Fluid inclusion evidence for metamorphic mobilization of chalcopyrite at the Tisová VMS dep., Czech Republic

Jiří Zachariáš

CHARLES UNIVERSITY
Faculty of Science

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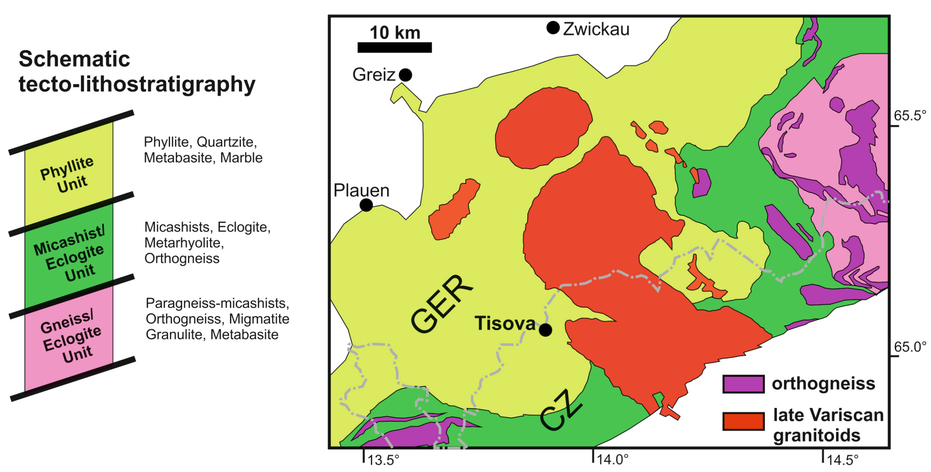
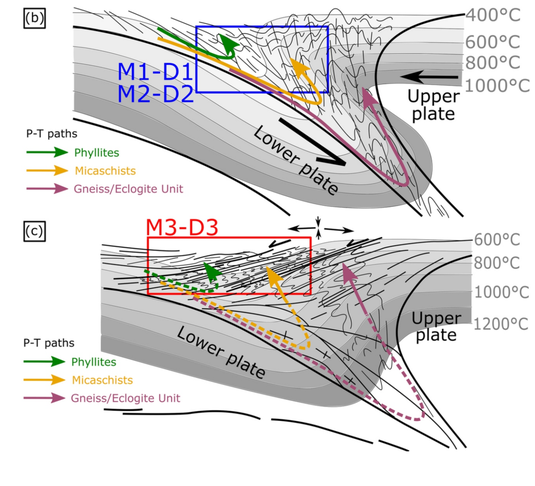
Tisová-Klingenthal deposit:

- VMS deposit type (Besshi subtype)
- historically mined for Cu, currently explored for Cu-Co
- western part of the Erzgebirge Mts. (Saxothuringian Unit, Bohemian Massif) – close to the Czech (CZ) - Germany (GER) border
- massive to semi-massive sulfidic ores (cpy, py, ph, mt; 6 Mt @ 0.86 wt.% Cu)
- Upper Cambrian sequence of phyllitic metasediments interbedded with metabasalts and metabasaltic tuffs
- Rocks and ores were polyphase metamorphosed (M1-M3) and deformed (D1 - D3) with a peak at ~520 °C and 12-13 kbars (Jouvent et al. 2021; Faryad and Kachlík 2013; Pertold et al. 1994)





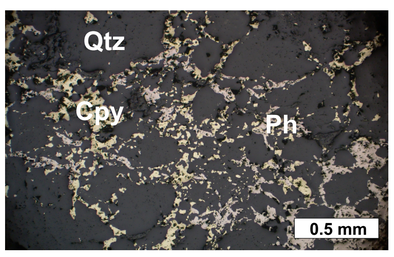
scheme from Jouvent et al. 2021 (Fig. 15 b-c)

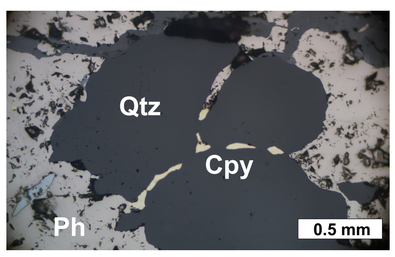
Quartz grain types enclosed in sulfidic ores:

1) relic grains - cloudy, semi-transparent, full of FI's

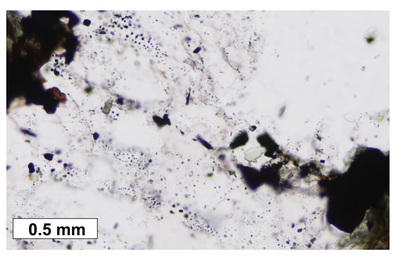
2) neoformed-recrystallized grains - transparent, with abundant solid inclusions of metamorphic phases (e.g. chlorite, muscovite, ilmenite), almost devoid of FI's

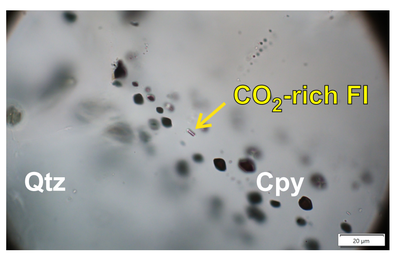
3) neoformed-retrograde grains - small transparent grains with isolated or clustered FI's





Chalcopyrite and pyrrhotite lining quartz grain boundaries - metamorphic moblization.





Trails of tiny secondary ore inclusions interspersed with fluid inclusions.

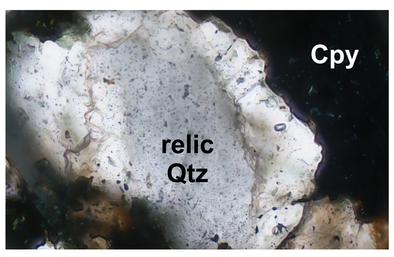
Fluid inclusion types:

- both intra- and inter-grain trails, isolated FI and 3D clusters
- large variations in bulk fluid and gaseous phase densities

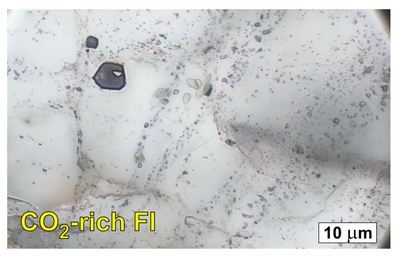
1) CO_2-rich

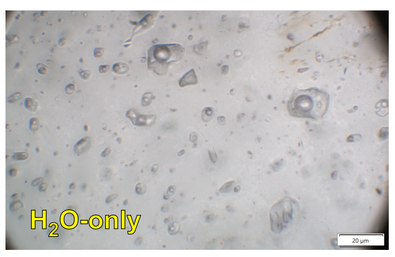
2) H_2O-CO_2-salt (2-4 wt. % eq. NaCl)

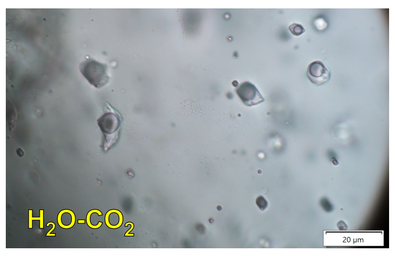
3) H_2O-salts (8-14 wt. % eq. NaCl)



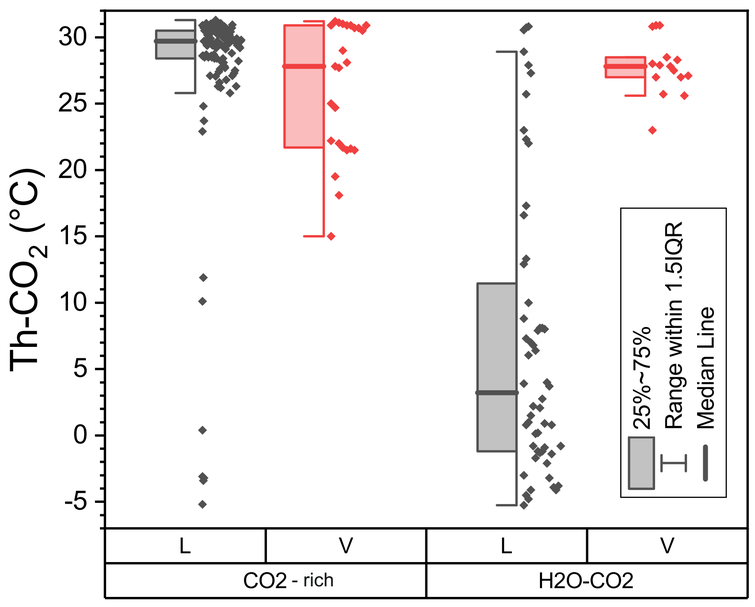
Relic quartz rimmed by neformed quartz.



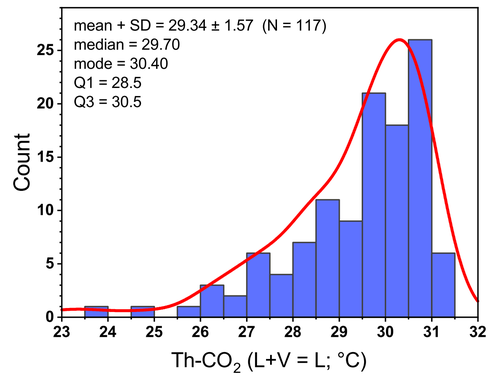


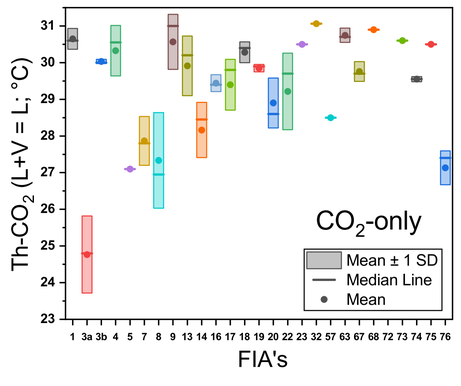


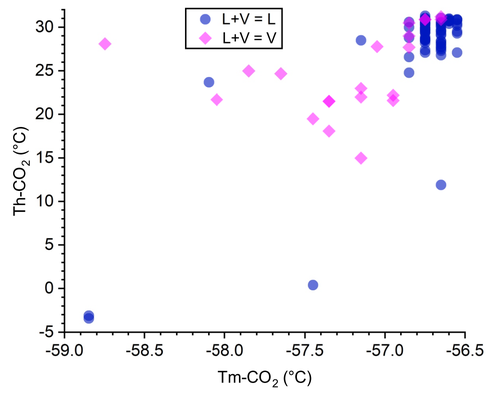
Examples of fluid inclusion assemblages.



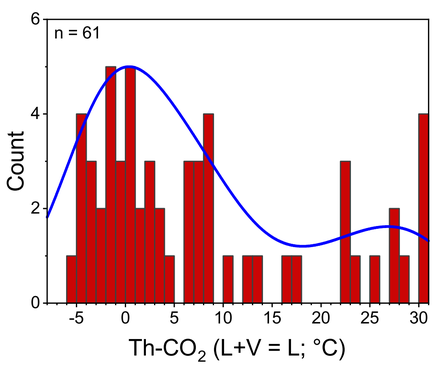
CO_2-rich FI's

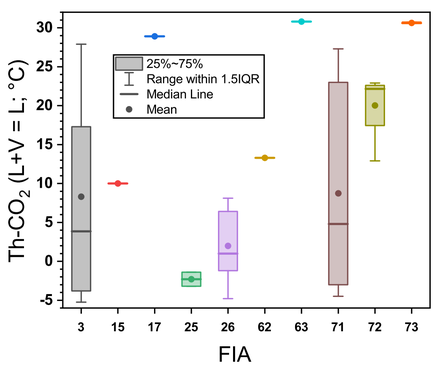


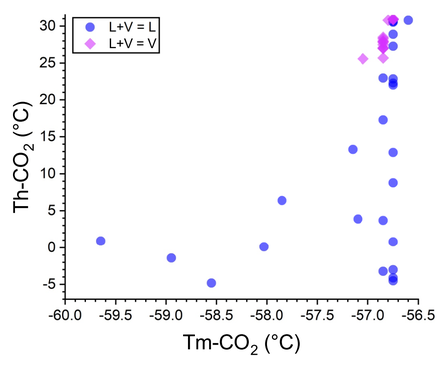


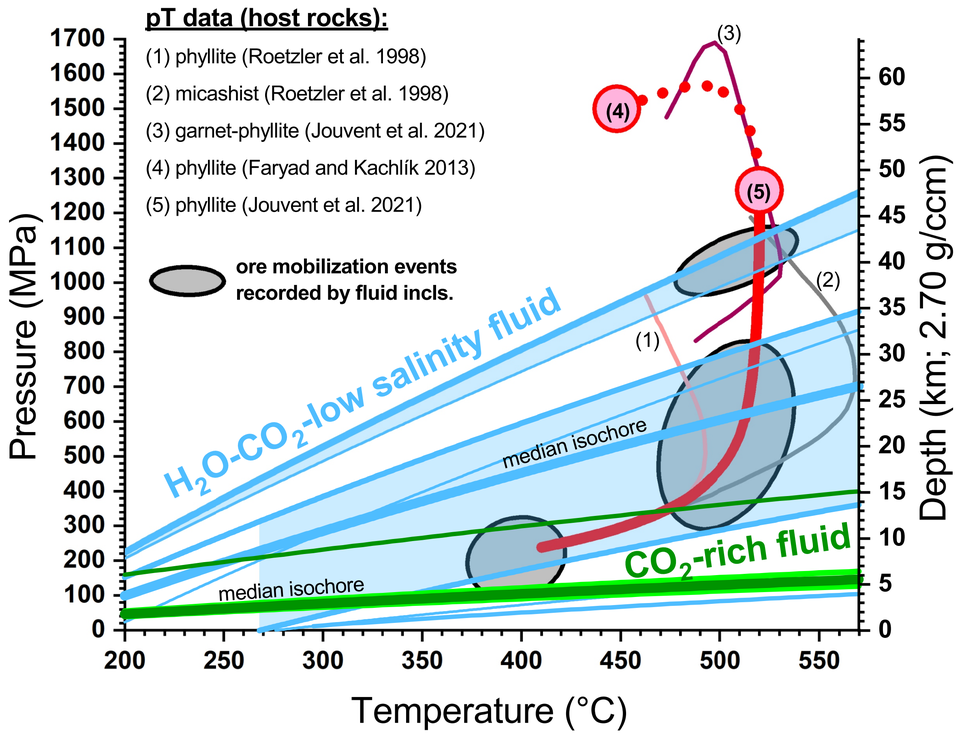


H_2O-CO_2 FI's









Conclusions

1) Density of relic H_2O-CO_2 FI's in relic quartz grains approaches metamorphic peak conditions (~1100 MPa, ~500 °C)
2) Most of the H_2O-CO_2 FI's were trapped along the isothermal decompression path (800-300 MPa, ~500 °C).
3) CO_2-rich FI's record low pressure only (200-100 MPa)
4) H_2O-CO_2 and CO_2-rich FI's represent two separate fluid events.
5) Coexisting ore (chalcopyrite, pyrrhotite) and fluid inclusions document retrograde mobilization of ore phases from ~500 °C/1000 MPa down to ~400 °C/100 MPa