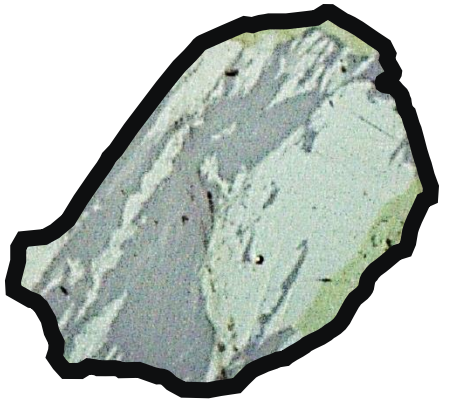
Metal enrichment as a result of SCLM metasomatism? Insight from ultramafic xenoliths from SW Poland.

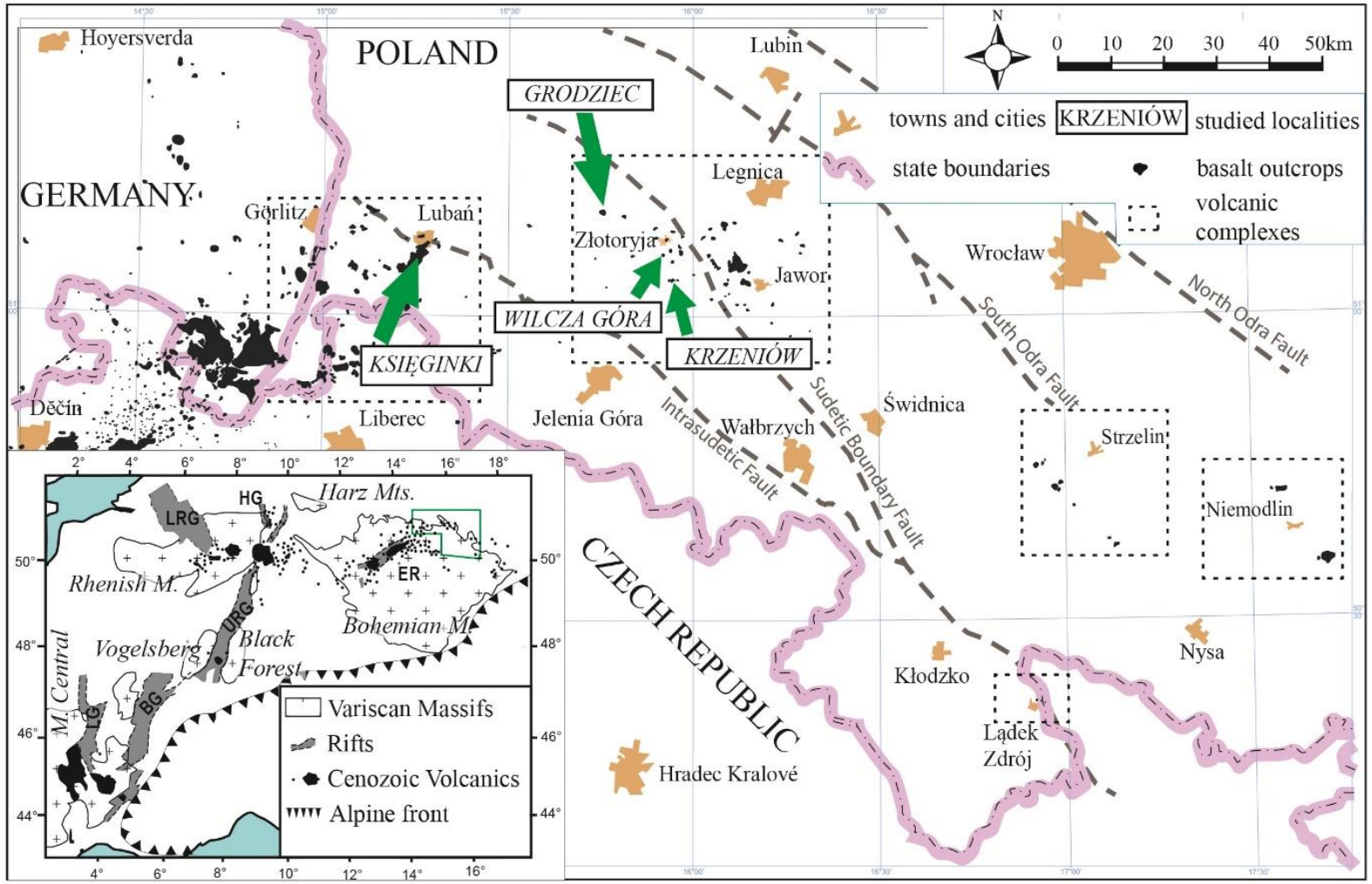
Hubert Mazurek[1], Jakub Ciazela[2], Magdalena Matusiak-Małek[1], Bartosz Pieterek[3], Jacek Puziewicz[1], Marina Lazarov[4], Ingo Horn[4], and Theodoros Ntaflos[5]

[1]Institute of Geological Sciences, University of Wrocław, Wrocław, Poland
[2]Institute of Geological Sciences, Polish Academy of Sciences, Wrocław, Poland
[3]Institute of Geology, Adam Mickiewicz University, Poznań, Poland
[4]Institut für Mineralogie, Leibniz Universität Hannover, Hannover, Germany
[5]Department of Lithospheric Research, University of Vienna, Vienna, Austria

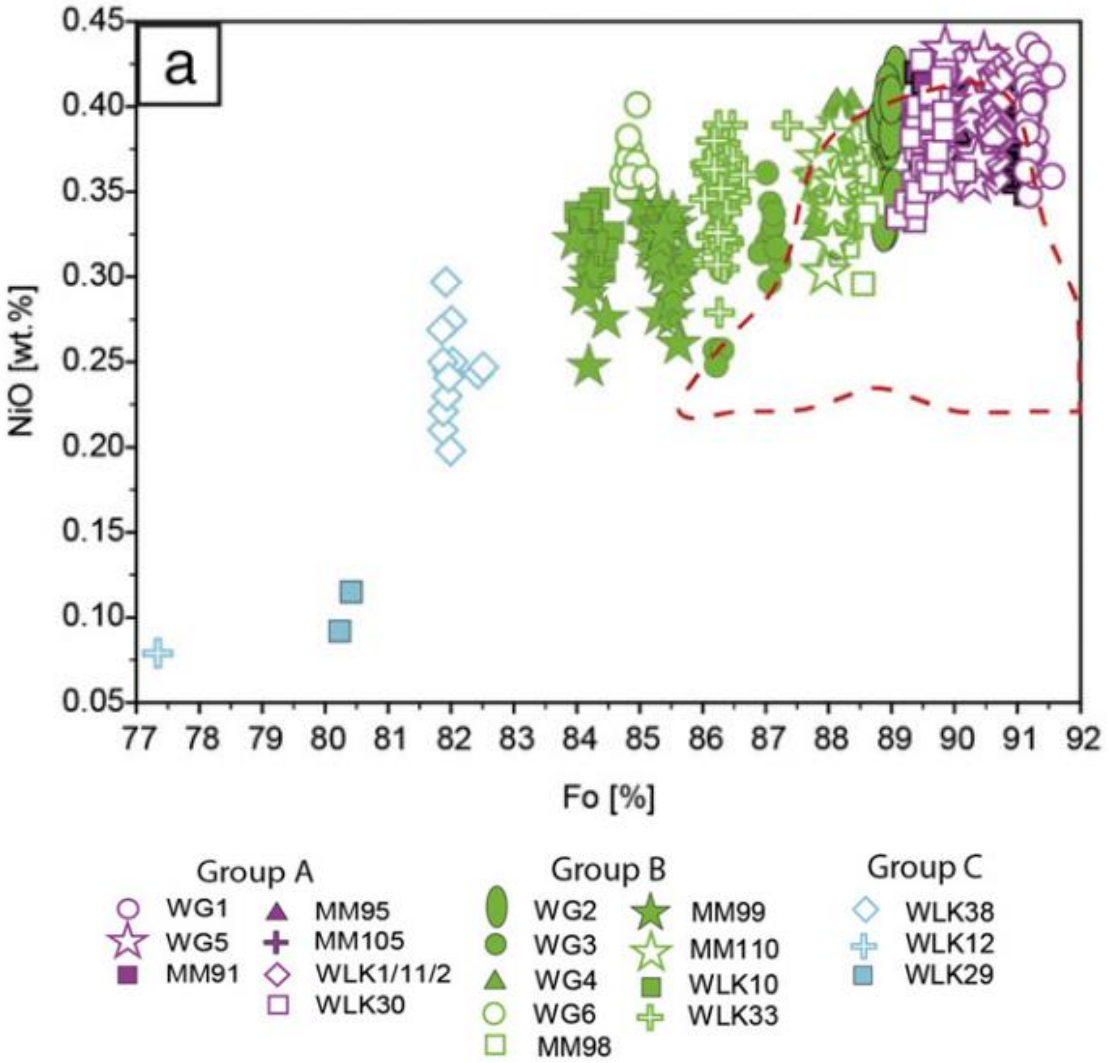


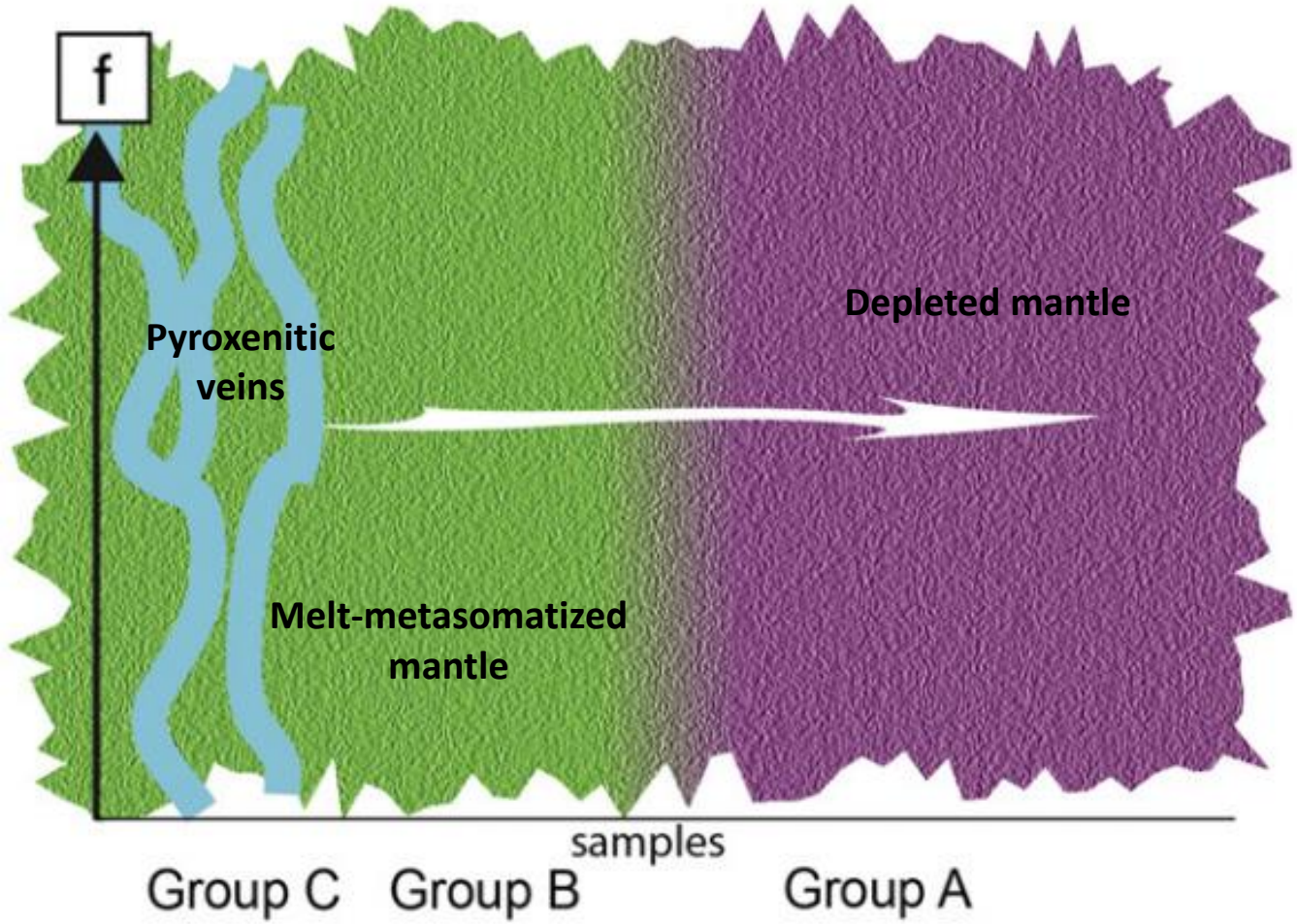
Geological setting

Map showing the occurrences of Cenozoic basaltic volcanic rocks in E Germany and SW Poland (compiled from Sawicki, 1995) and their division into volcanic complexes. Green arrows indicate localities of xenoliths studied in this article. Inset in A shows the studied area (green square) relative to the major tectonic units, European Cenozoic Rift System and associated Variscan Massifs; BG – Bresse Graben, ER – Eger Rift, HG – Hesse Graben, LG – Limagne Graben, URG – Upper Rhine Graben (Ulrych et al., 2011).



Silicate context





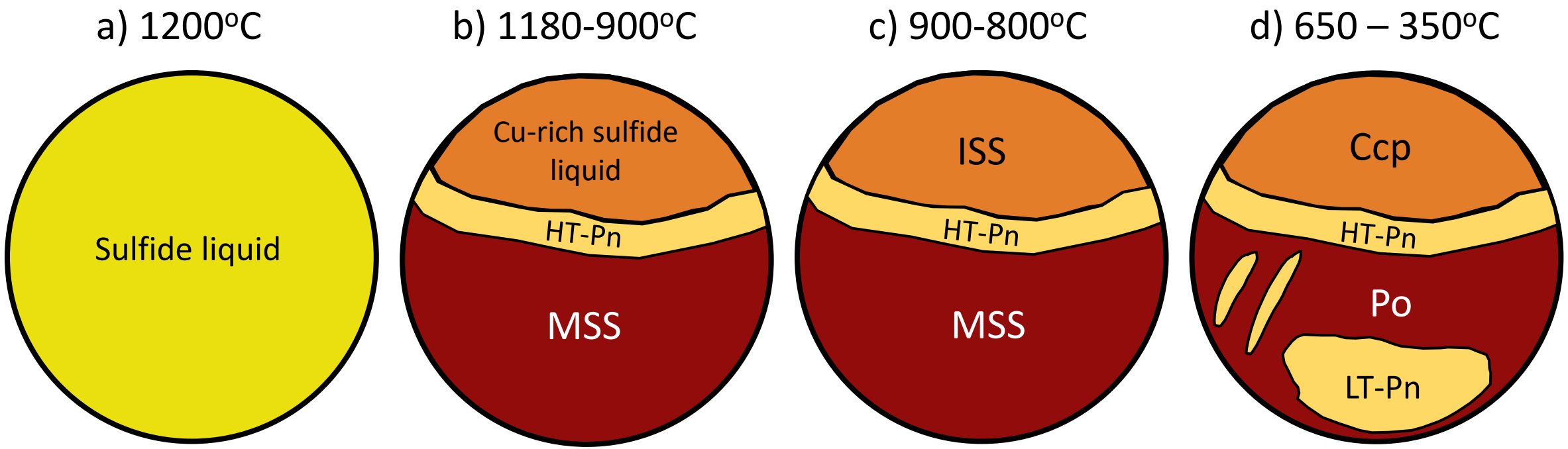
Matusiak-Małek et al., 2017

Magmatic sulfide origin

MSS (*Monosulfide Solid Solution)*
Ni-rich
ISS (*Intermediate Solid Solution*)
Cu-Fe-rich

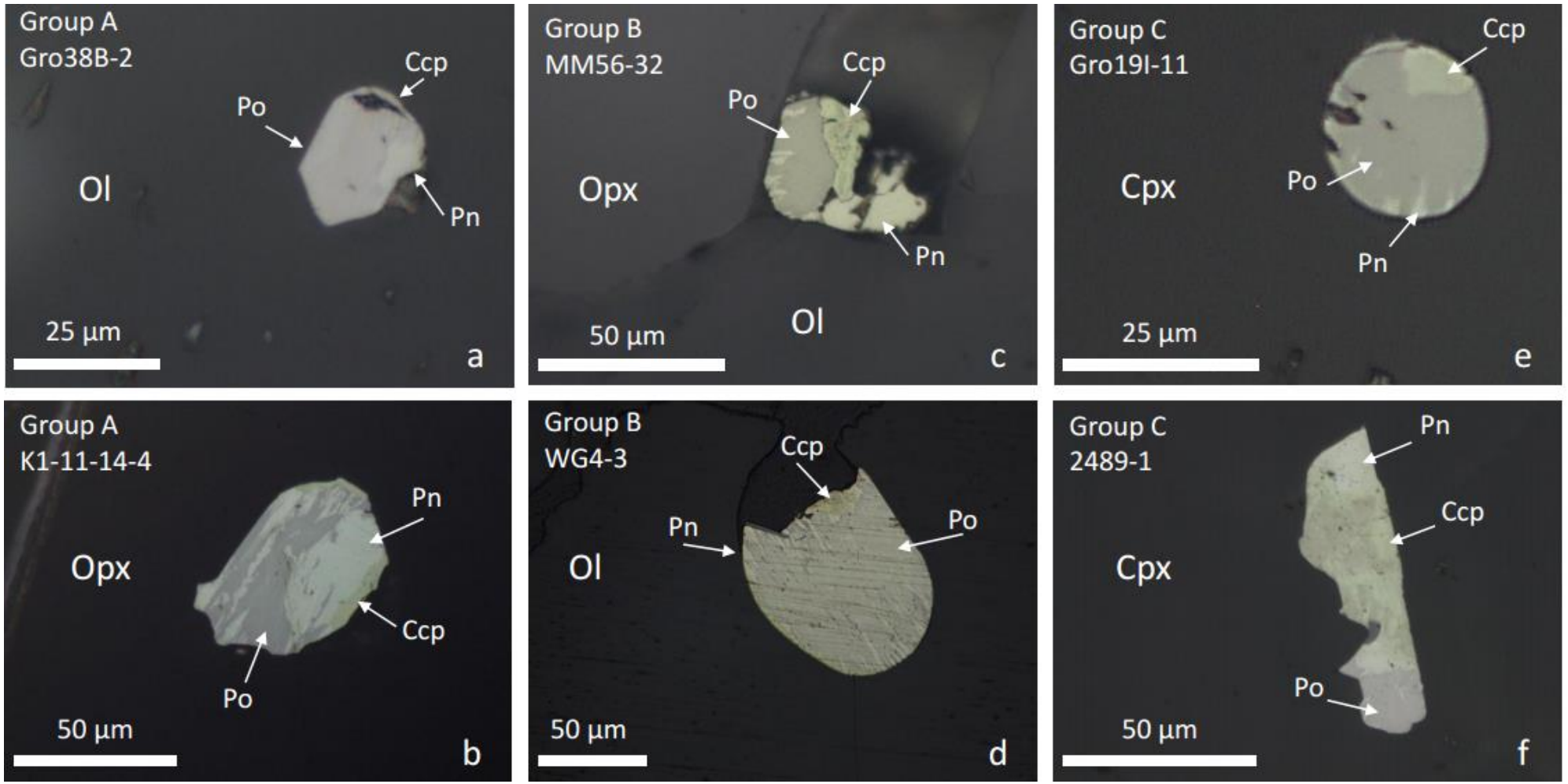
Po – pyrrhotite	$Fe_{1-x}S$
Pn – pentlandite	$(Fe,Ni)_9S_8$
Ccp – chalcopyrite	$CuFeS_2$

HT – high-temperature
LT – low-temperature



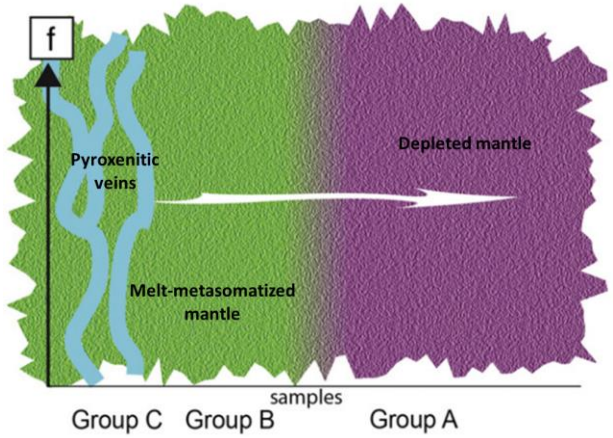
Mansur et al., 2021

Sulfide petrography

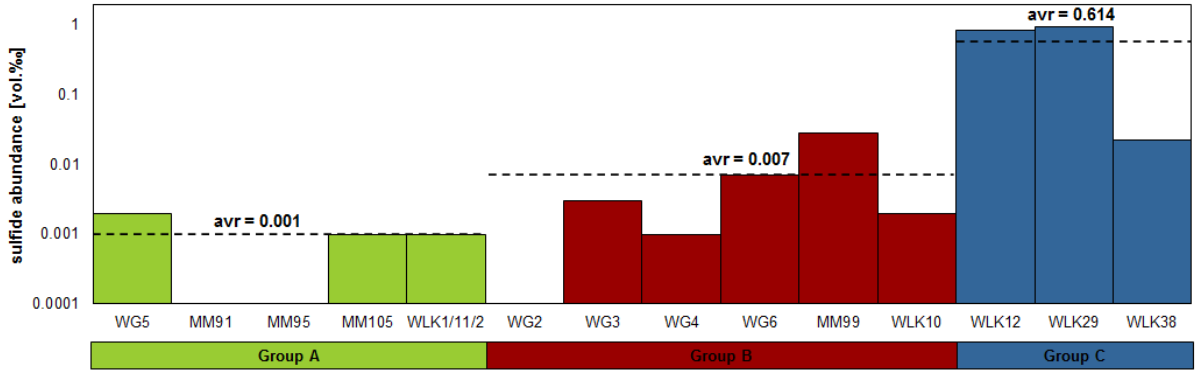


Polyphasic sulfide grains composed of pyrrhotite (Po), pentlandite (Pn) and chalcopyrite (Ccp). Grain (c) is interstitial, and the others are enclosed in the silicates.

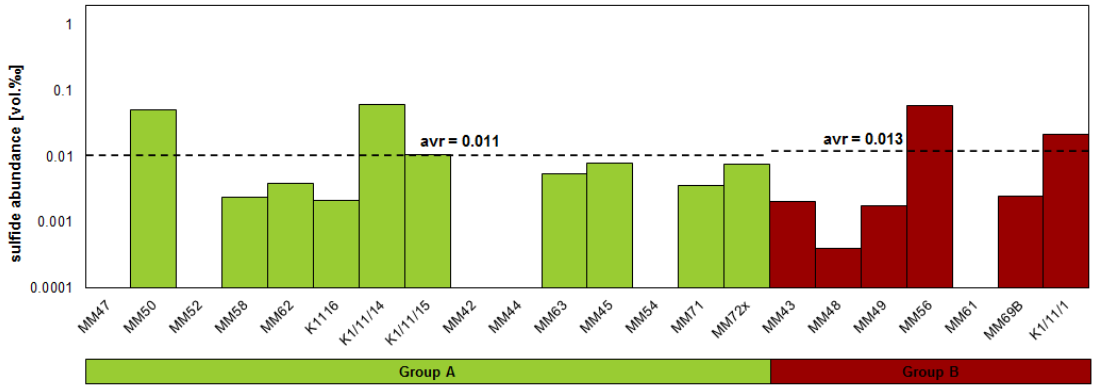
Sulfide abundances [vol.‰]



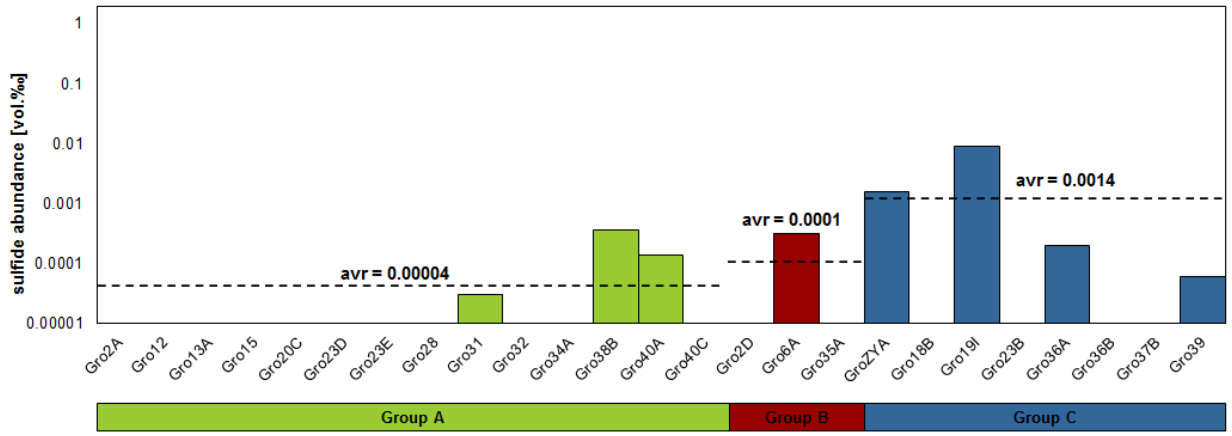
a) Wilcza Góra



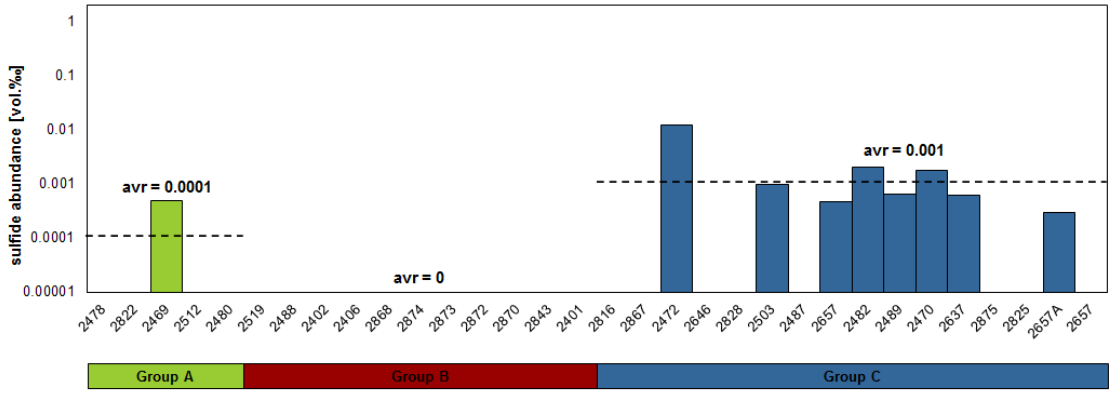
b) Krzeniów



c) Grodziec

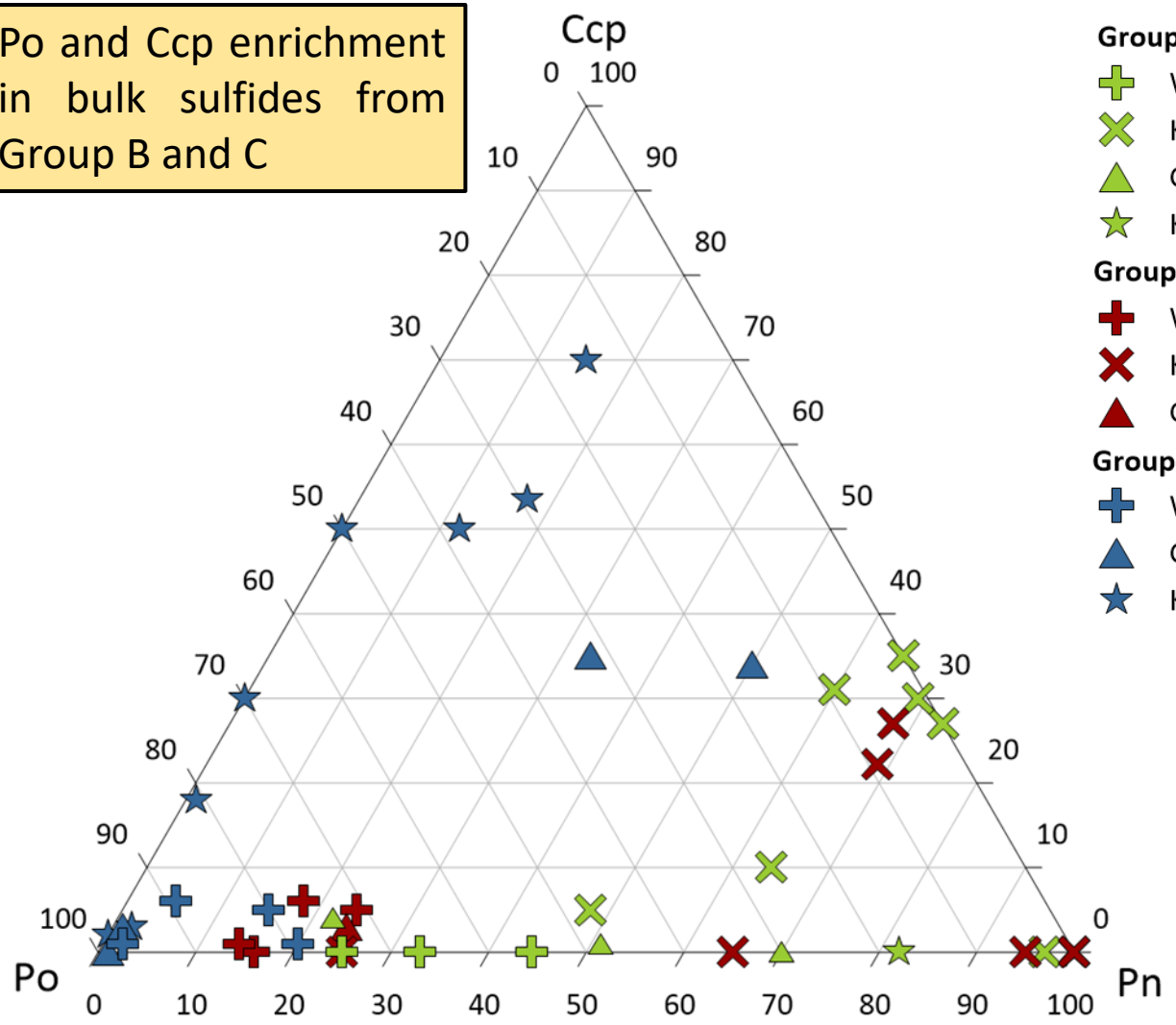


d) Księginki



Mineral and chemical composition of sulfides

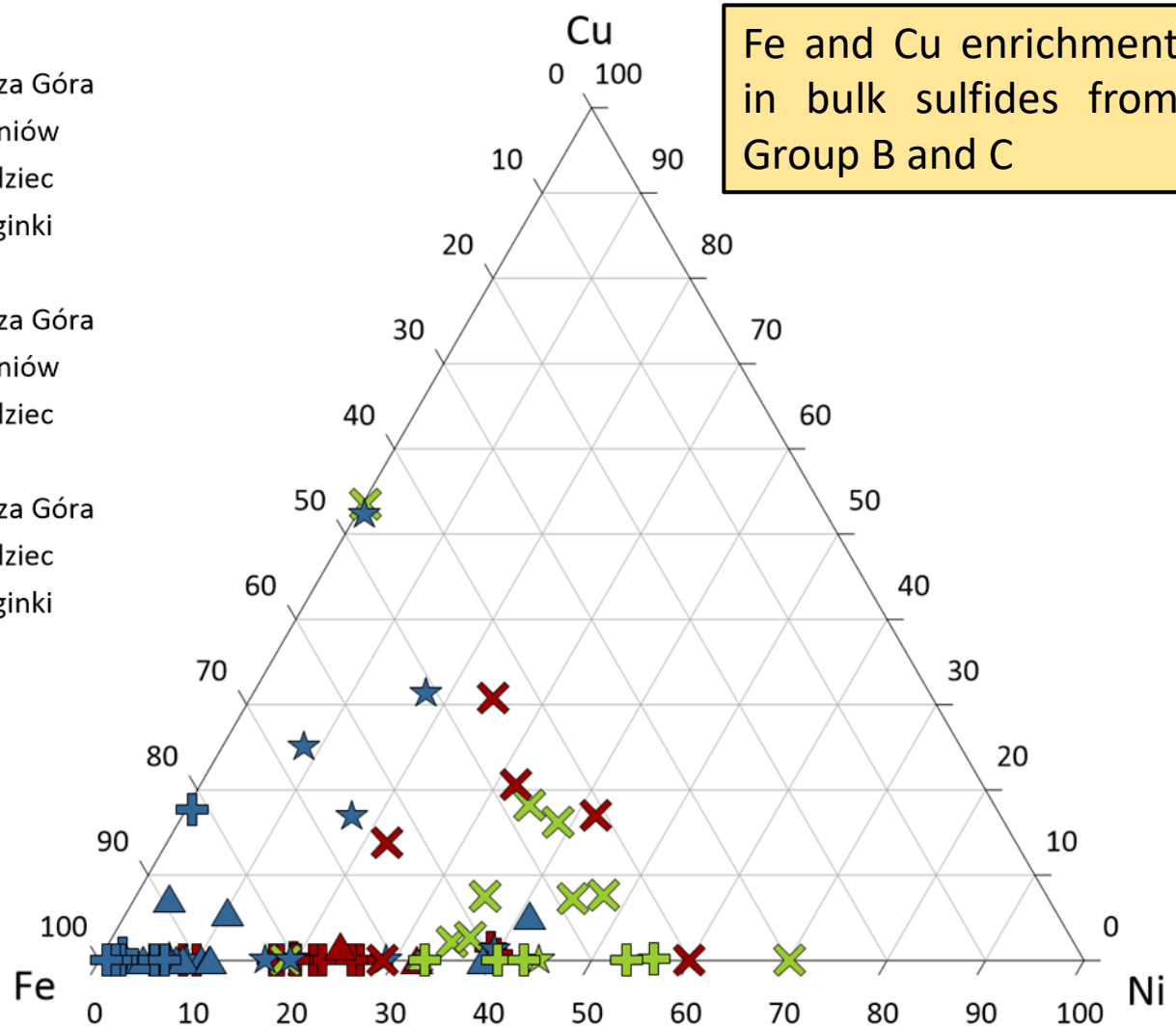
Po and Ccp enrichment in bulk sulfides from Group B and C



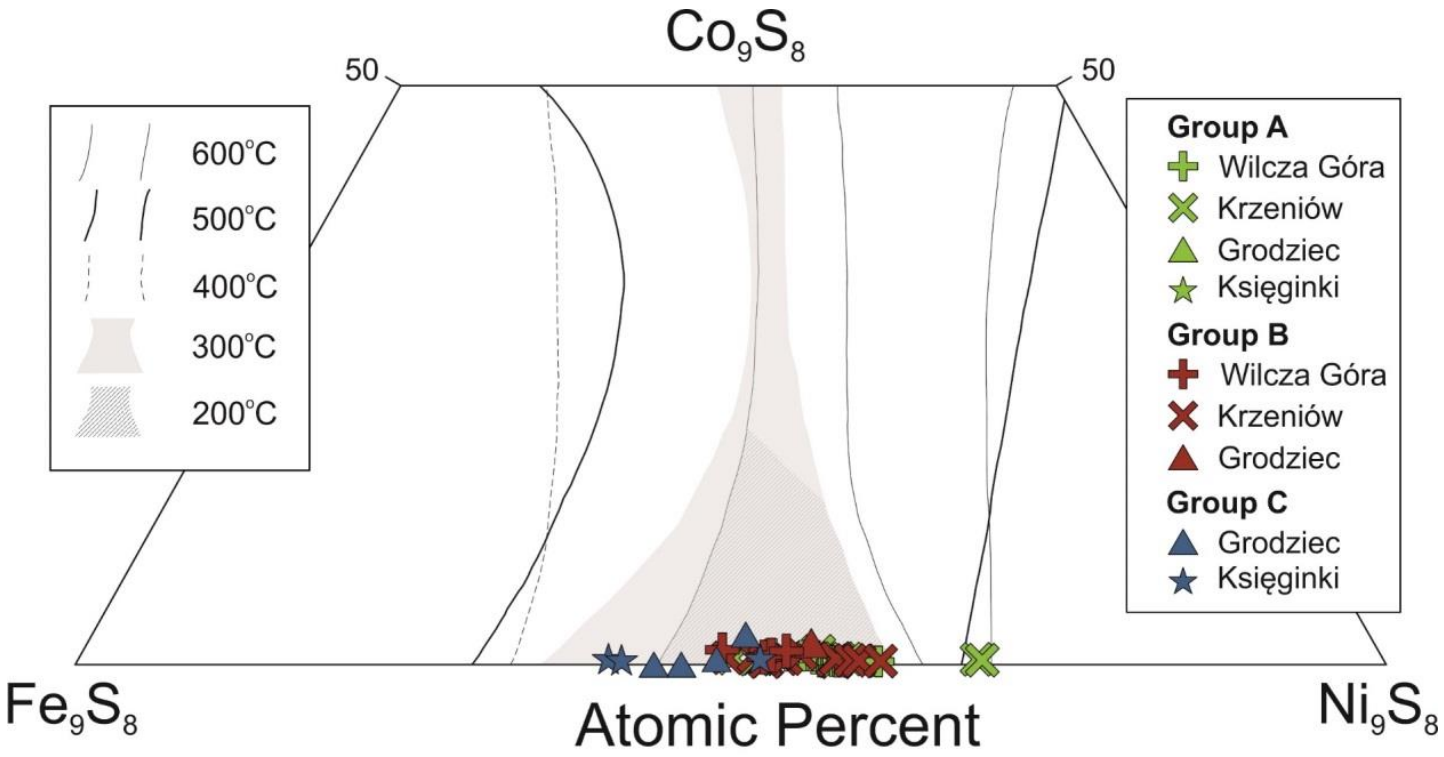
Group A
- Wilcza Góra
- Krzeniów
- Grodziec
- Księginki

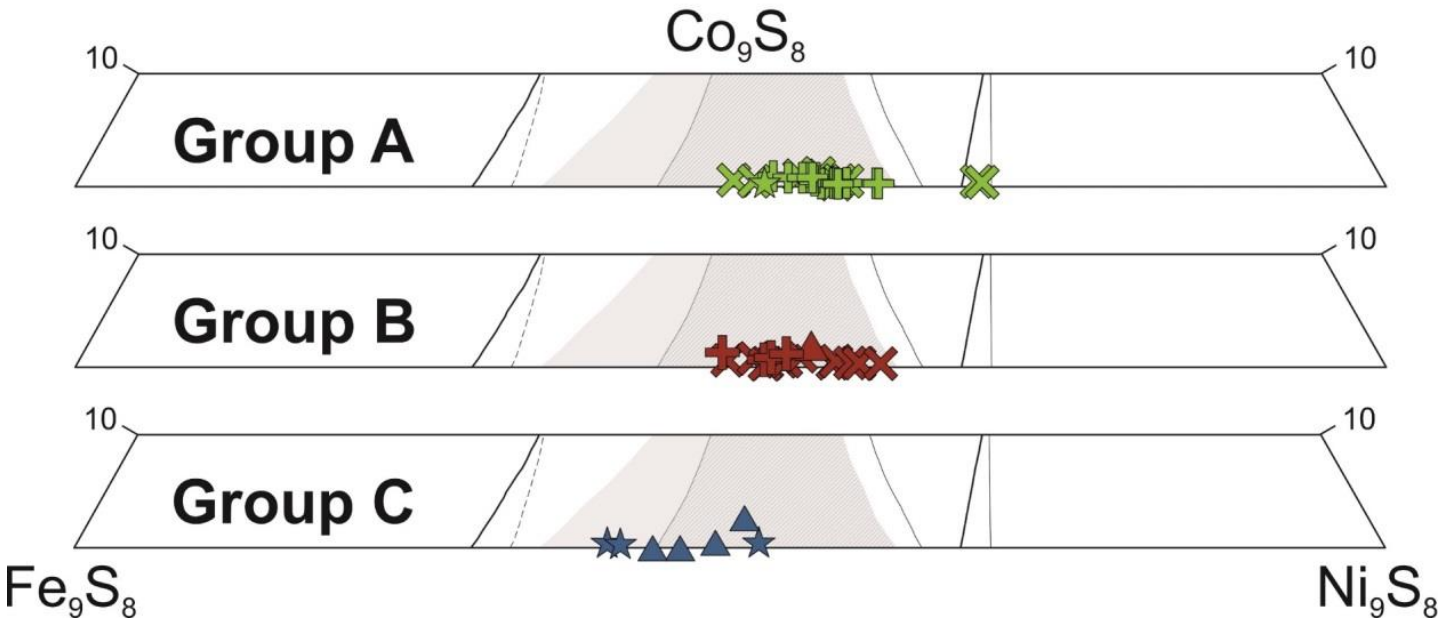
Group B
- Wilcza Góra
- Krzeniów
- Grodziec

Group C
- Wilcza Góra
- Grodziec
- Księginki



Fe and Cu enrichment in bulk sulfides from Group B and C

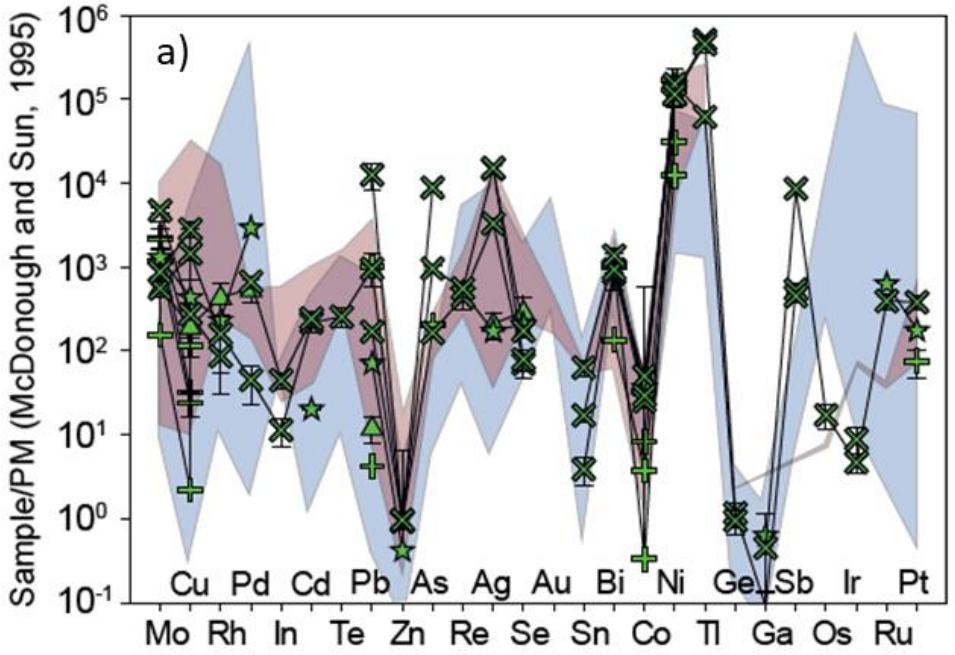


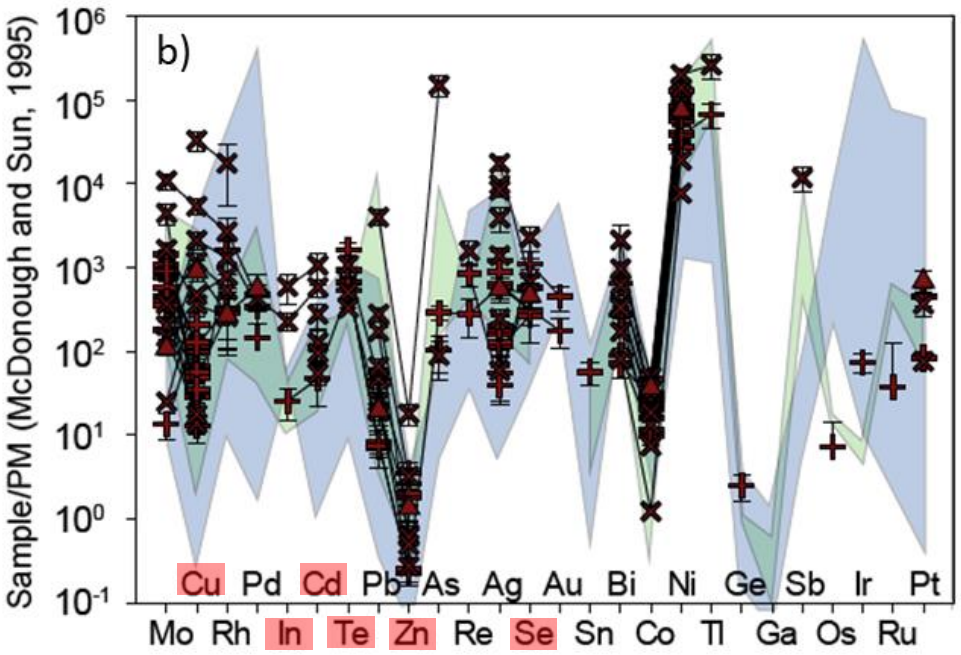


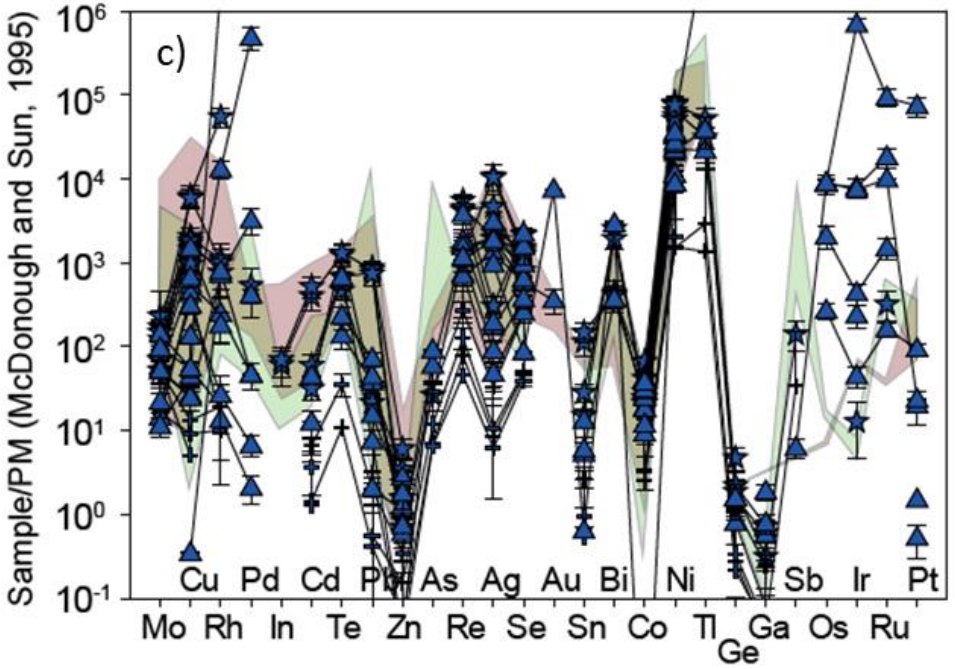
Rising Fe content in pentlandite from Group B and C

Kaneda et al., 1986

Trace elements







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data range for group A sulfides

data range for group B sulfides

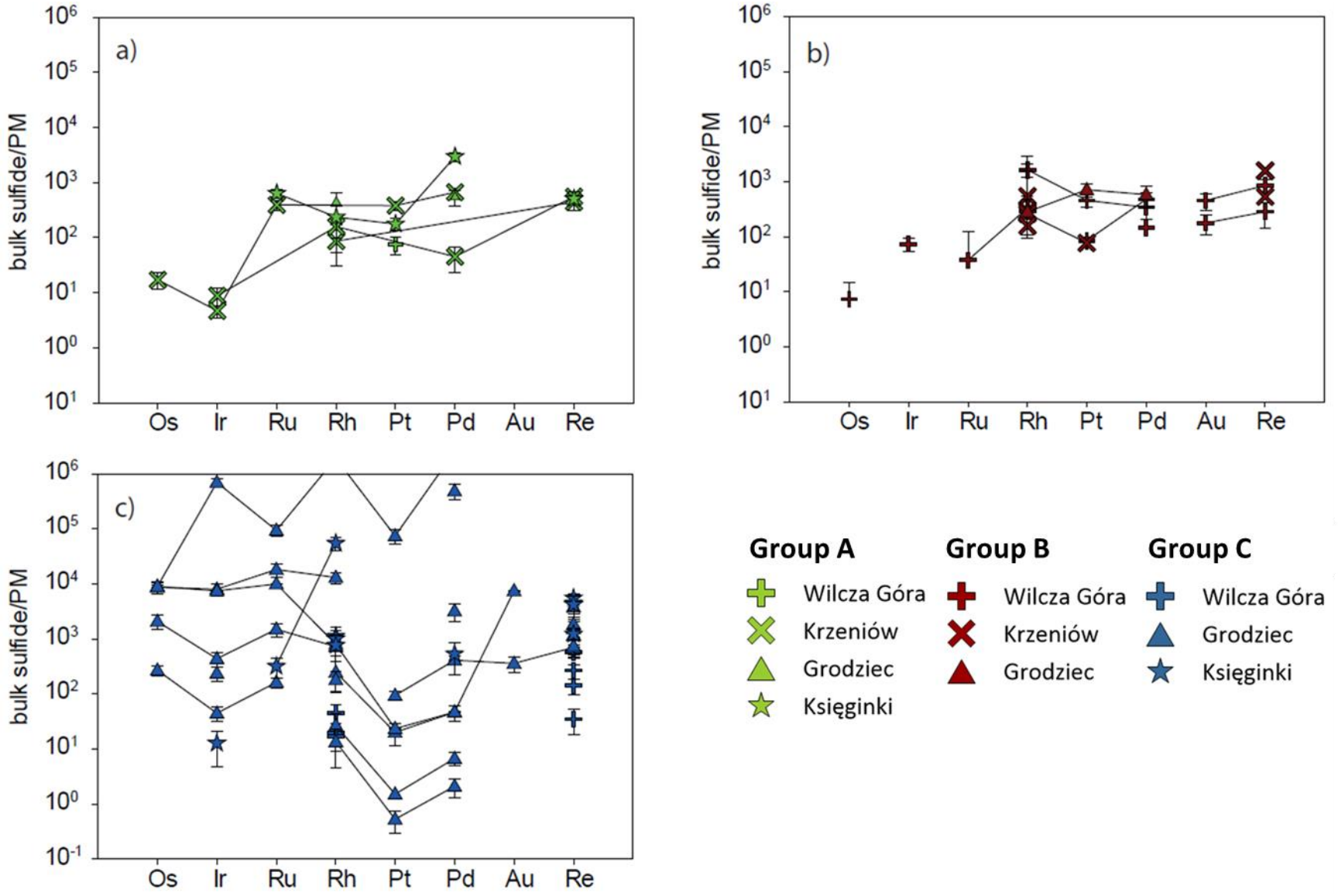
data range for group C sulfides

Enrichment in chalcophile elements such as: Cu, Se, Zn, Cd, In i Te in sulfides from Group B

Classification of elements: Lee (2016).

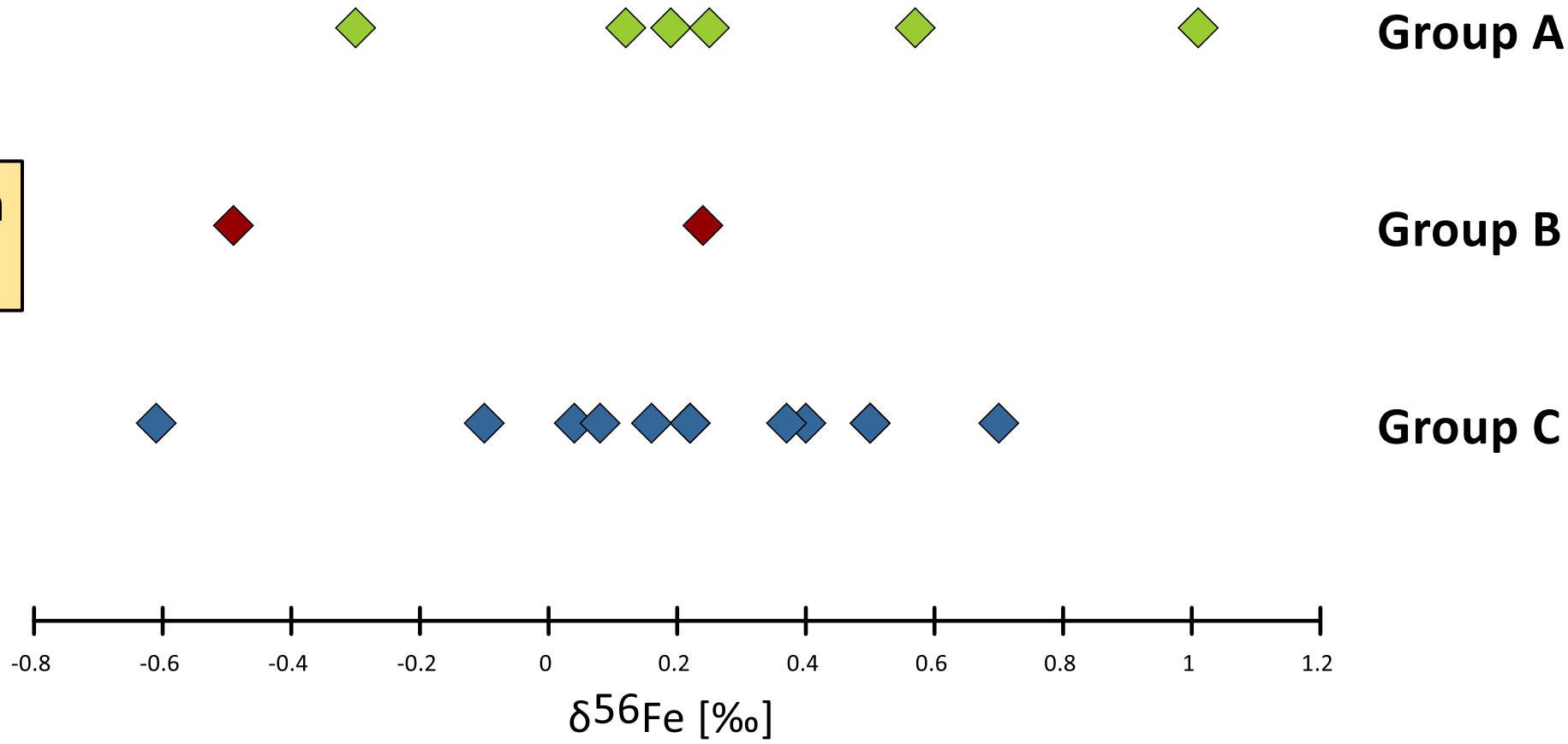
Platinum Group Elements + Au + Re = HSE

No essential variability between Groups A and B. Enrichment in Group C

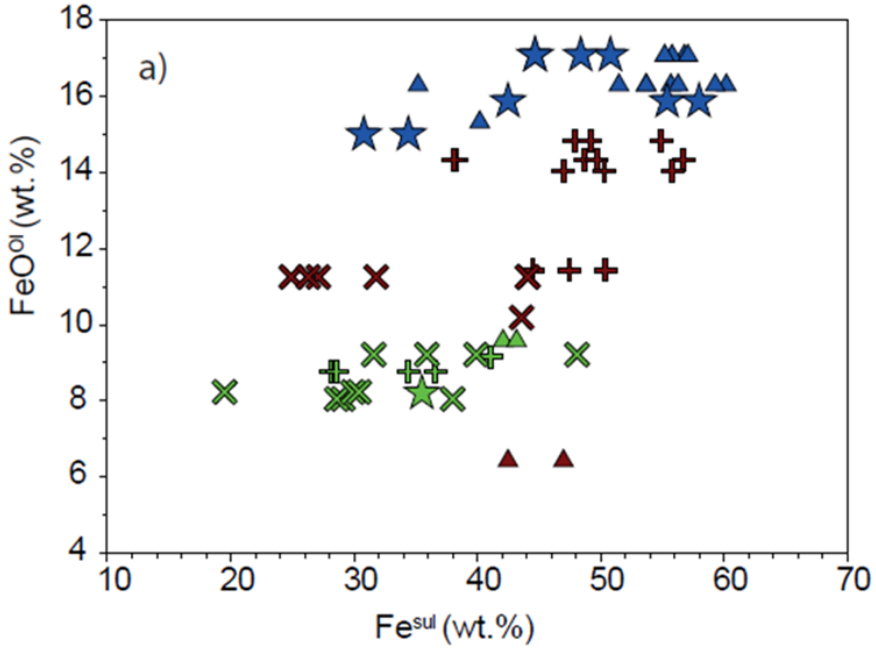


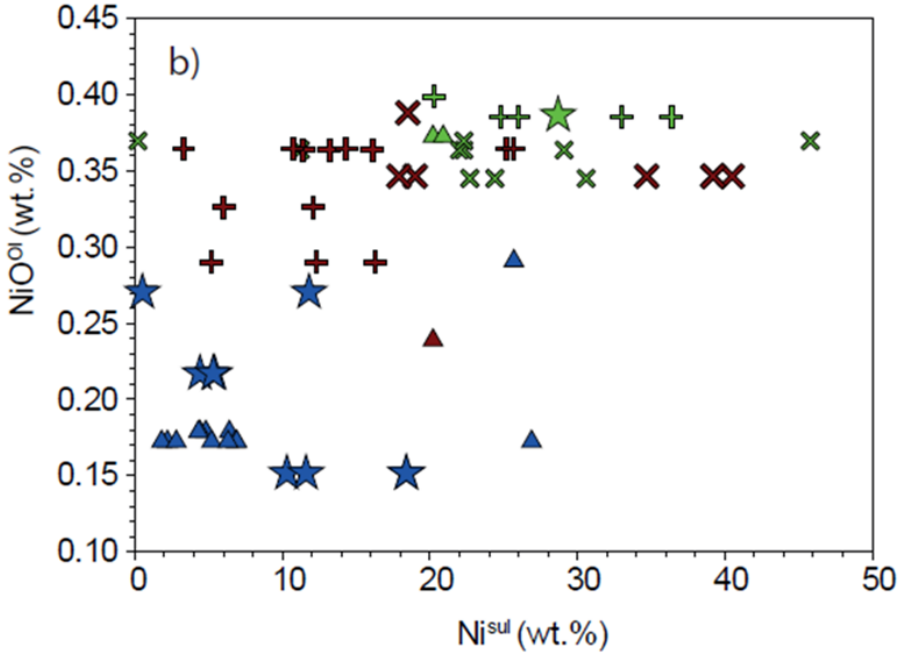
Iron isotopes

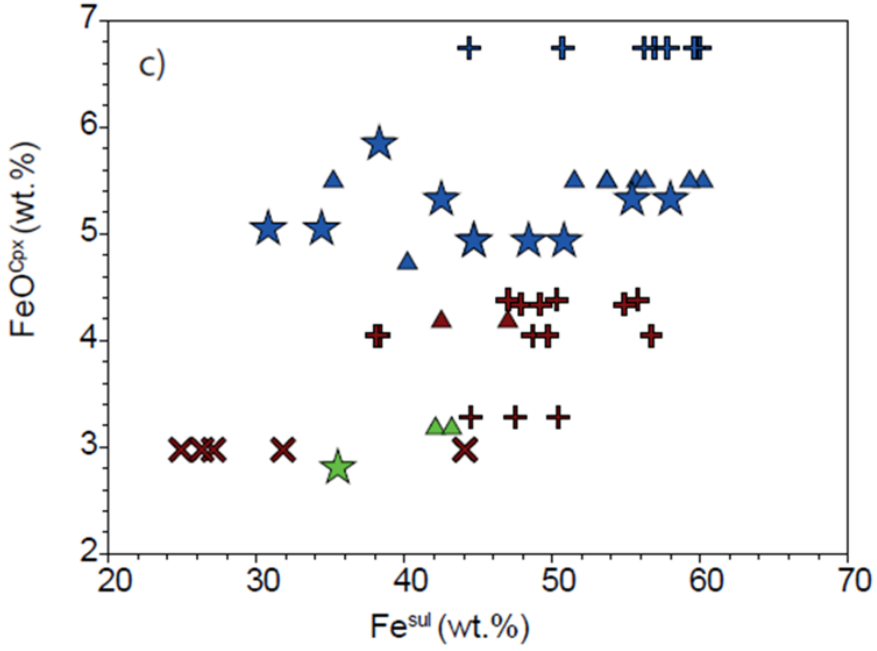
Negligible variability in $\delta^{56}Fe$ between groups



Silicates vs sulfides







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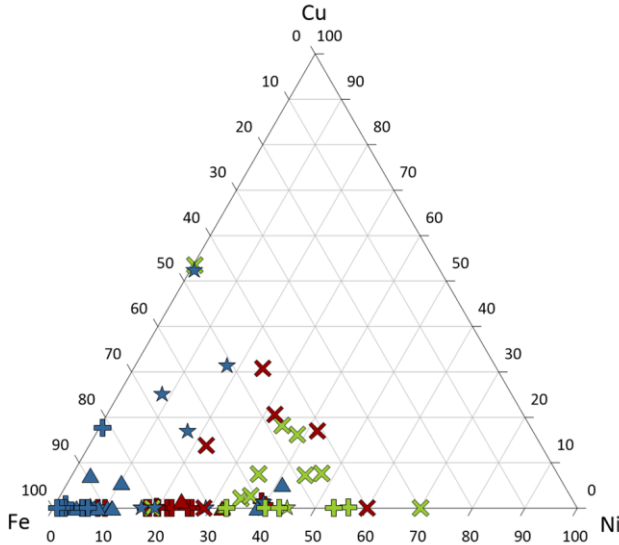
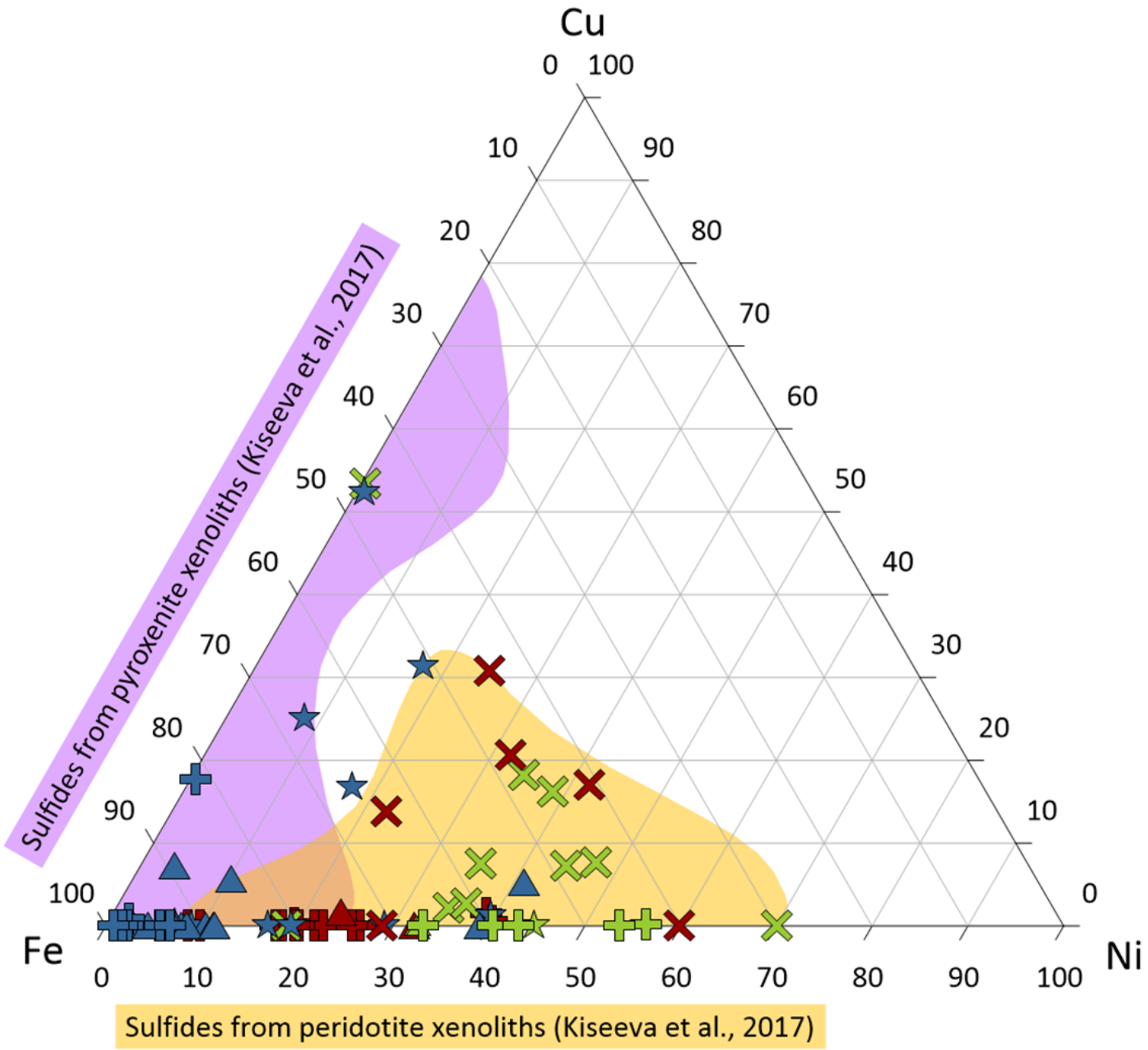


Silicates data:
Puziewicz et al., 2011
Matusiak-Małek et al., 2014, 2016, 2017

Global context



Group A
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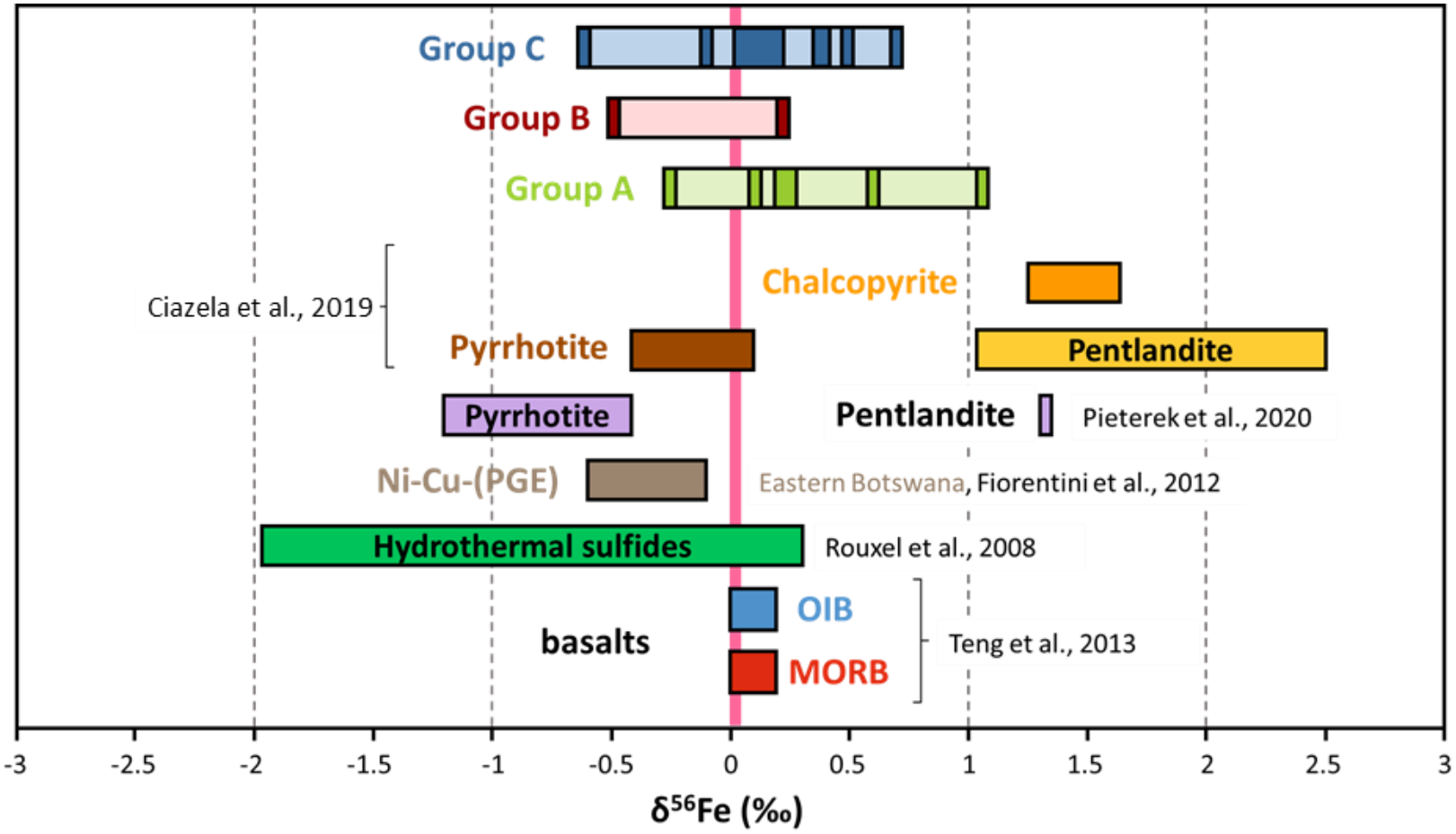
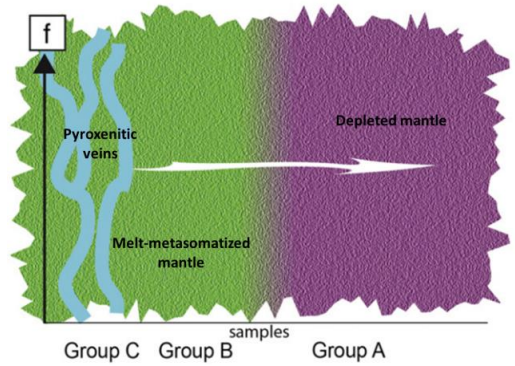
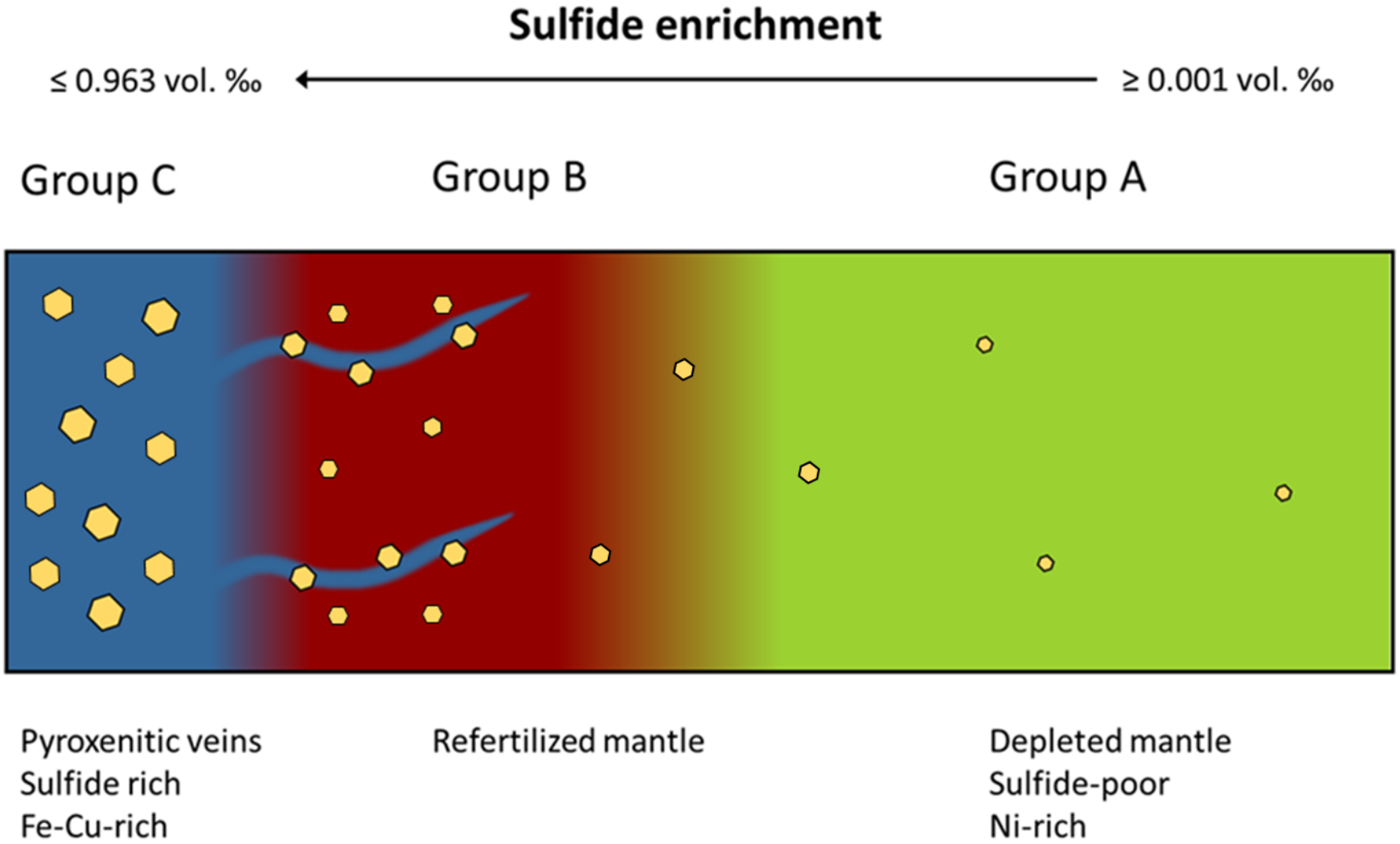
Metasomatism and iron isotopes



No effects on iron isotopes fractionation

The effect of Fe-Cu-S rich melts' migration





Schematic model of enrichment in sulfides along melt channels in the upper mantle based on the sulfides from Lower Silesia mantle xenoliths. The yellow dots represents sulfide grains, which are the smallest and lowest in abundance in depleted mantle (Group A) and both rise in melt-metasomatized mantle (Group B) due to pyroxenitic veins (Group C) as metasomatic medium. The non-sulfide background is a model of evolution of SCLM beneath NE margin of the Bohemian Massif (Lower Silesia and Upper Lusatia; Matusiak-Małek et al., 2017b).

Conlusions

- The sulfide-rich xenoliths from Group C **indicate the important role of migration Fe-Cu-S rich melts during melt-metasomatism**.
- The melt-rock reaction with depleted mantle (Group A) results in its enrichment in sulfides (Group B) in chalcophile elements, such as: Cu, Se, Zn, Cd, In and Te.
- **Melt-metasomatism results in SCLM metal enrichment.**
- Melt-metasomatism seems to not reflect indirectly in iron isotopes fractionation.

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