



The genesis of different pegmatite types

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Introduction

Pegmatites are highly fractionated, coarse-grained igneous rocks that form across the magmatic-hydrothermal transition. Due to the wide range in compositions and geological settings, genetic models in the literature are diverse and sometimes even contradictory. This work explores the use of fluid inclusions, geochemical and petrological data to improve our understanding of the genesis of two pegmatite endmembers: Formation via fractional crystallization of (1) calcalkaline magmas and (2) anatectic melts.

Geology

The Island of Elba represents a calcalkaline magmatic system with multiple pegmatite dykes dated to between 5 and 7 Ma (Dini et al. 2002). These pegmatites are characterized by a high number of miarolitic cavities in which gem specimens of minerals are formed. The anatectic pegmatites found in Ticino area are related to the Lepontine Barrovian metamorphic dome and zone of Alpine migmatization (Burri et al. 2005). Occasionally, these pegmatites also contain miarolitic cavities with gem quality mineral specimens (Stroppini, 2019).

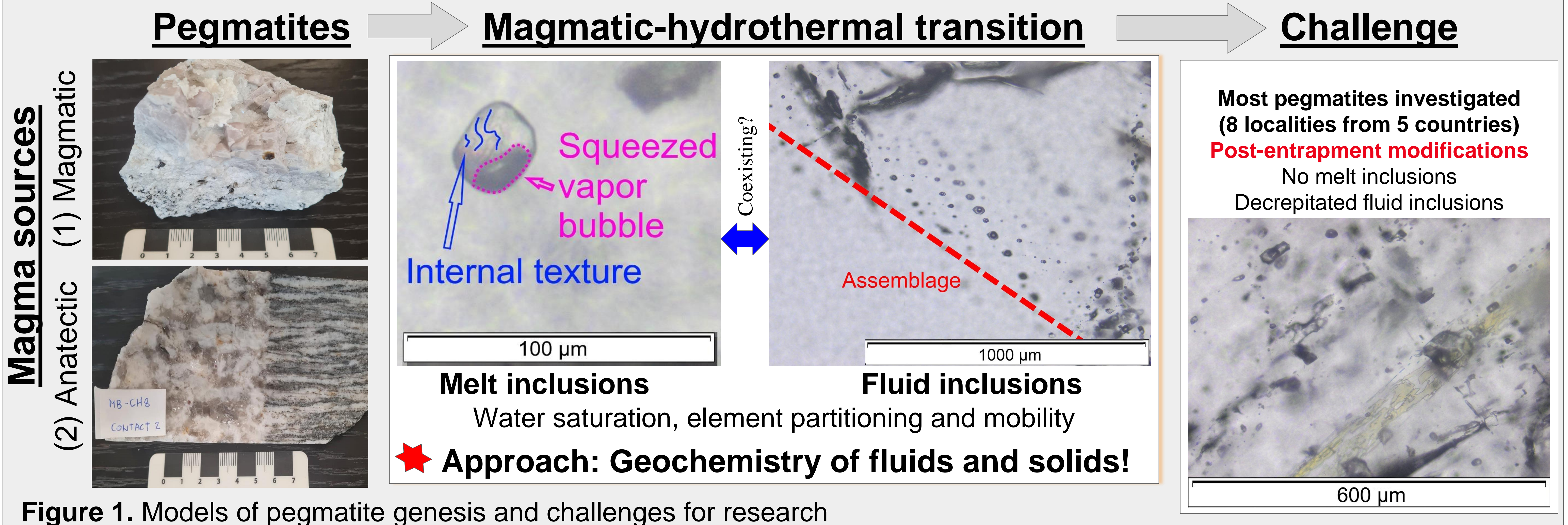
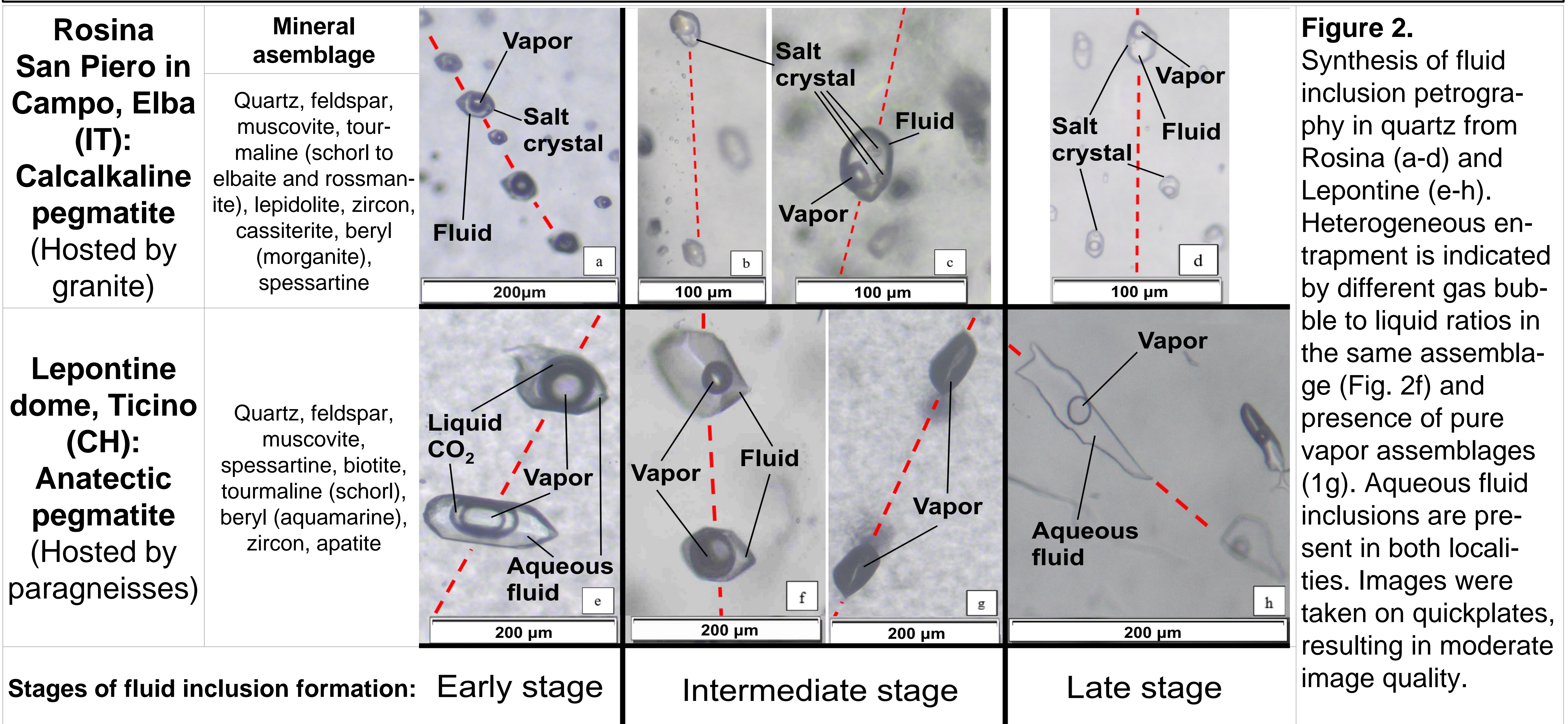


Figure 1. Models of pegmatite genesis and challenges for research

Preliminary results

Petrography reveals that fluid inclusions in quartz samples from Rosina show higher salinity than those from Lepontine (Figure 2b, c), whereas fluid inclusions from Ticino have a higher CO₂ content (Figure 2e).



Preliminary conclusions

- (1) Most pegmatites record a protracted magmatic ± hydrothermal genesis with much potential for post-entrapment modification.
- (2) Calcalkaline and anatectic pegmatites record different fluid inclusion compositions.

Future work

To further constrain the genesis of the two pegmatite types we plan to:

- (1) Refine entrapment history of inclusions via relation to quartz crystal growth zoning imaged by SEM charge contrast mapping
- (2) Measure H₂O content in host quartz via FTIR spectroscopy
- (3) Perform microthermometry to constrain formation temperature and bulk fluid salinity
- (4) Measure inclusion and host quartz chemistry via LA-ICP-MS to constrain dissolved solid load and quartz formation temperature (Ti-in-quartz thermometry)

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References: Dini A., Innocenti F., Rocchi S., Tonarini S. and Westerman D.S. (2002) Geological Magazine 139, pp. 257–279.; Burri T., Berger A. and Engi M. (2005) Schweizerische Mineralogische und Petrographische Mitteilungen, 85, pp. 215–232.; Stroppini A. (2019) Schweizer Strahler, 3, pp. 2–19.