Vegard's law application to selenium-bearing digenite of Musonoï Mine, Katanga, DRC

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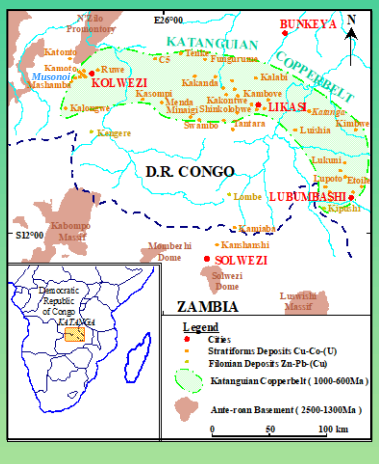
Introduction

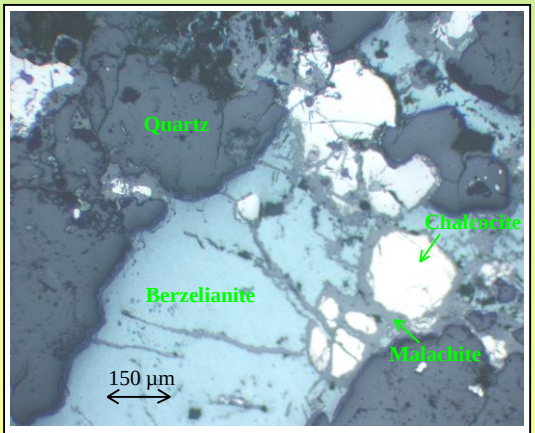
Musonoï Mine lies in the westernmost part of the Katanguian Copperbelt, in the democratic republic of Congo. It is an important Cu-Co deposit where sulphides and selenides are the primary ore minerals.

Katanga Map



Vegard's Law

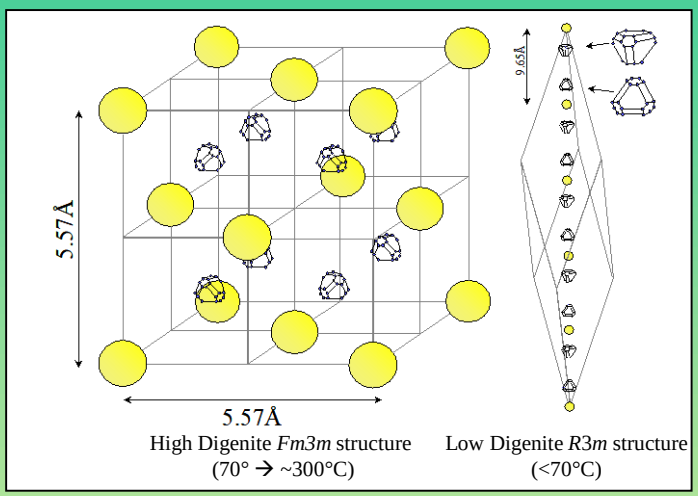
Vegard's law shows an increase of the cubic cell parameter when larger ions are introduced [4], [5]. In this case, several $Cu_{2-x}(S,Se)$ samples from Musonoi have been analyzed and compared with other digenite and sulphur-bearing berzelianite [1], [2], [3].



Polished section of a berzelianite vein

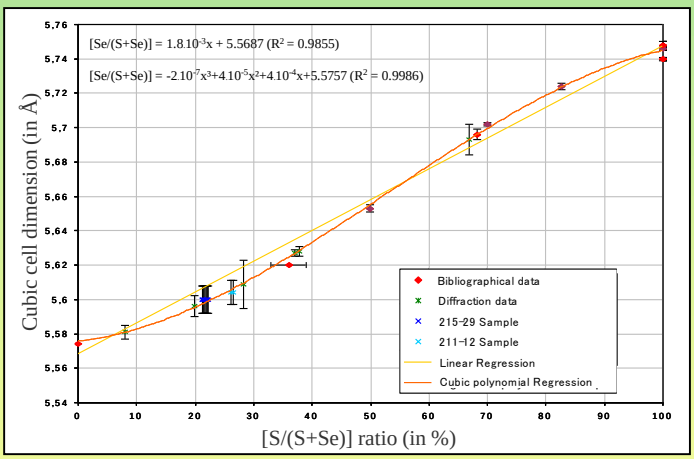
Digenite and Berzelianite

Digenite is a copper sulphide, Cu_9S_5, which has a high-temperature (>70°C) face-centered cubic lattice of *Fm*3*m* space group. A rare analogous seleniferous mineral is berzelianite, $Cu_{2-x}Se$, which has been recently found at Musonoï.



High Digenite *Fm3m* structure (70° → ~300°C)

Low Digenite *R3m* structure (<70°C)



Conclusions

- The digenite-berzelianite series seems to realize a complete substitution of sulphur by selenium anions inside the cubic structure according to Vegard's law.
- This isomorphous series does not show a linear correlation between the two terms and this could be understood as a behaviour of non ideal solid solution.
- Selenium content in these types of minerals can be estimated by powder X-ray diffraction.

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References:
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