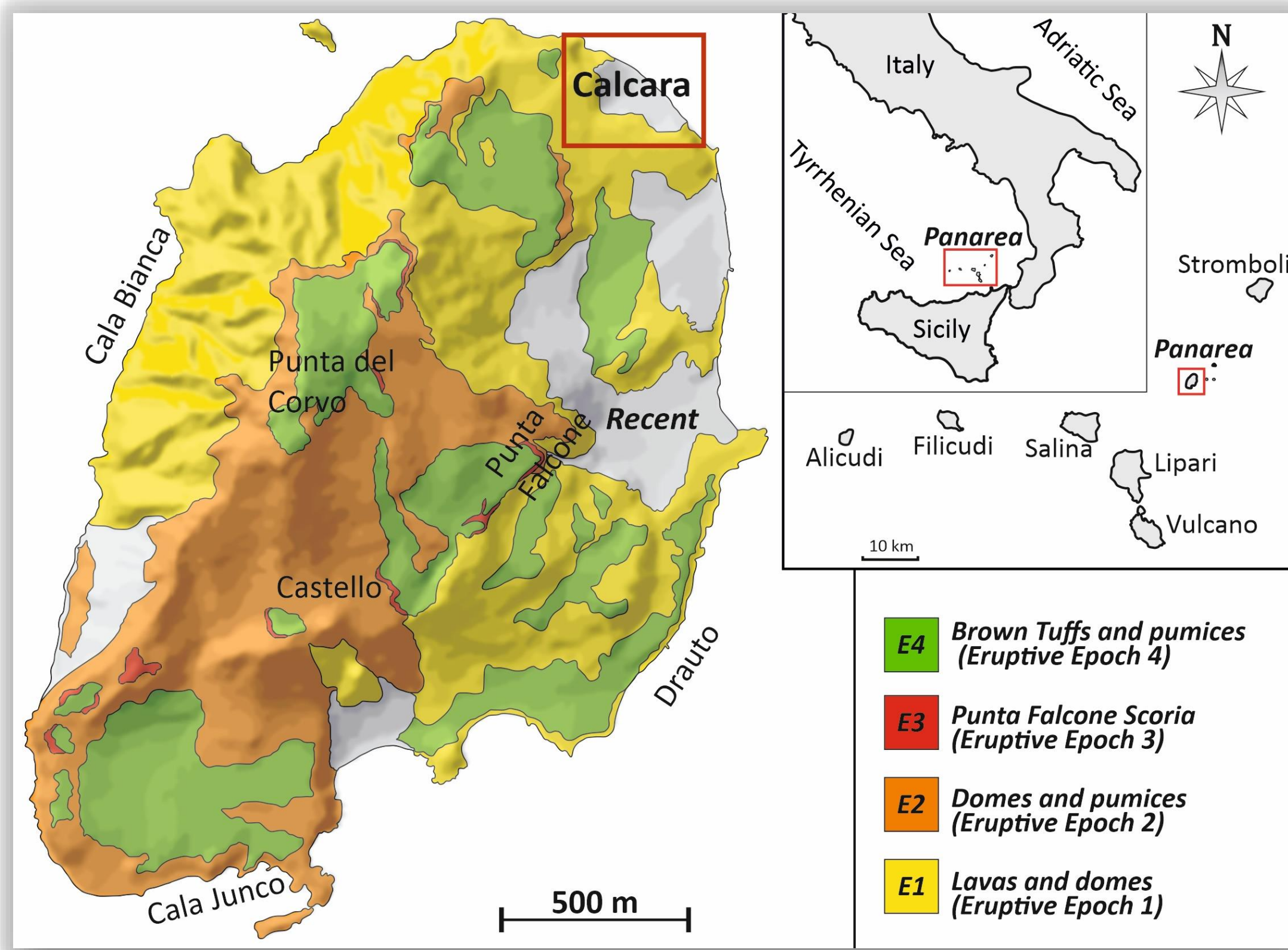
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# Geochemistry of acid-sulfate alteration in Panarea (Aeolian Islands, Italy)

Théo Bouvart, Julien Poot, Augustin Dekoninck, Flore Schmit, Maxime Keutgen De Greef, Alain Bernard & Johan Yans



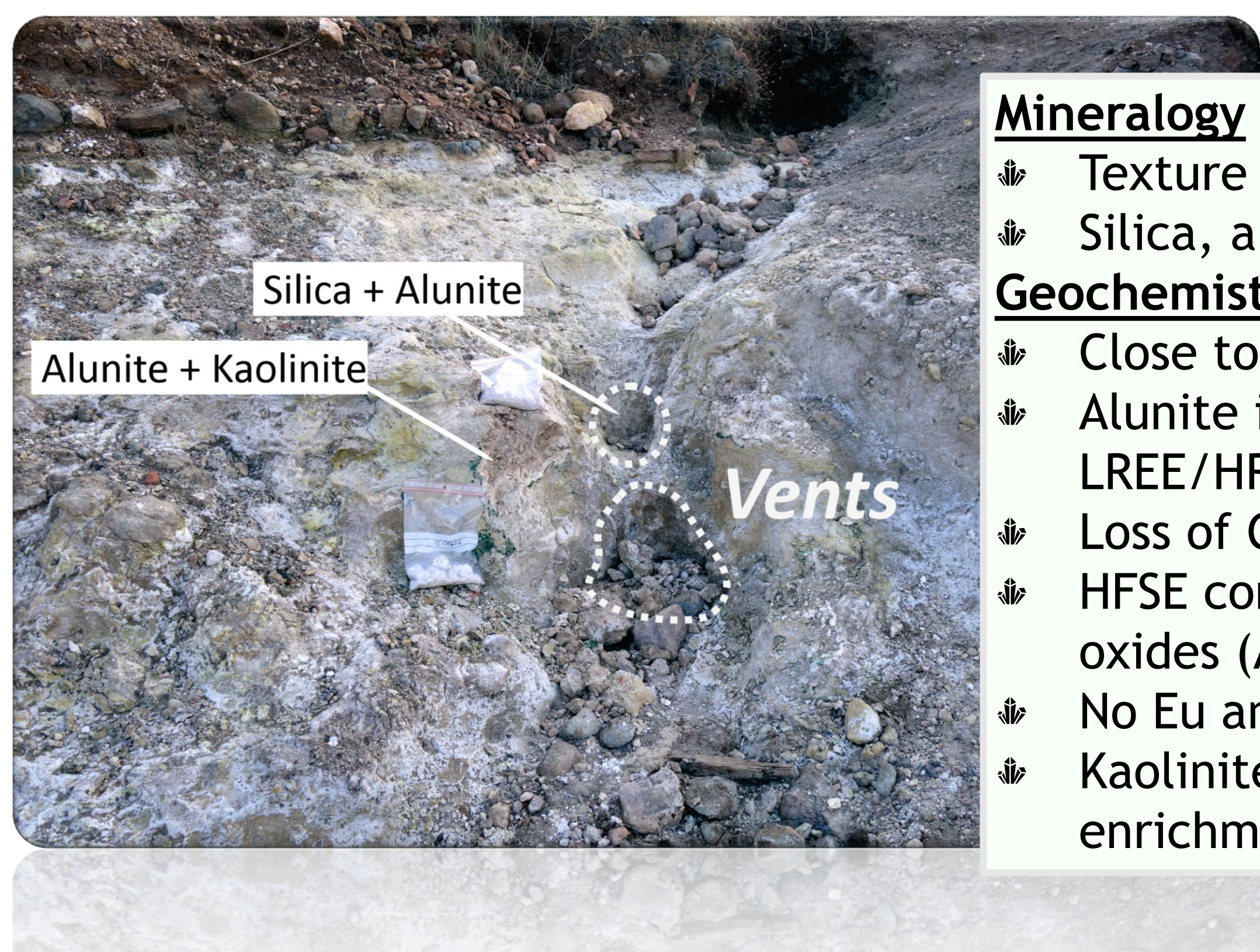
- Panarea is a partially emerged caldera.
- Protolith is calc-alkaline to high-K calc-alkaline andesite & dacite.
- **La Calcara** is an active steam-heated environment.
- Fluids typically originate from seawater, modified by complex interactions between boiling volcanic gases and meteoric water<sup>1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



Fumarole

Different alteration textures

Altered prism

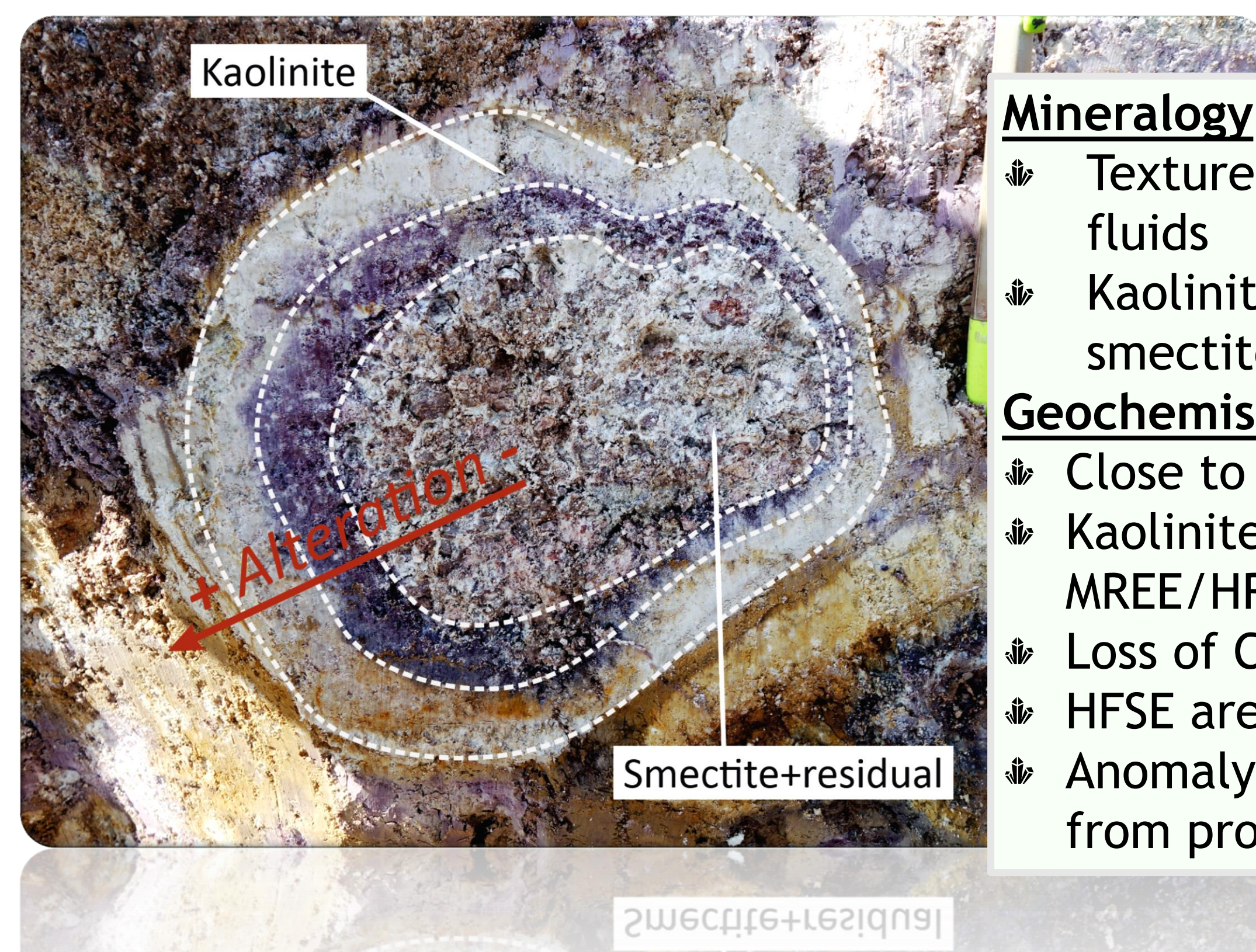


### Mineralogy

- 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

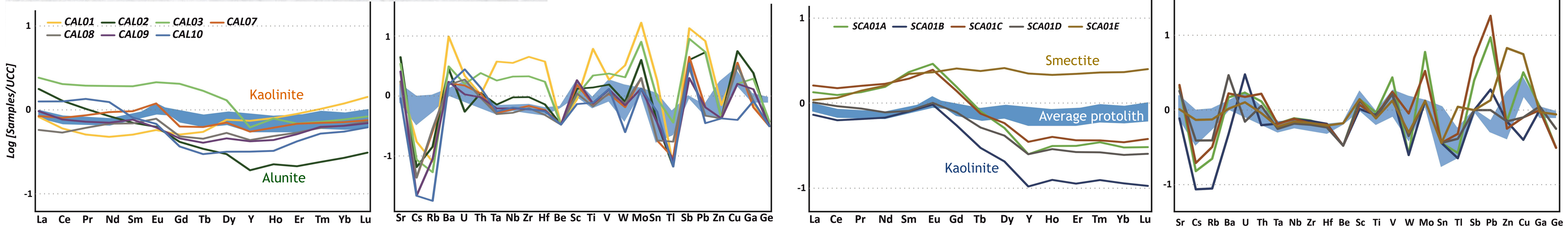


### Mineralogy

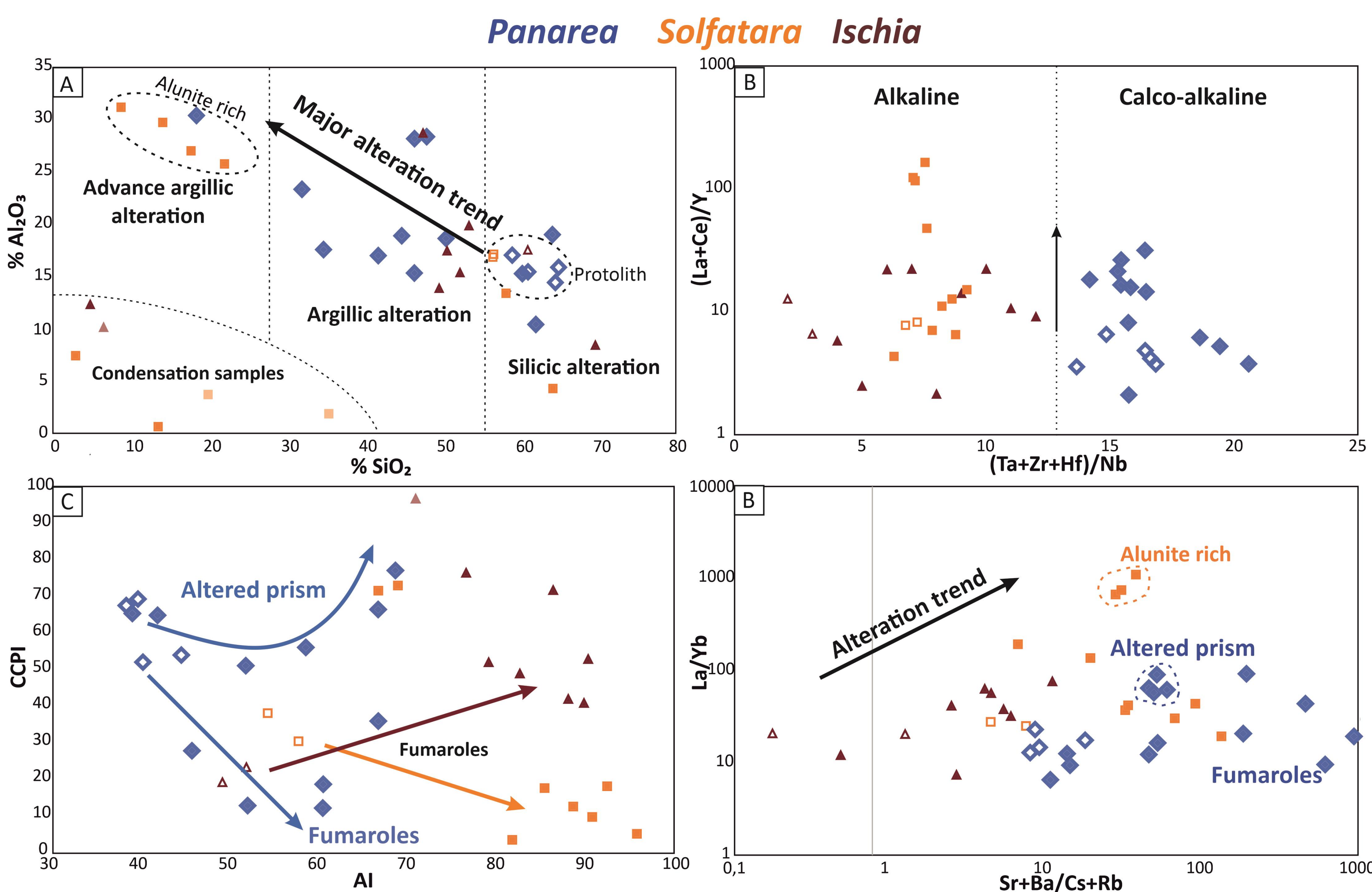
- Texture preserved, pervasive fluids
- Kaolinite (± alunite), smectite, residual plagioclase

### 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<sup>4</sup>.
- **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

- Tassi, F., Capaccioni, B., Caramanna, G., Cinti, D., Montegrossi, G., Pizzino, L., Quattrocchi, F., Vaselli, O., 2009. Low-pH waters discharging from submarine vents at Panarea Island (Aeolian Islands, southern Italy) after the 2002 gas blast: Origin of hydrothermal fluids and implications for volcanic surveillance. *Applied Geochemistry* 24, 246-254. <https://doi.org/10.1016/j.apgeochem.2008.11.015>
- Capaccioni, B., Tassi, F., Vaselli, O., Tedesco, D., Poreda, R., 2007. Submarine gas burst at Panarea Island (southern Italy) on 3 November 2002: A magmatic versus hydrothermal episode. *J Geophys Res Solid Earth* 112, B05201. <https://doi.org/10.1029/2006JB004359>
- Italiano, F., Nuccio, P.M.M., 1991. Geochemical investigations of submarine volcanic exhalations to the east of Panarea, Aeolian Islands, Italy. *Journal of Volcanology and Geothermal Research* 46, 125-141. [https://doi.org/10.1016/0377-0273\(91\)90079-F](https://doi.org/10.1016/0377-0273(91)90079-F)
- Pandarath, K., 2022. Application potential of chemical weathering indices in the identification of hydrothermally altered surface volcanic rocks from geothermal fields. *Geosciences Journal* 26, 415-442. <https://doi.org/10.1007/s12303-021-0042-2>