OH signatures of pyroxenes: A new tool to probe lithosphere evolution?

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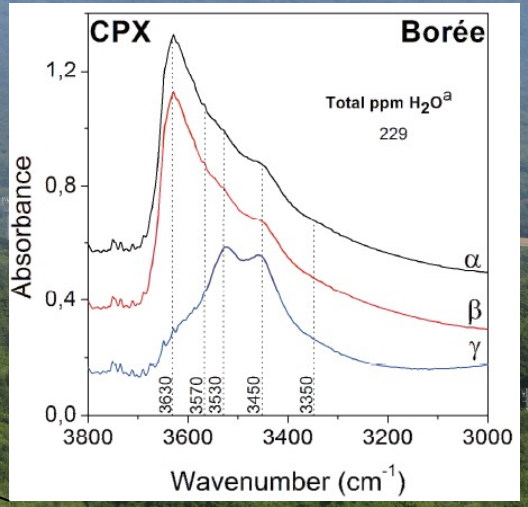
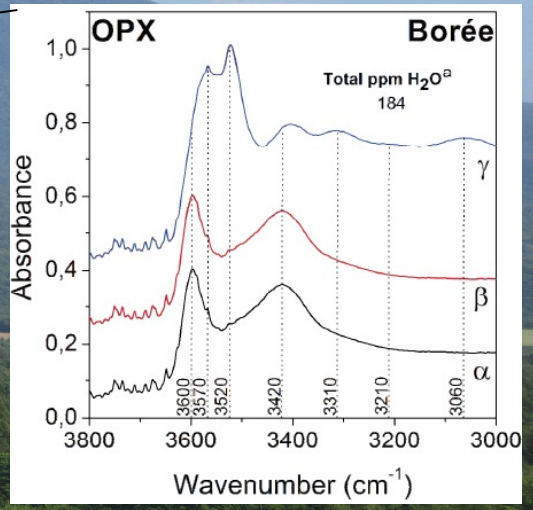
Representative OH signatures of pyroxenes from mantle rocks

A representative OH spectrum is built from the sum of 3 spectra acquired with the beam polarized parallel to each of the crystallographic axes of a pyroxene crystal. Another way is to sum unpolarized spectra recorded from a sufficient number of pyroxenes grains randomly oriented from an homogeneous xenolith.

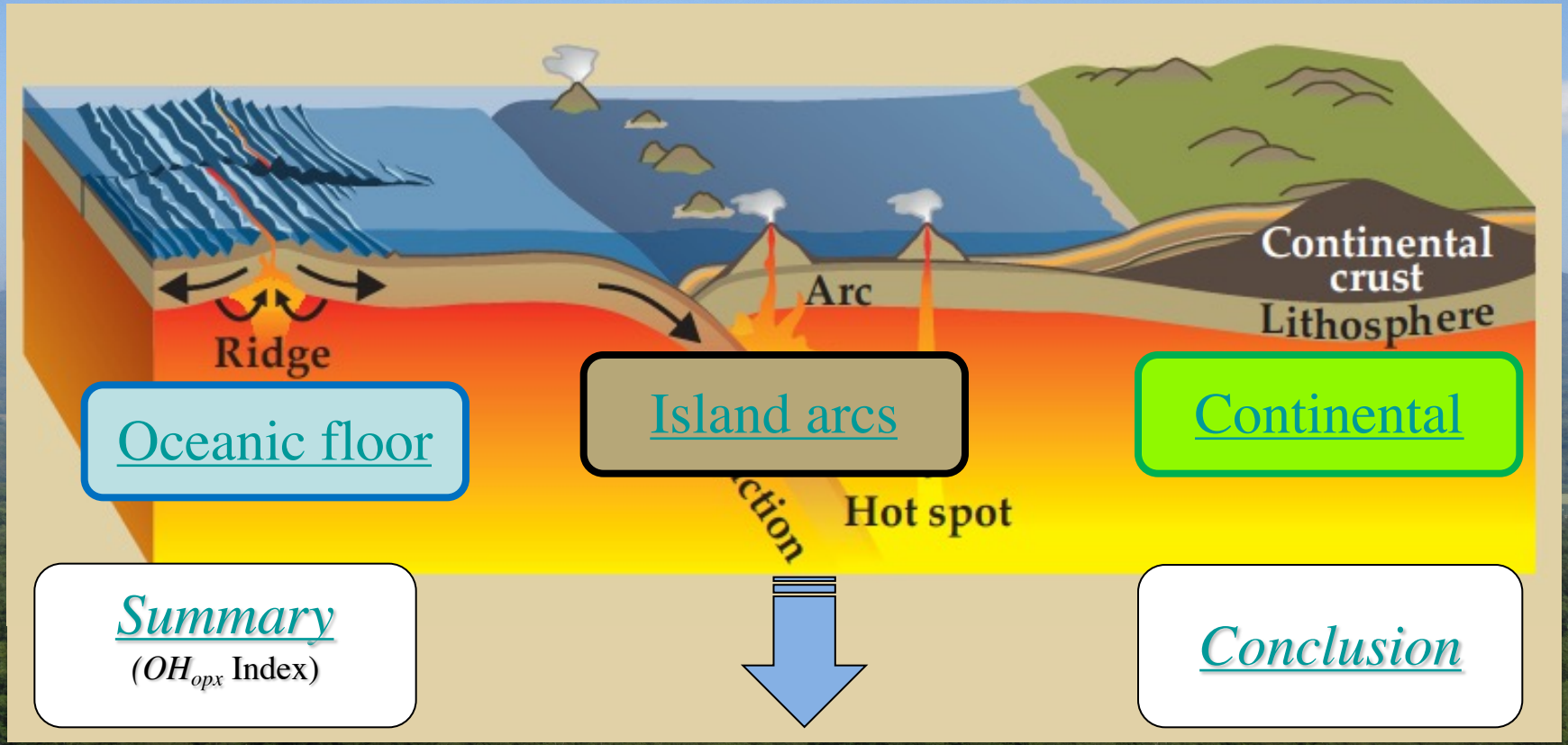
μ-infrared analysis

Xenolith from Mare de Borée, French Massif Central

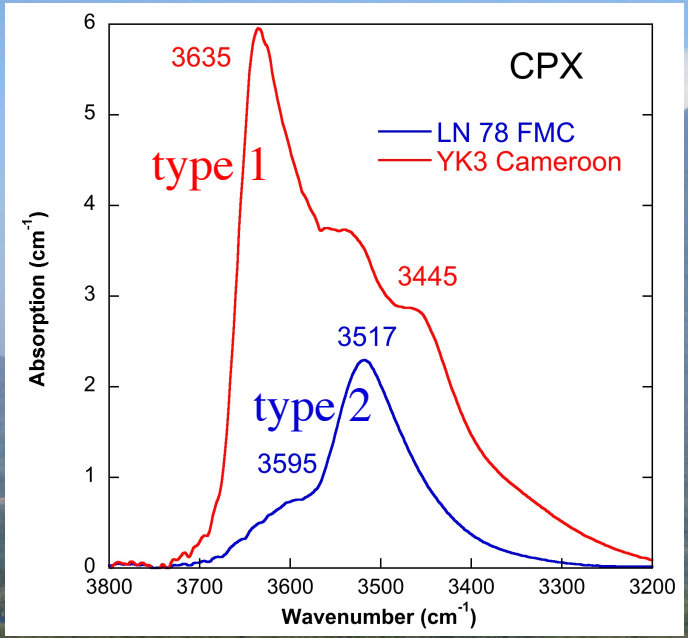


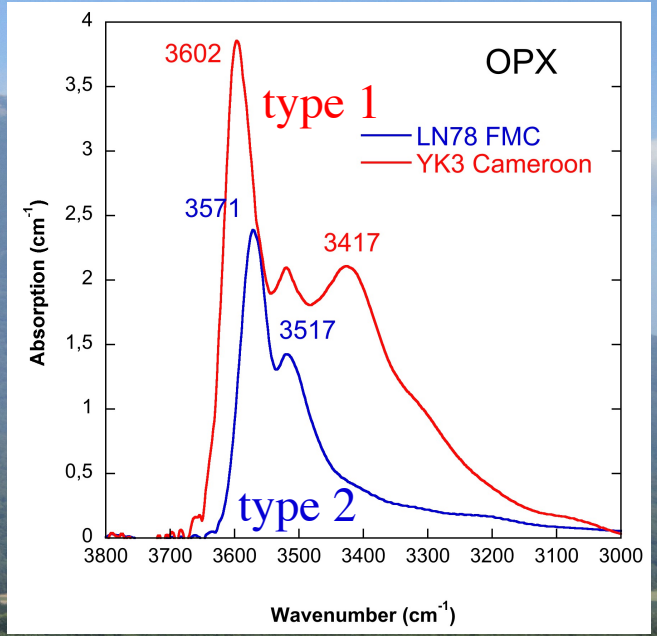


OH signatures of opx and cpx pyroxenes vary simultaneously with the geodynamic context. Let's explore the differences….



Deep Continental Lithosphere

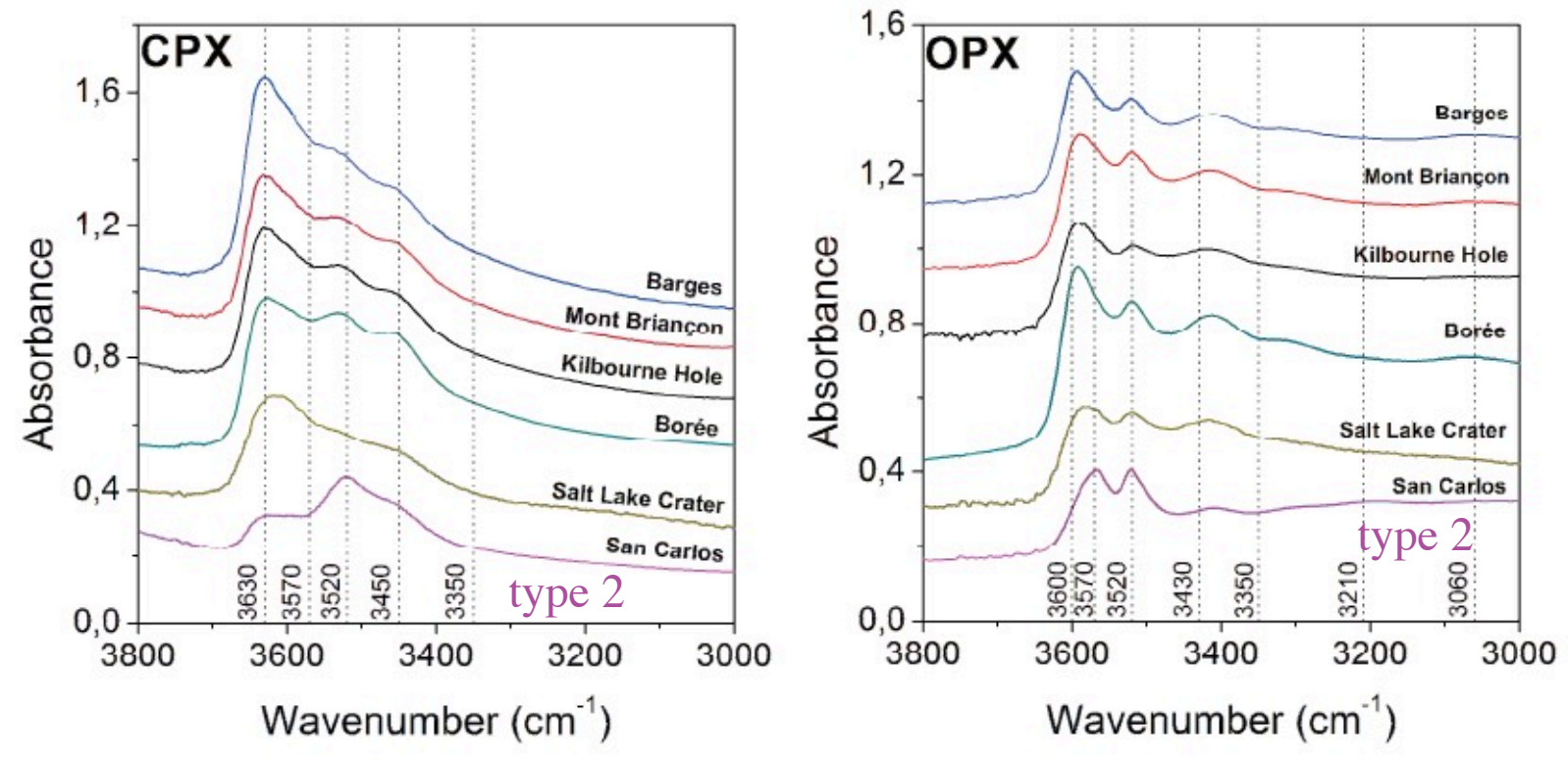




Tow types of signatures: type 1 & type 2

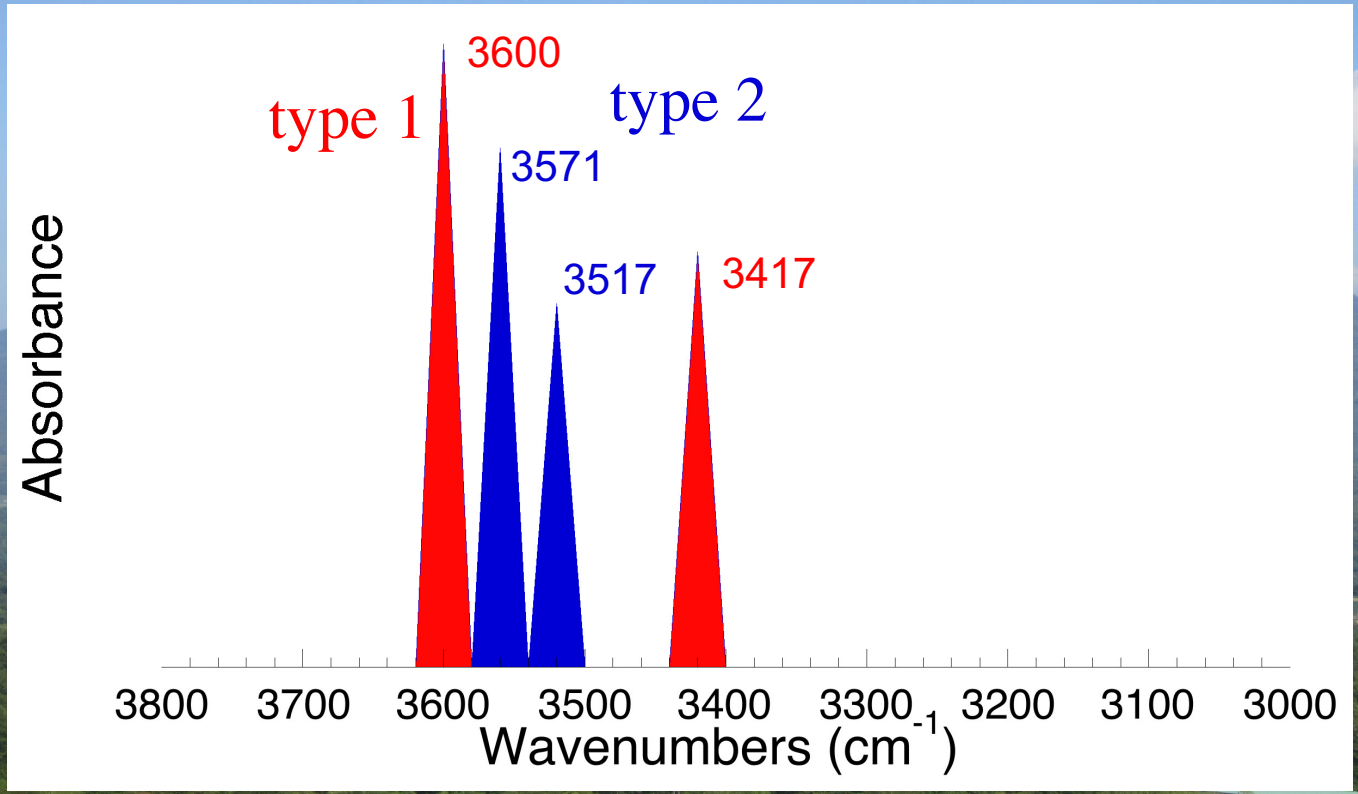
Pyroxenites from French Massif Central (FMC) / Adamawa Volcanic Plateau (Cameroon)

Deep Continental Lithosphere



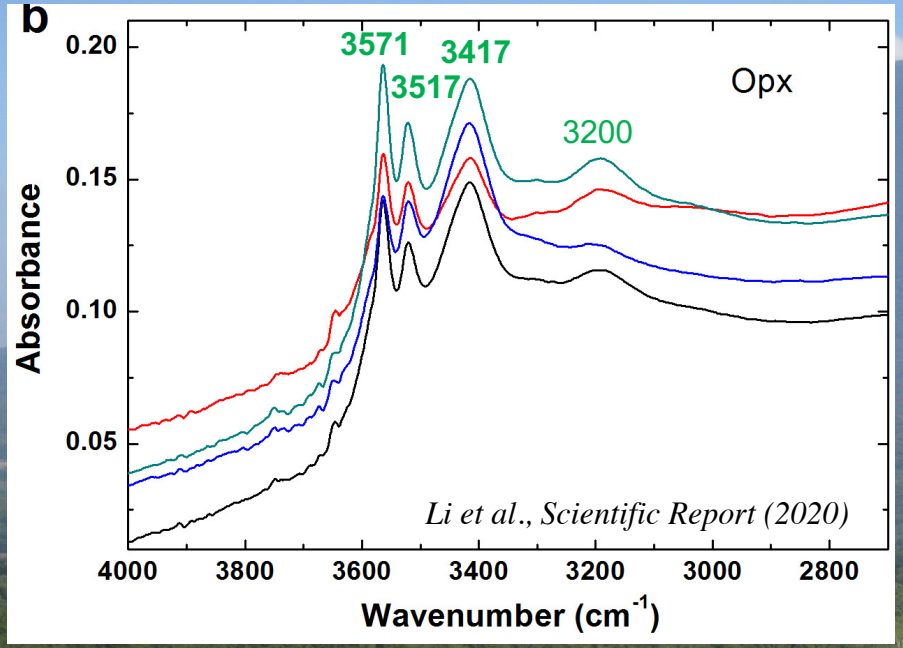
Lherzolites from San Carlos (USA), type 2

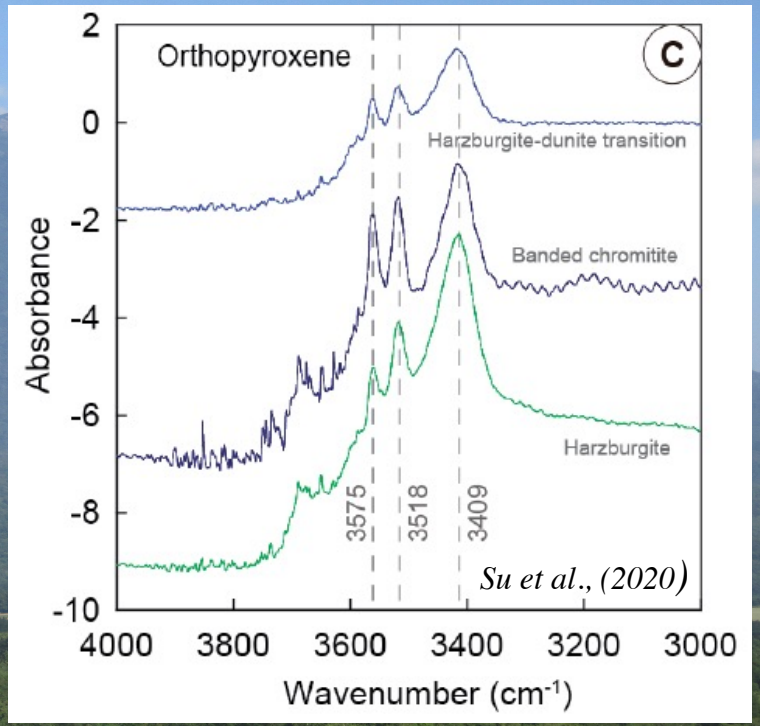
Deep Continental Lithosphere



Up

Deep Oceanic Lithosphere

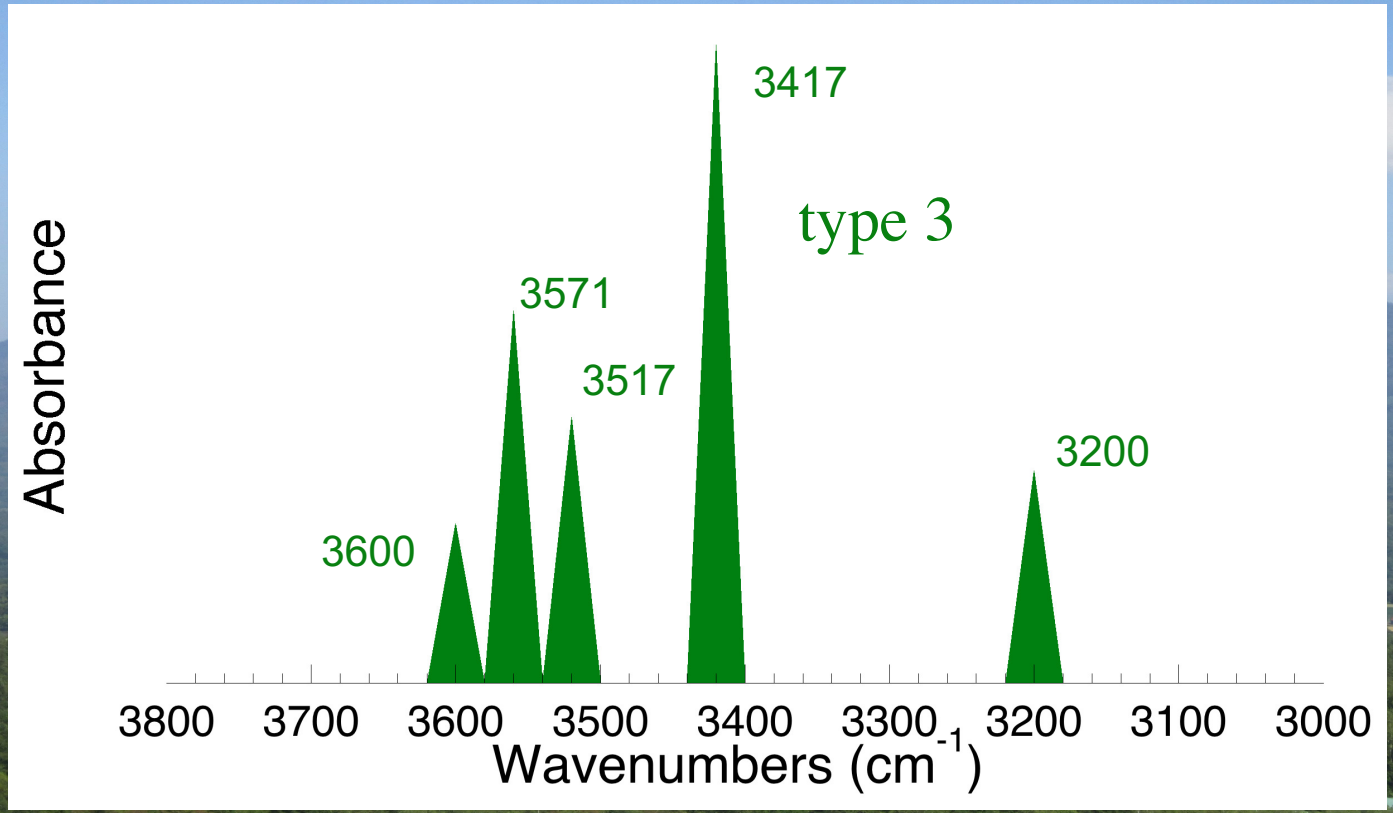




One type of signature: type 3

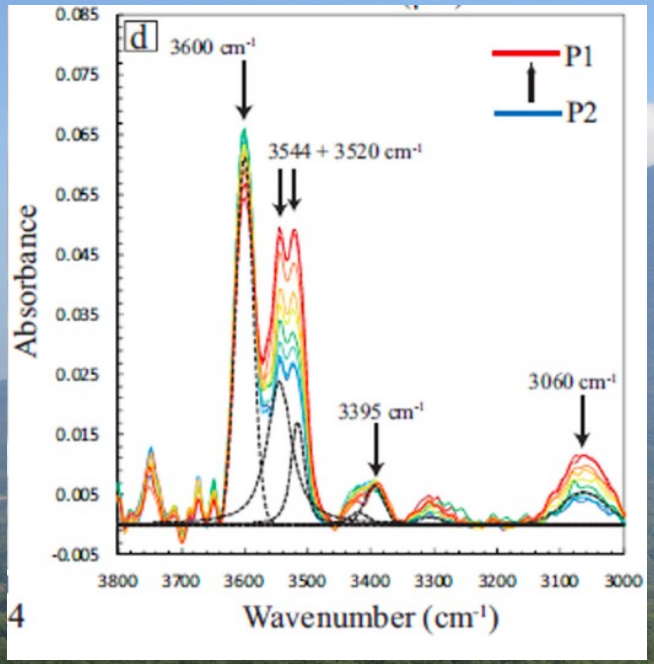
Abyssal mid-Atlantic peridotites / Kizildag ophiolite (Turkey)

Deep Oceanic Lithosphere

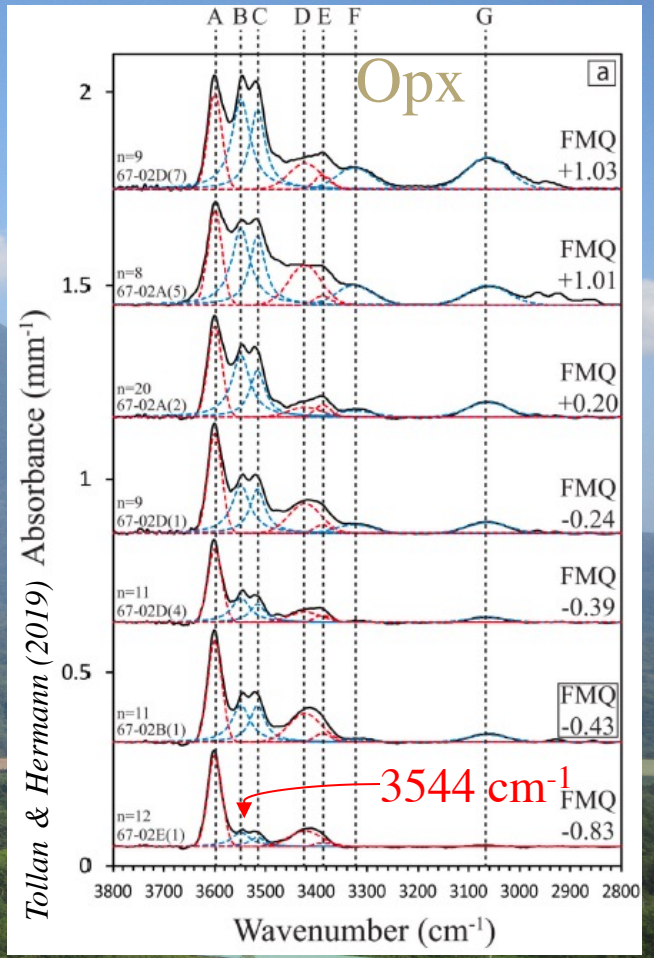


Up

Mantle Xenoliths from Island Arc



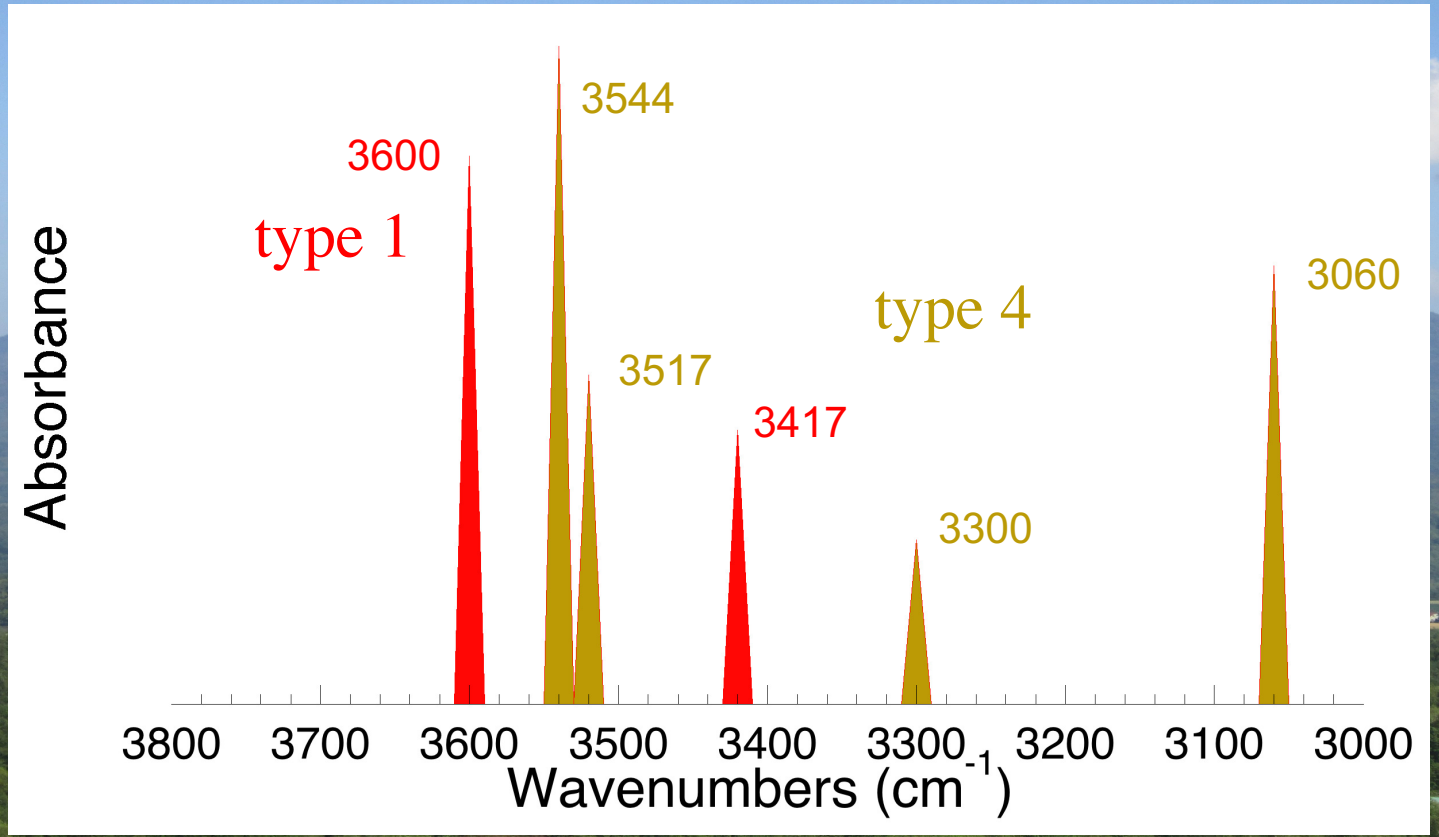
Record progressive oxidation of the mantle along melt ascent.



Tow types of signatures: type 1 & type 4

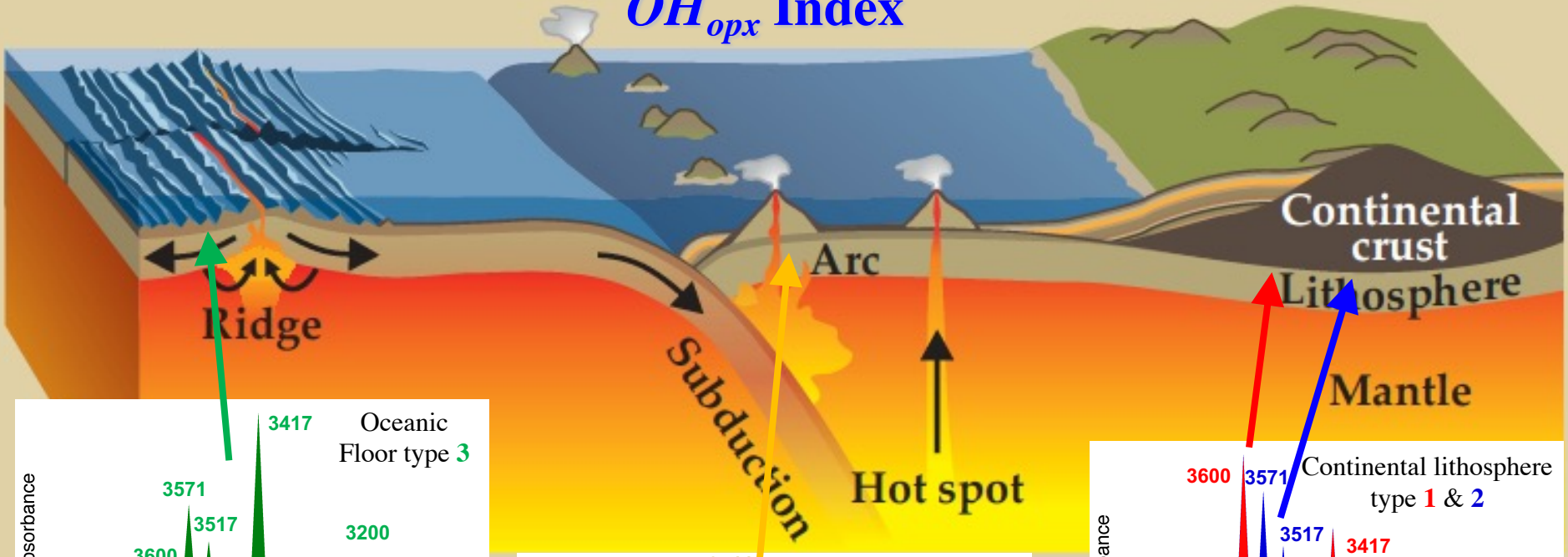
Harzburgites xenoliths from the West Bismarck island arc

Mantle Xenoliths from Island Arc

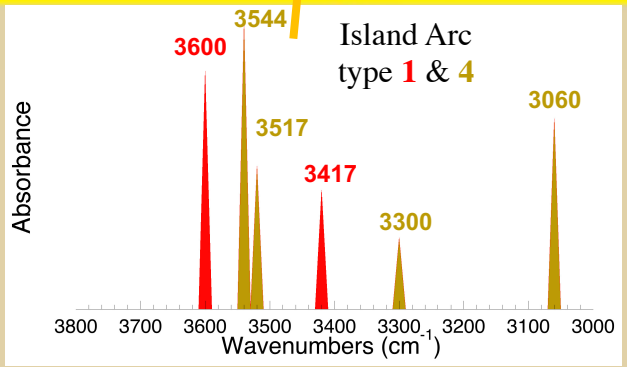


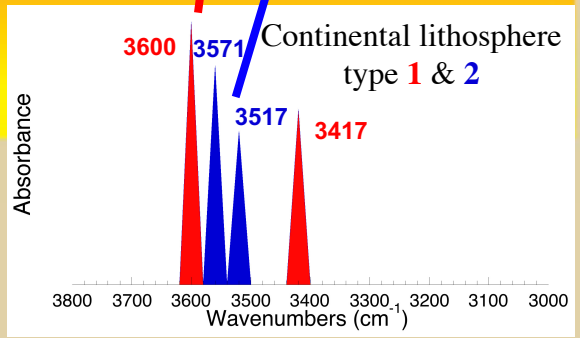
Up

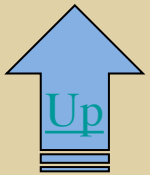
OH_{opx} Index


Ridge
Subduction
Arc
Hot spot
Continental crust
Lithosphere
Mantle

Oceanic Floor type 3
3417
3571
3517
3600
3200
Absorbance
3800 3700 3600 3500 3400 3300 3200 3100 3000
Wavenumbers (cm-1)


Island Arc type 1 & 4
3544
3600
3517
3060
3417
3300
Absorbance
3800 3700 3600 3500 3400 3300 3200 3100 3000
Wavenumbers (cm-1)


Continental lithosphere type 1 & 2
3600
3571
3517
3417
Absorbance
3800 3700 3600 3500 3400 3300 3200 3100 3000
Wavenumbers (cm-1)


Up

Conclusion

1) Two types of signatures in opx and cpx from continental lithosphere, type 1 and type 2
2) One type of signature in oceanic lithosphere: type 3
3) Two types of signatures in xenoliths from island arc : types 1 and 4.

It remains now:

- to identify the OH defects associated to these specific signatures;
- to identify the metasomatic stages associated to them.

Up