Oscillatory compositional zoning in minerals has been observed in hydrothermal magmatic and metamorphic environments and has been commonly attributed to changing chemical or physical conditions during crystal growth. Chemical zoning is common in solid solution minerals however it has been rarely described in phyllosilicates.

The present study describes oscillatory zoning in chlorite from pelitic samples from the Pic de Port Vieux thrust sheet, a minor thrust sheet associated to Gavarnie thrust fault zone (Central Pyrenees). The Pic de Port Vieux Thrust sheet comprises a 1-20 meter thick layer of Triassic red pelite to sandstone and mylonitized Cretaceous limestone. The thrust sheet is affected by faults and cleavage; the important deformation product is a set of veins filled by quartz and chlorite (Grant, 1992).

Chlorite fills extension veins, crack-seal shear veins and is also present in open cavities. The chlorites filling the open cavities occur as pseudo-uniaxial plates arranged in rosette-shaped aggregates. These aggregates appear to have developed as a result of radial growth of the chlorite platelets.

Detailed observations (SEM, TEM images) and analyses (microprobe analyses) were focused on these chlorite aggregates. Oscillatory zoning is well imaged from Backscattered Scanning Electron Microscopic images and X-ray Mapping. According to point and microprobe X-ray images, these chlorites display oscillatory chemical zoning with alternating iron-rich and magnesium-rich bands. The chlorite composition ranges from Fe rich pole (\(\text{[Si}_{2.62}\text{Al}_{1.38}\text{O}_{10}\text{(Al}_{1.47}\text{Fe}_{1.87}\text{Mg}_{2.61})\text{(OH)}_{8}\text{]}\)) to Mg rich pole (\(\text{[Si}_{2.68}\text{Al}_{1.31}\text{O}_{10}\text{(Al}_{1.45}\text{Fe}_{1.41}\text{Mg}_{3.06})\text{(OH)}_{8}\text{]}\)).

Temperature maps are derived from standardized microprobe X-ray images using the program XMapTools (Lanari et al. 2014). The (\(\text{Fe}^{3+}/\text{Fe}_{\text{tot}}\)) value in chlorite is directly measured using \(\mu\)XANES spot analyses collected at the Fe-K edge. These analyses permit an estimation of temperature and redox state of the fluid from which chlorite precipitated.

All these data will permit to discuss the origin of the oscillatory zoning in chlorite and to determine if this type of zoning can be attributed to an external control of cyclic change in temperature, pressure or fluid composition or to a growth mechanism resulting in differential incorporation of Mg or Fe related to matrix and kinetic effects.
