



# L'apport de la microscopie électronique à l'étude des météorites

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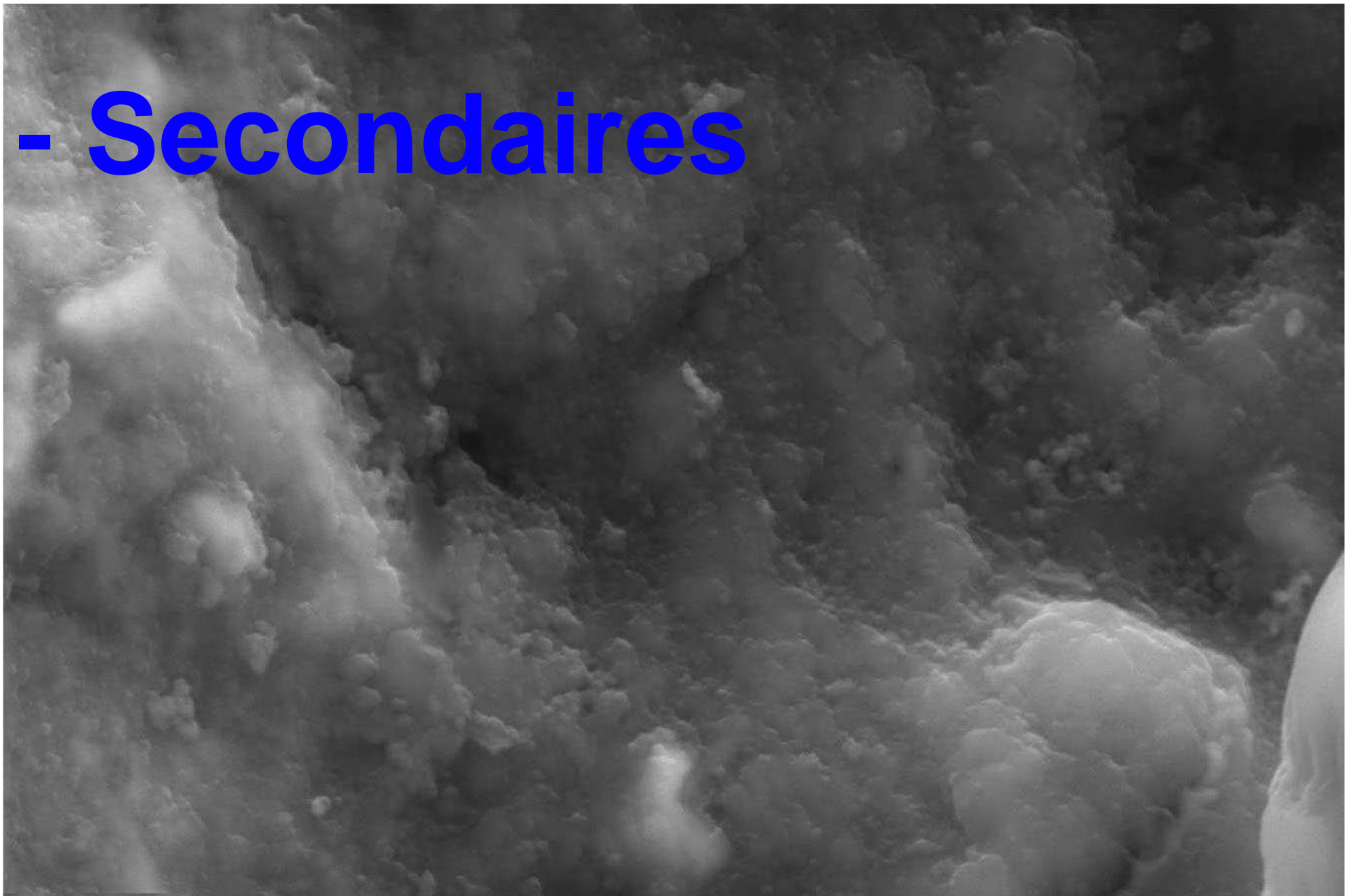
# **L'apport de la microscopie électronique à l'étude des météorites**

- **L'imagerie électronique**
- **L'analyse EDS**
- **La microfluorescence X**
- **La cathodoluminescence**
- **La microspectrométrie Raman**
- **L'EBSD**

# L'imagerie électronique

- - Secondaires
- - BSE
- - faible tension
- - vide partiel

# - Secondaires



1  $\mu\text{m}$



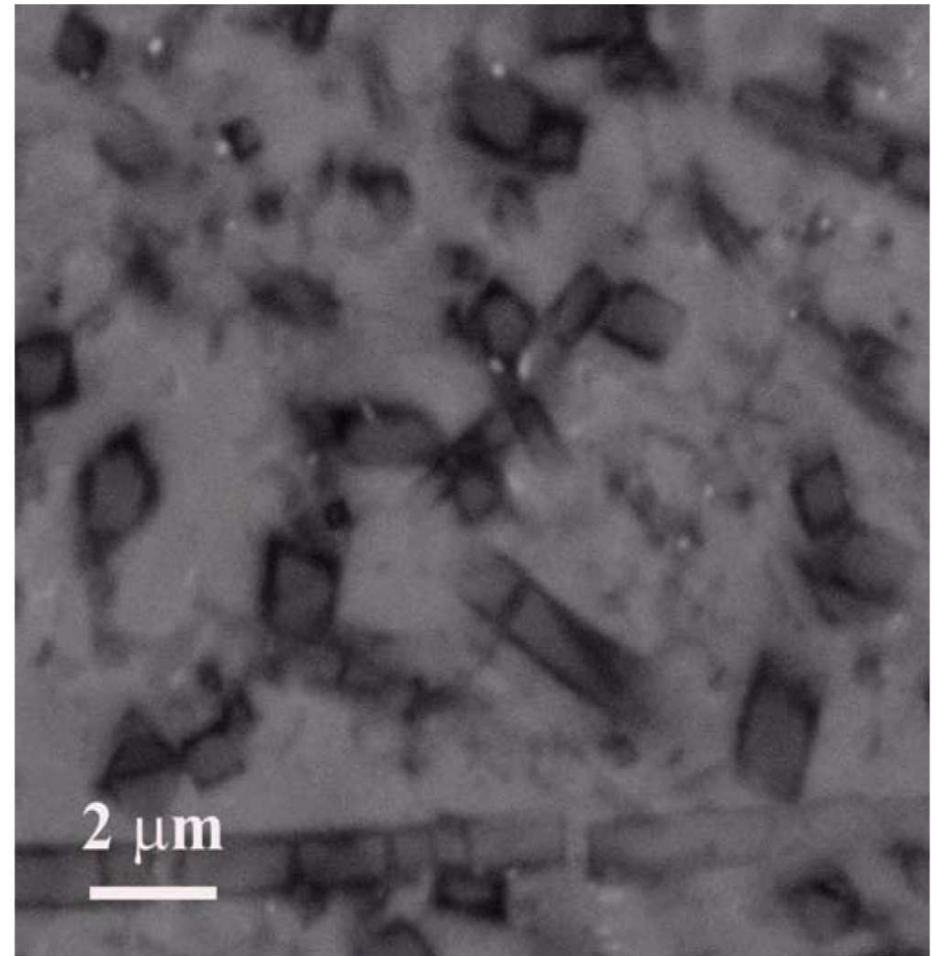
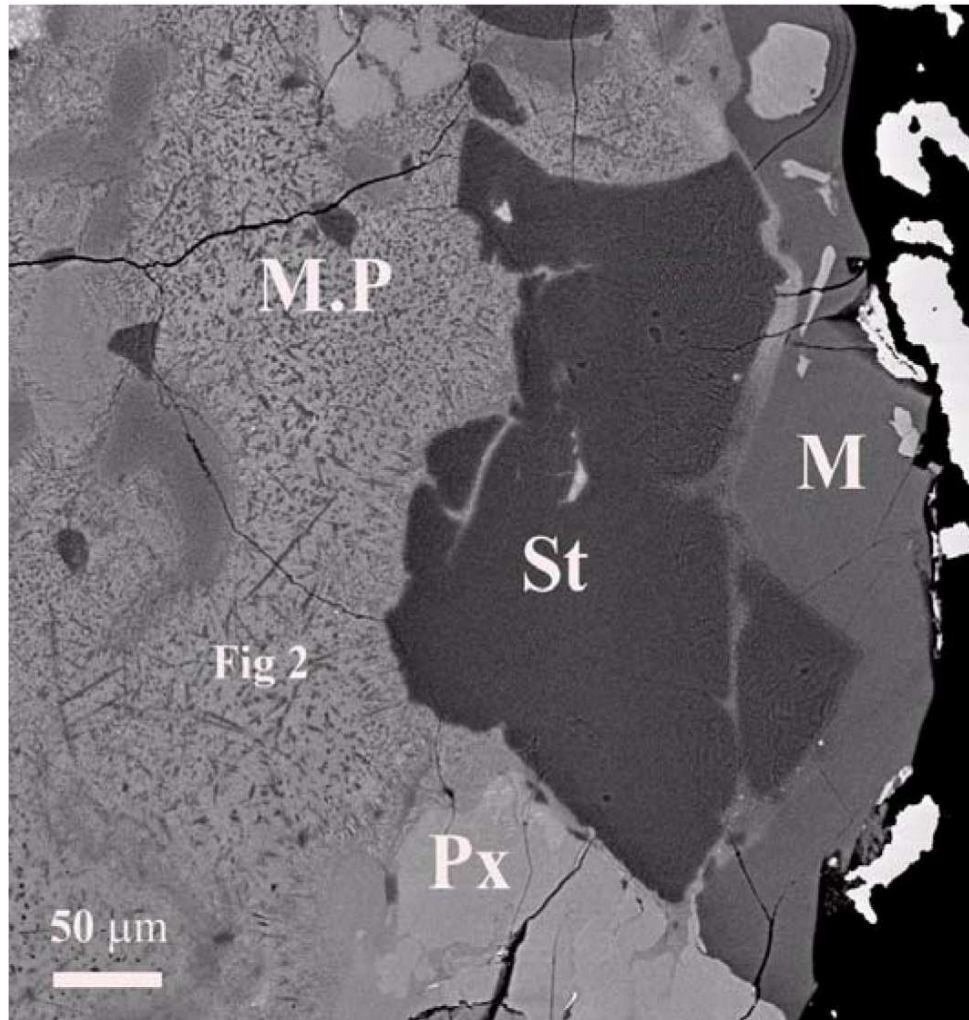
EHT = 15.00 kV

WD = 10 mm

Date :23 Jan 2007

# -BSE

Chennaoui et al (2008) MAPS



- - **faible tension**
- - **vide partiel**

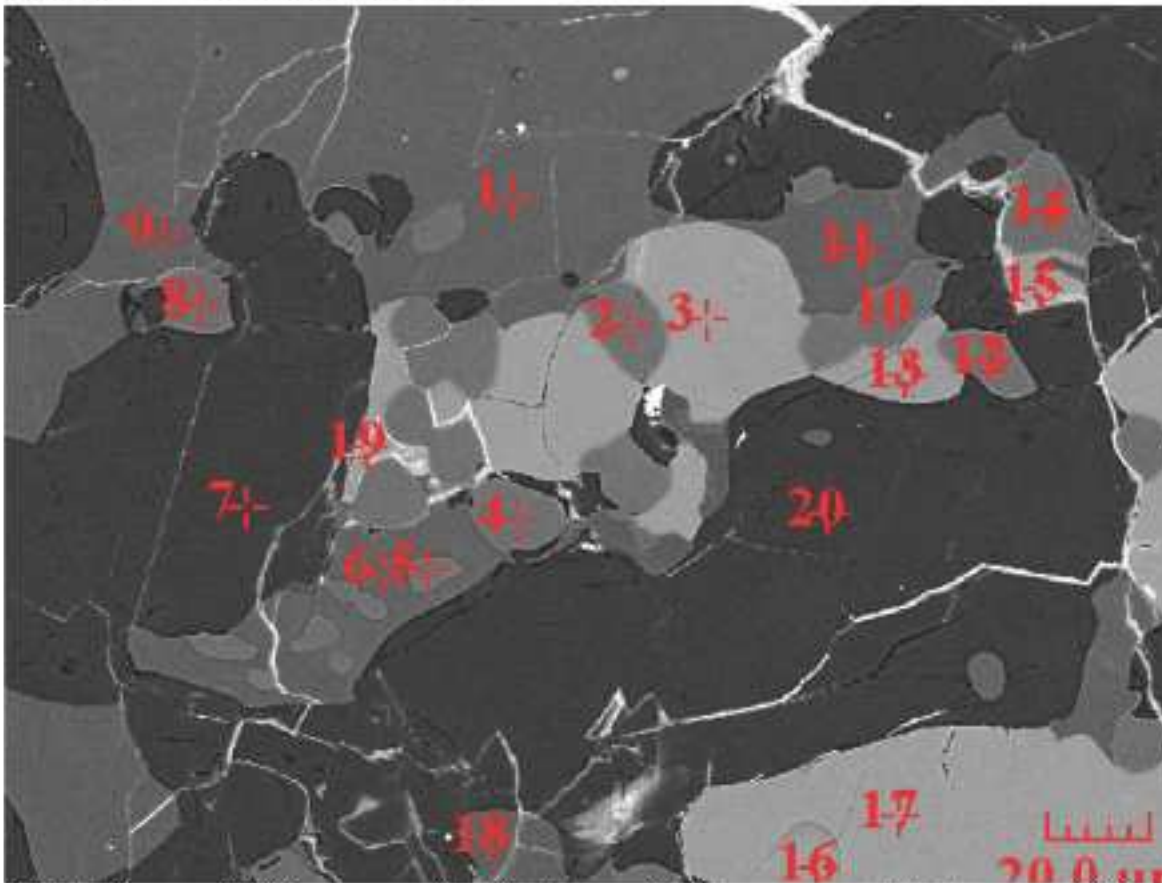
# L'analyse EDS

- **analyse chimique ponctuelle**
- **cartographie chimique**

# Analyse chimique ponctuelle

Element	KRatio	Wt%	At%	Compound	Cmpd Wt%	ChiSquared	Net (cps)
Ca	0.0084	0.91	0.50	CaO	1.27	0.99	45.9
Mg	0.1127	14.86	13.38	MgO	24.63	2.15	1071.9
Al	0.0043	0.60	0.49	Al <sub>2</sub> O <sub>3</sub>	1.14	2.15	40.9
Si	0.2163	25.38	19.79	SiO <sub>2</sub>	54.30	2.15	1995.5
Na	0.0026	0.33	0.31	Na <sub>2</sub> O	0.44	2.15	17.9
Fe	0.1216	13.34	5.23	FeO	17.16	1.33	249.2
Mn	0.0061	0.63	0.25	MnO	0.81	1.33	14.1
O	0.0000	43.71	59.81			47.48	1596.3
<b>Total</b>	<b>0.4720</b>	<b>99.75</b>	<b>99.75</b>	<b>Total</b>	<b>99.75</b>	<b>18.78</b>	

File: g:\clients\BACHAR\12MAR09\FM15\_2\_SE.tif  
 Collected: mars 12, 2009 10:49:31

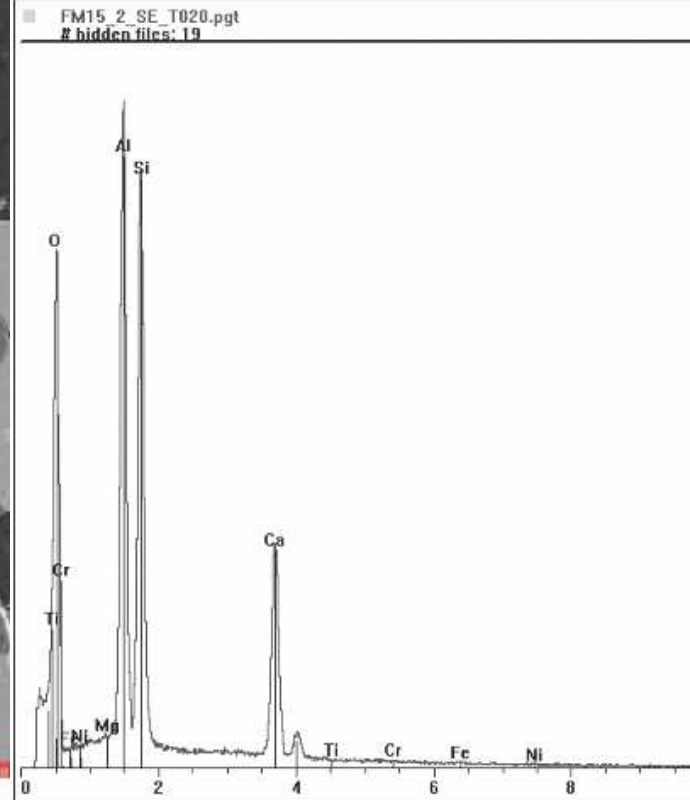


Width(μm): 233.78      Height(μm): 175.34      μm/pixel: 0.228

Scope magnification: 476X

File: g:\clients\BACHAR\12MAR09\FM15\_2\_SE\_T020.pgt  
 Collected: mars 12, 2009 10:39:36

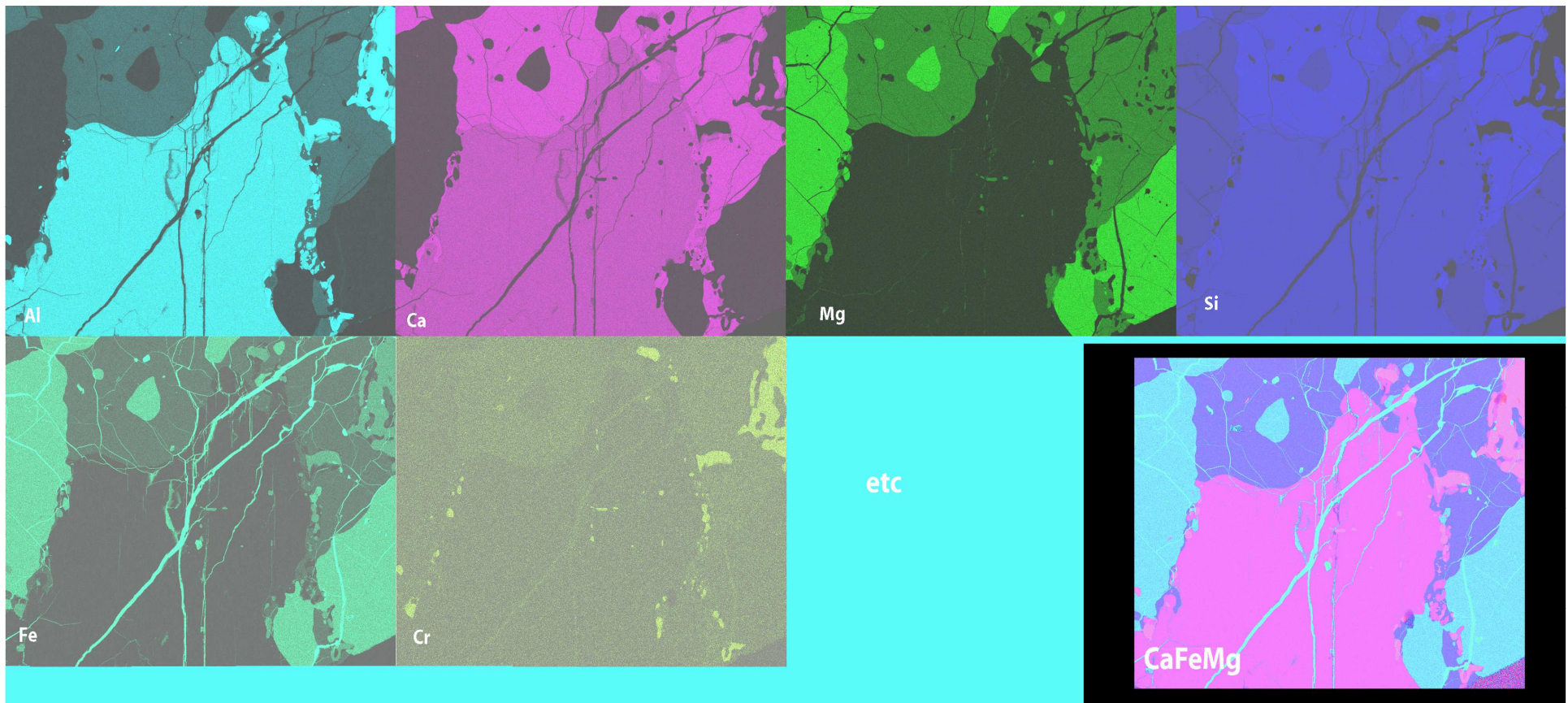
Live Time: 5.00      Count Rate: 50700      Dead Time: 0.00 %  
 Beam Voltage: 15.00      Beam Current: 0.53      Takeoff Angle: 24.94



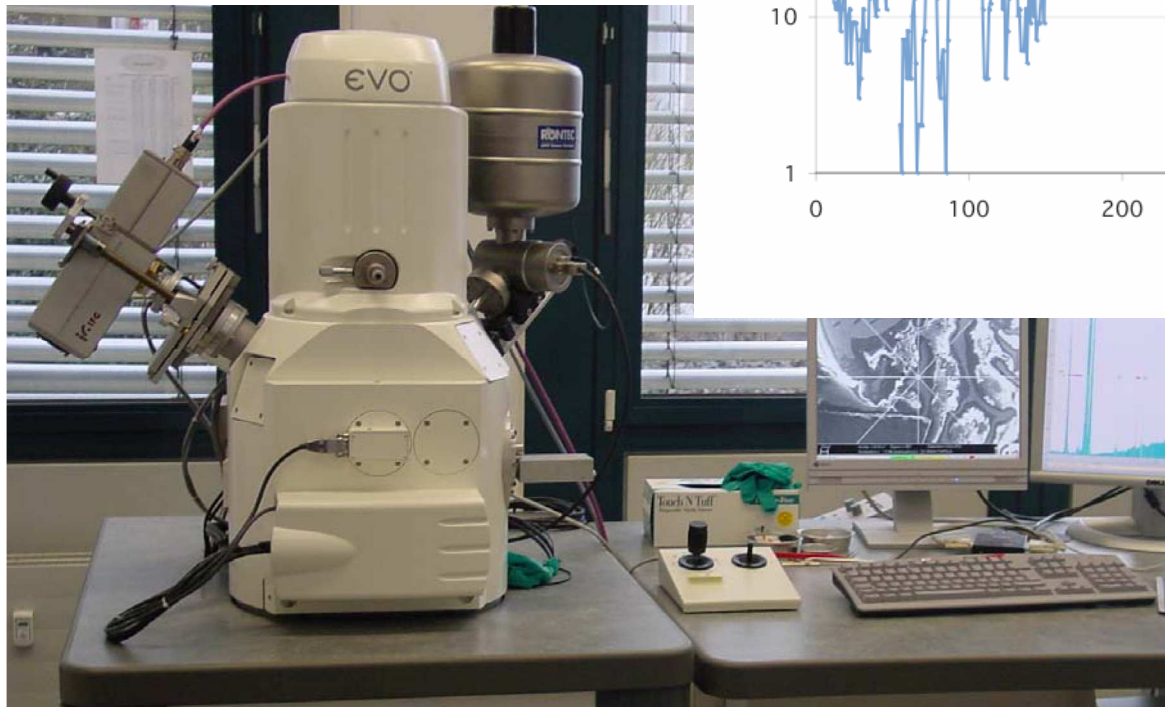
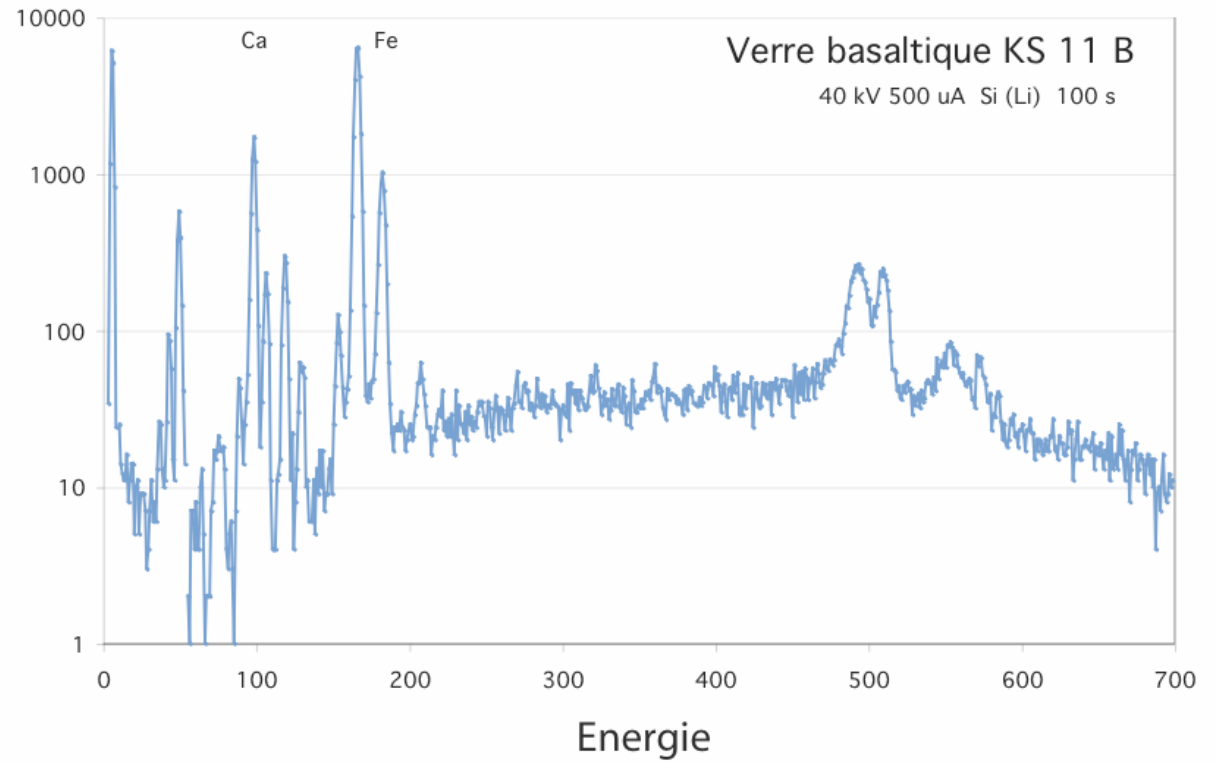
# Cartographie chimique

-qualitative

-quantitative



# La microfluorescence X

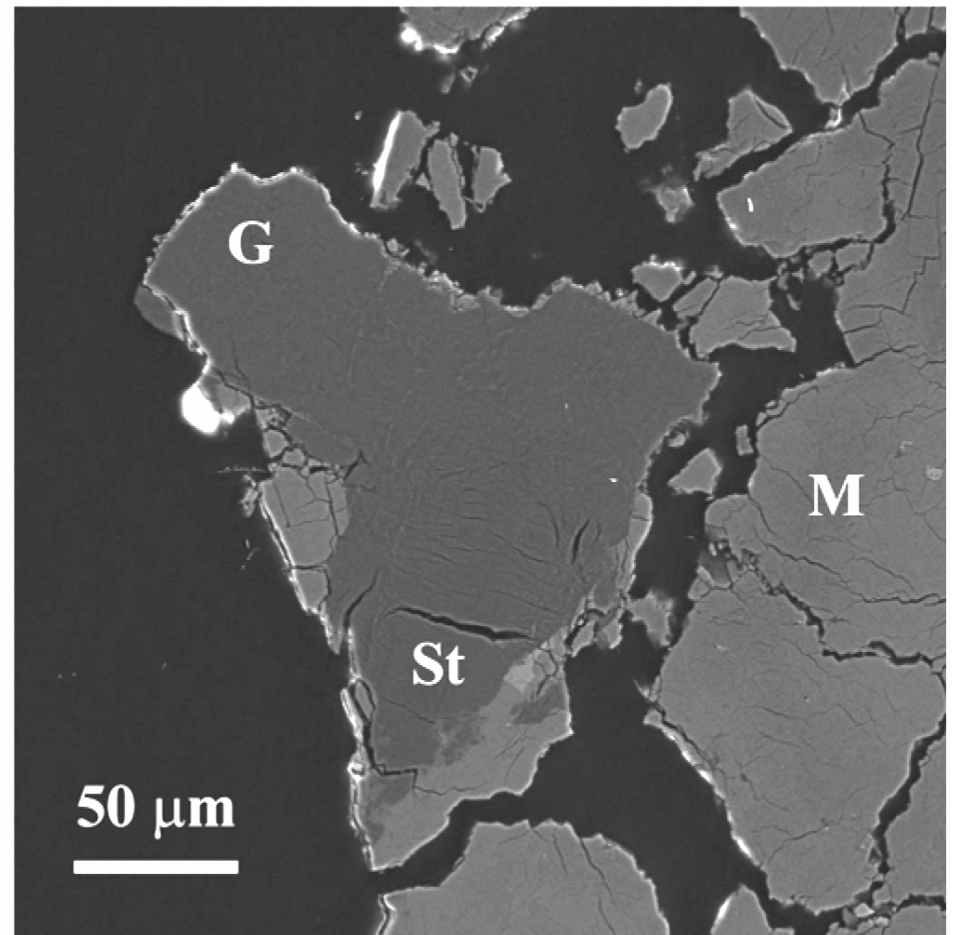
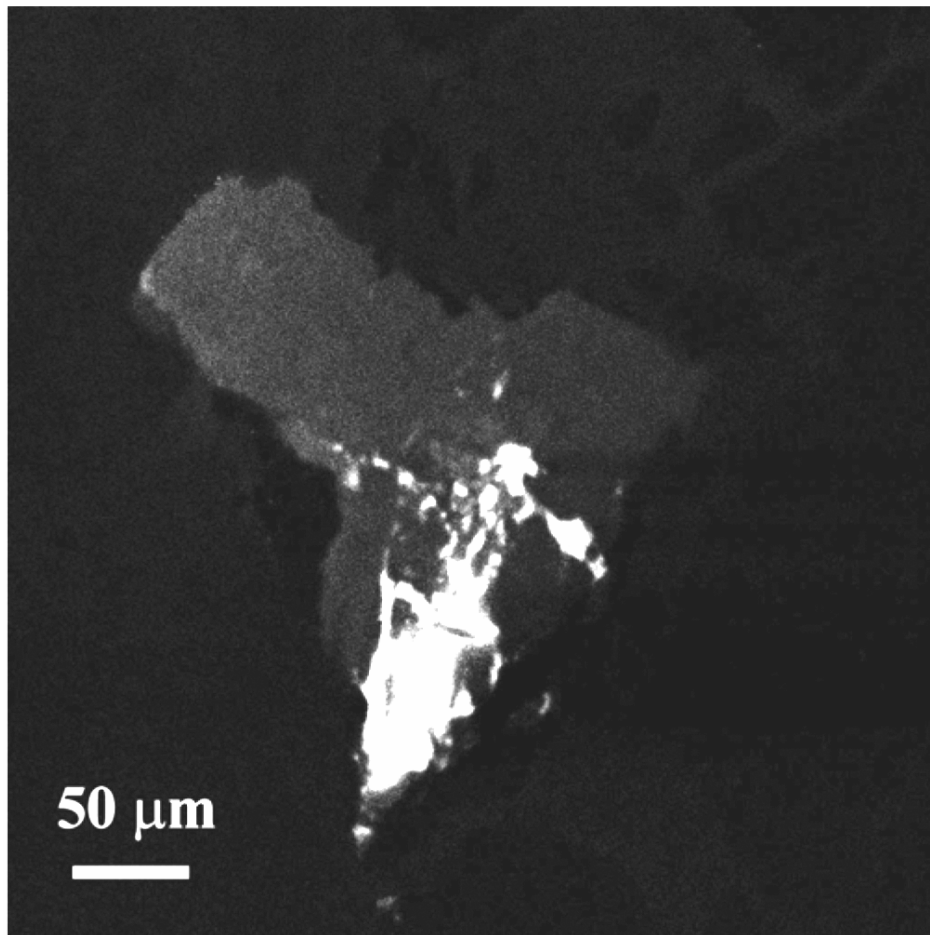


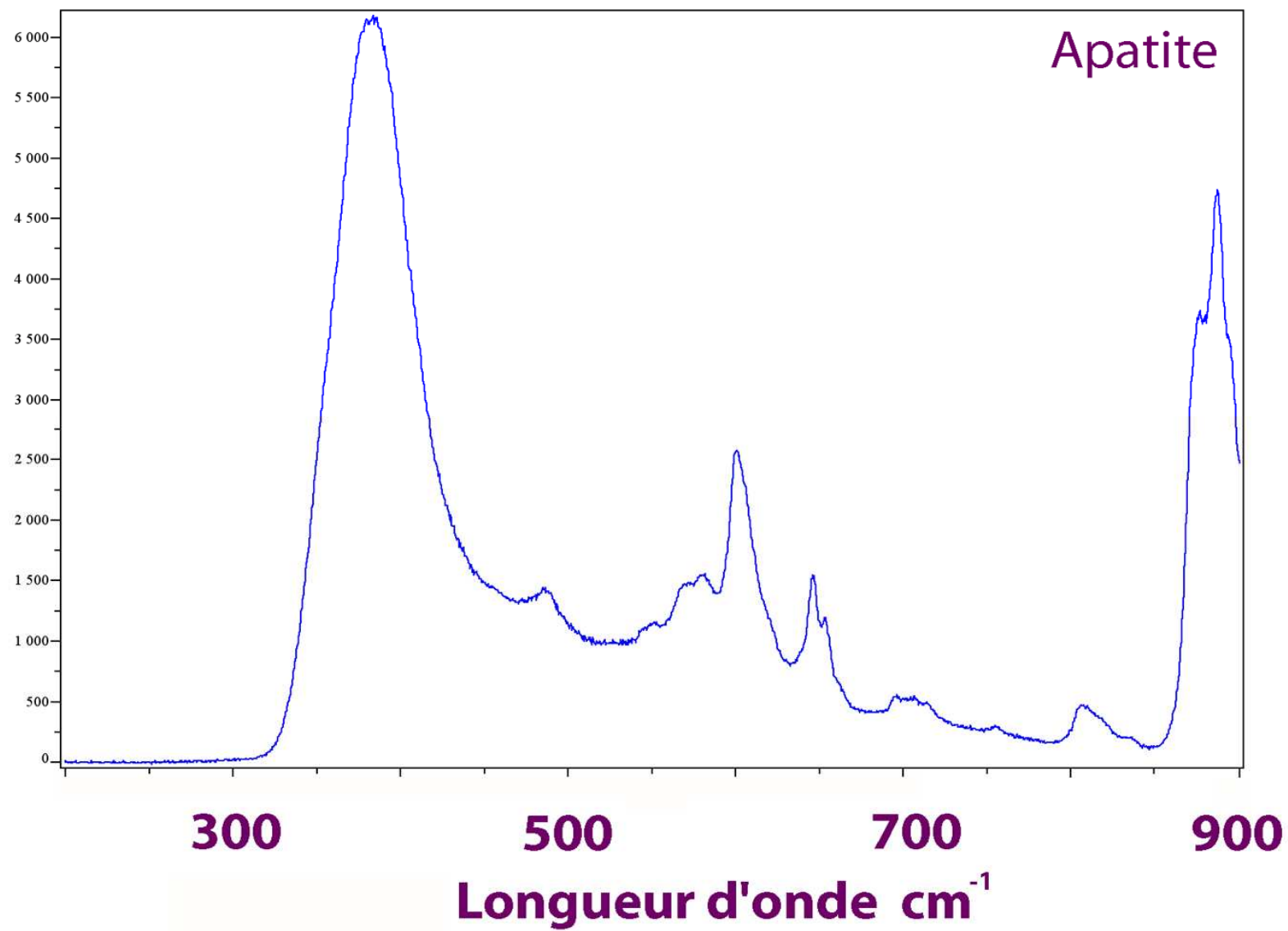
# La cathodoluminescence

- **Imagerie**
- **Spectroscopie**
- **- mode ponctuel**
- **- mode balayage**

# Exemple : Spéciation de la silice

Chennaoui et al. (2005) MAPS

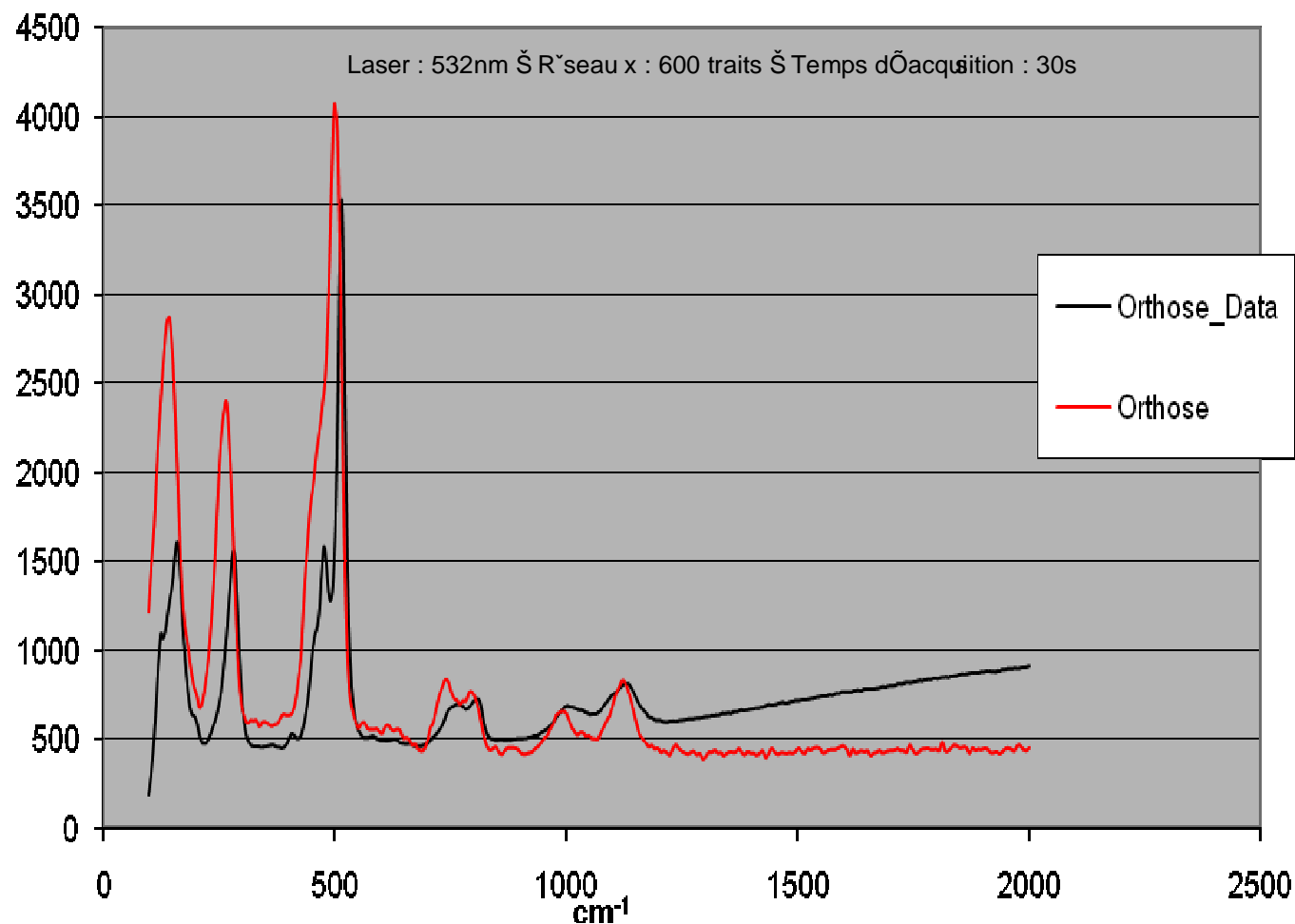




# La microspectrométrie Raman

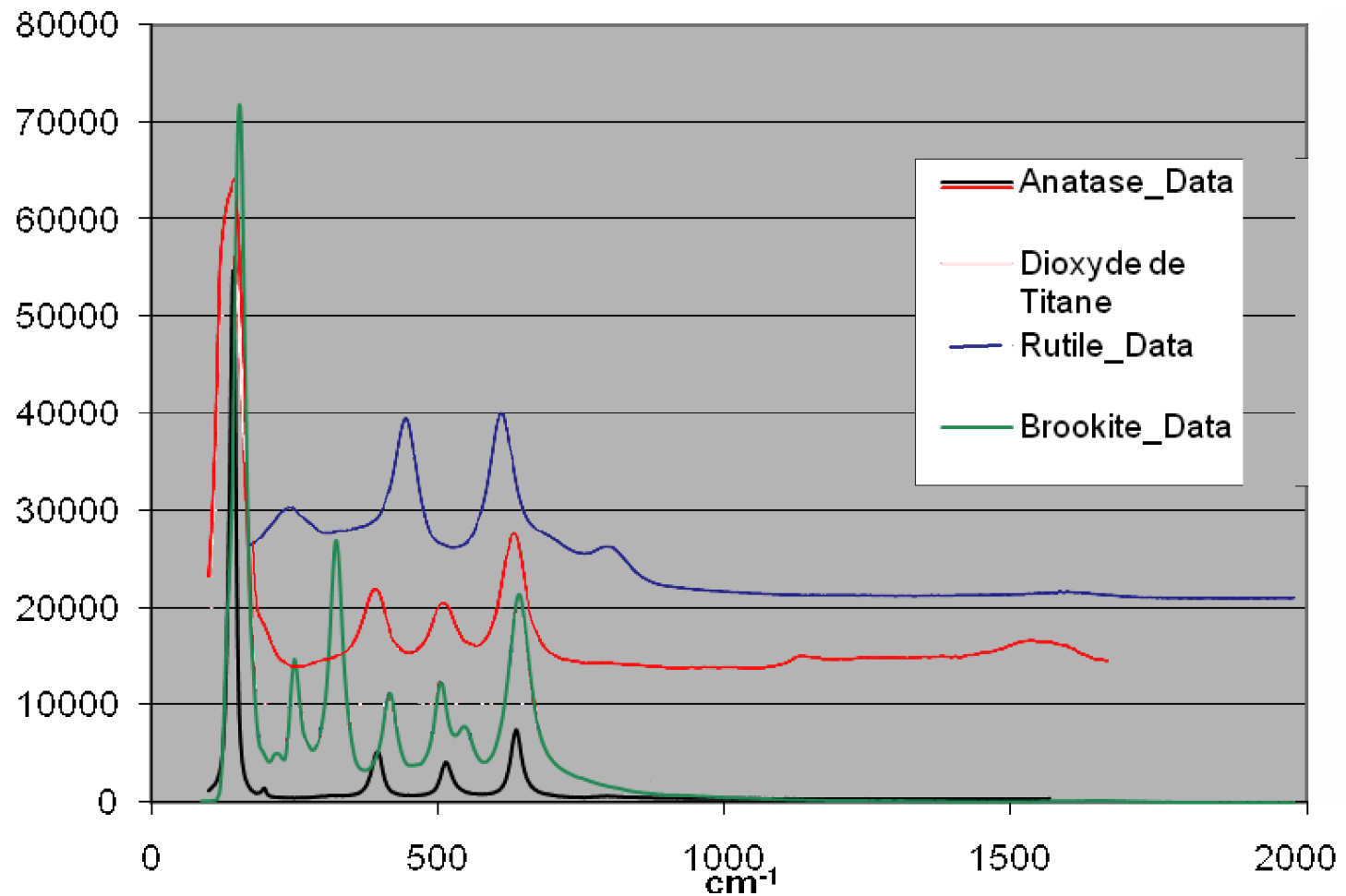
Identification de phase  
Cartographie

Spectres Raman de l'Orthose



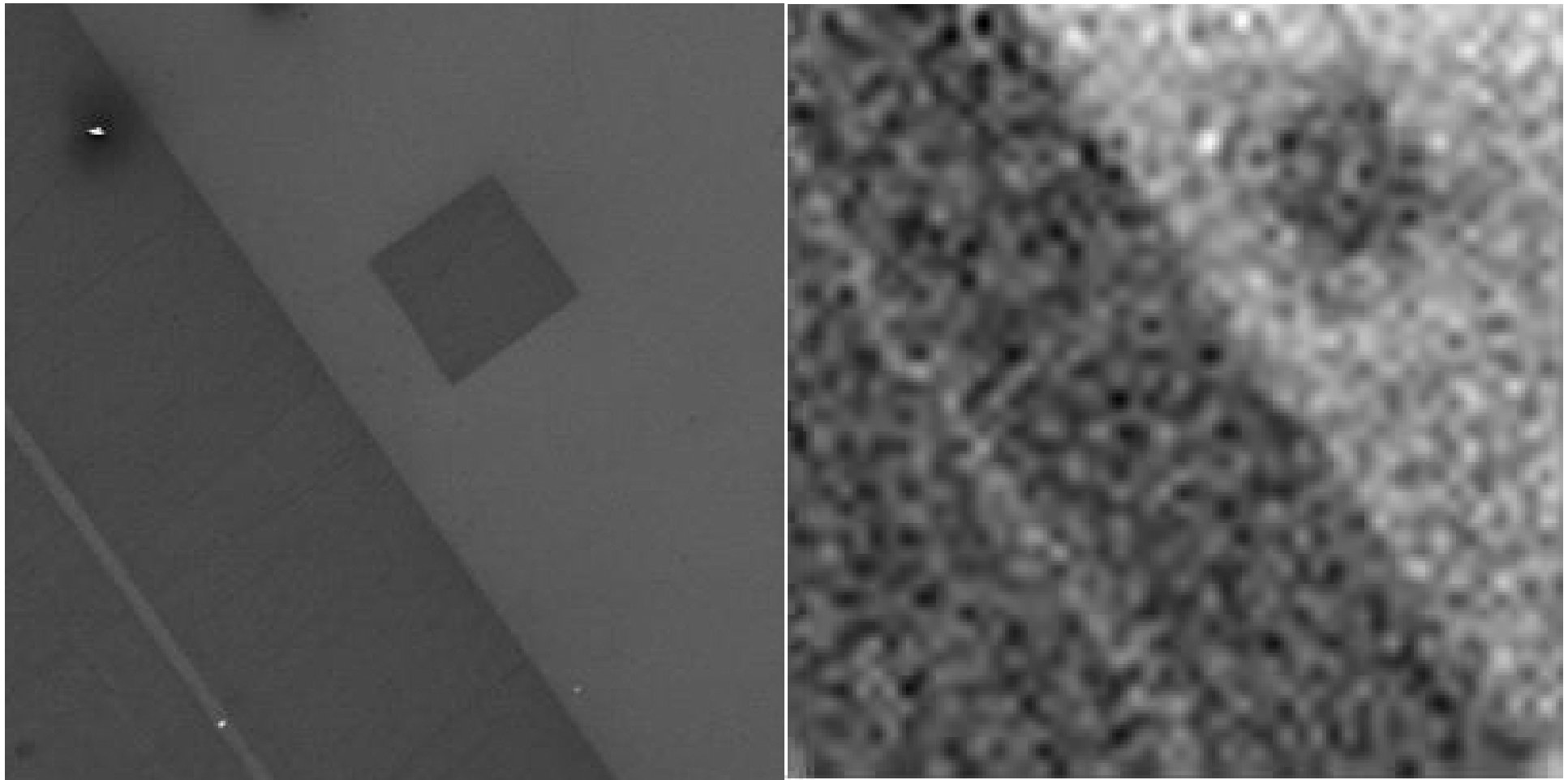
# Spéciation

## Spectres Raman du Dioxyde de Titane



# Cartographie du silicium

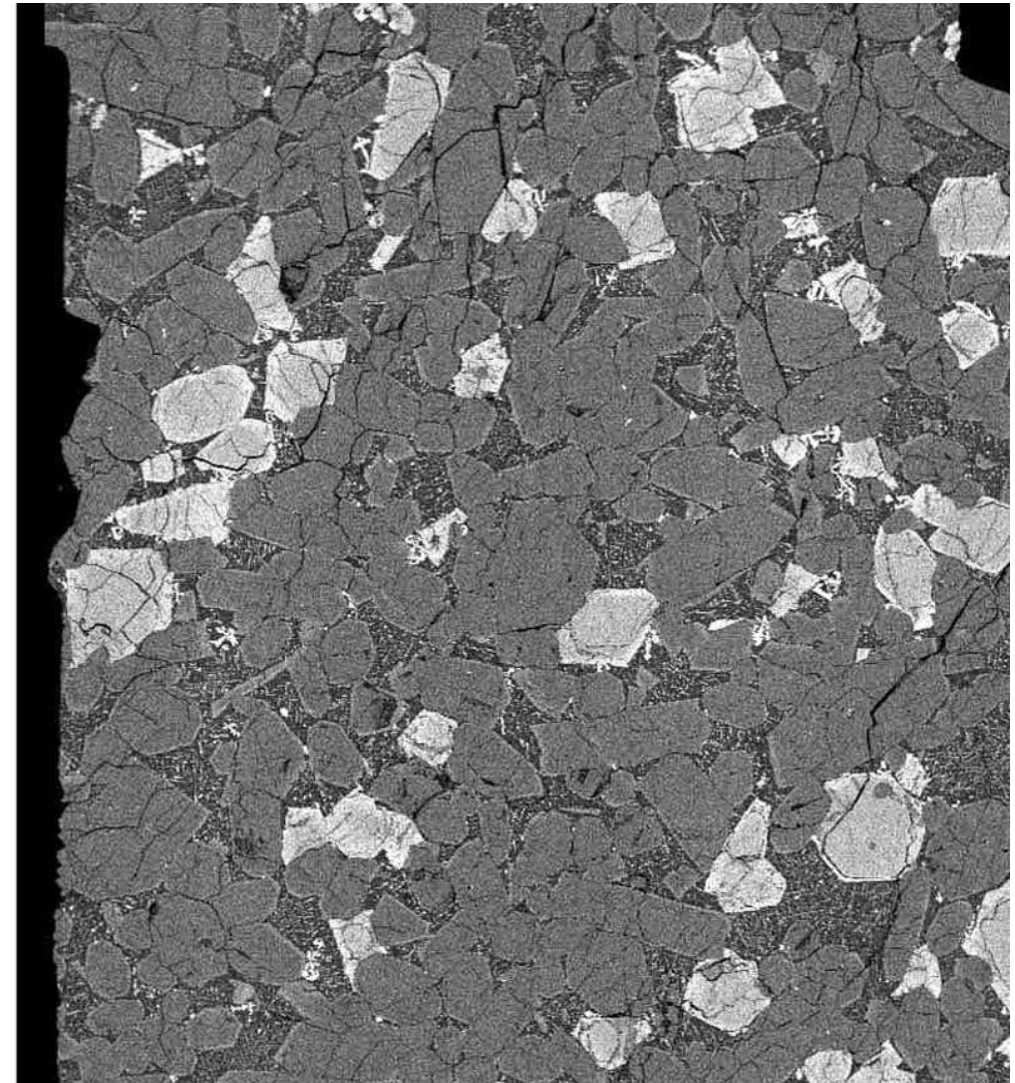
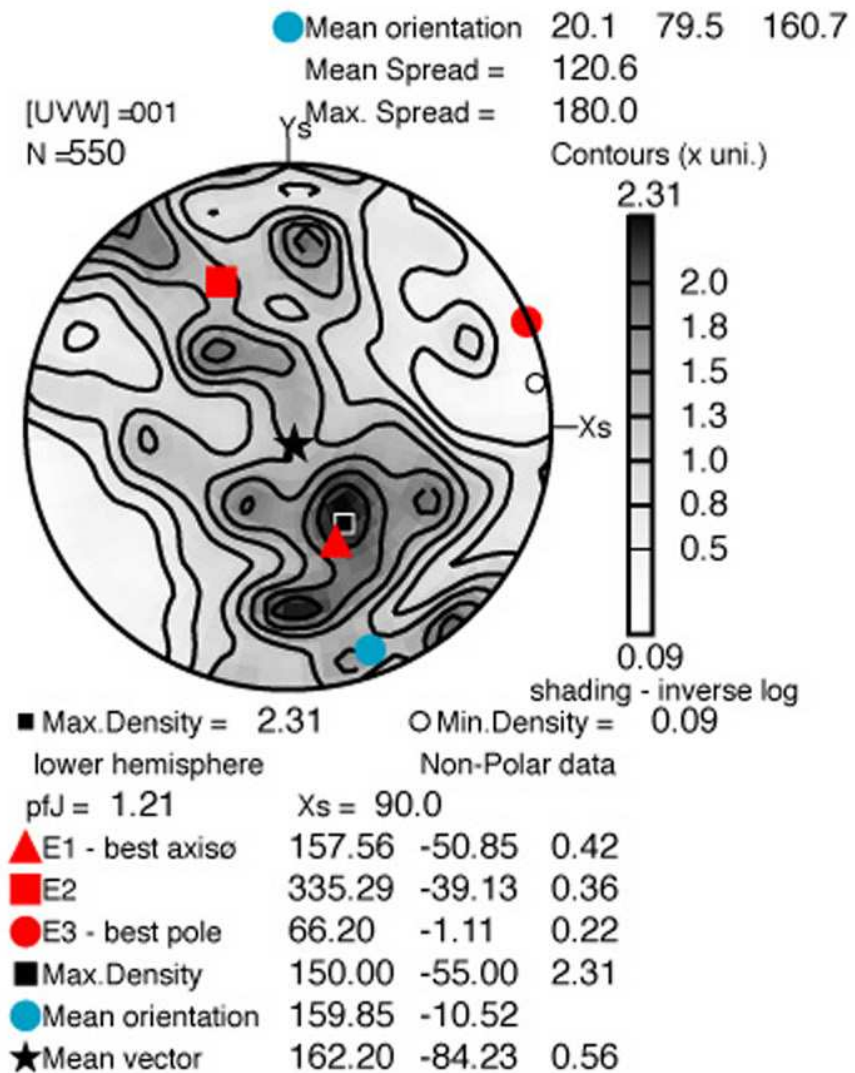
1.4 x 1.4 mm<sup>2</sup>



# L'EBSD

B. Ildefonse USTL

- Identification de phases
- Analyse de texture
- Cartographie



# Conclusions

- **Neccessité de couplage de plusieurs méthodes analytiques** (Imagerie, Raman, CL ...)
- **Cartographie quantitative**
  - en balayage
    - pb de focalisation, déformation
  - asservissement de la platine
    - faible grossissement
    - déplacements importants
  - traitement informatiques des données