

Dipartimento di Scienze della Terra - Università di Parma

16 Aprile 2008

# La tecnica SEM-EBSD ed alcune sue applicazioni nello studio dei materiali geologici: dalla petrografia all'archeometria



Dr. Luca Peruzzo

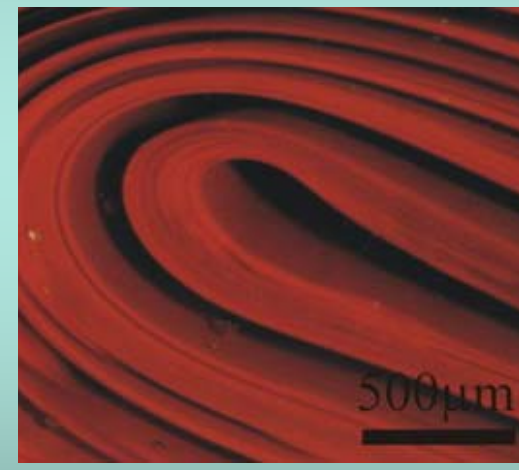
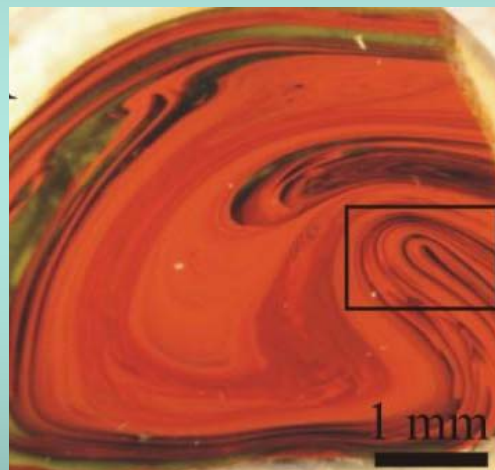
CNR - Istituto di Geoscienze e Georisorse - Sez. Padova

## APPLICAZIONI - alcuni esempi

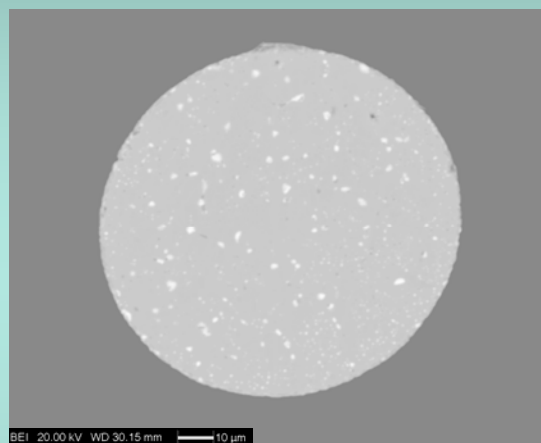
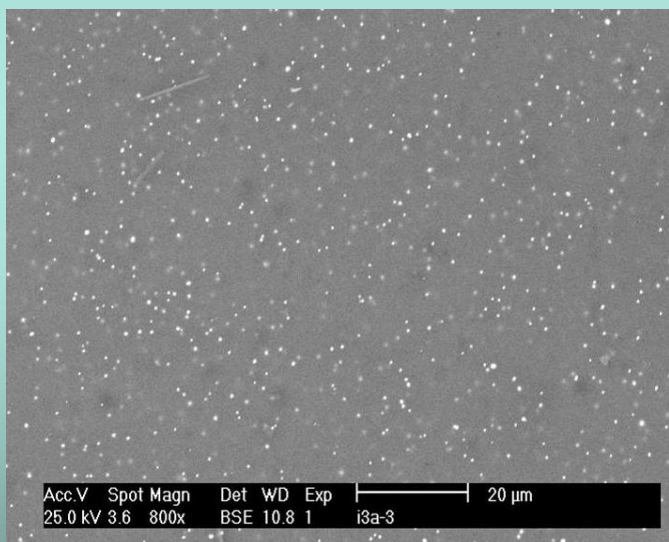
- microstrutture in rocce e minerali: granati
- microstrutture in metalli: bronzi
- riconoscimento di fase: pigmenti

- Materiale vetroso per mosaici  
(Cattedrale di Siena, XIII-XIV sec)
- Ceramica graffita  
(Castelfiorentino, XV-XVII sec)
- Ceramica decorata  
(Merv, Turkmenistan, IX-X sec)

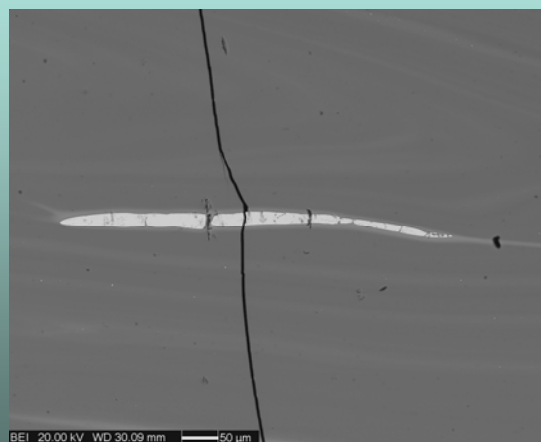
Pani di vetro per la produzione di tessere  
da mosaico: **rosso opaco**



# Pani di vetro per la produzione di tessere da mosaico: rosso opaco



Rame



Ferro

# Pani di vetro per la produzione di tessere da mosaico: **rosso opaco**

Cu (nativo)

CuO (tenorite)

Cu<sub>2</sub>O (cuprite)

CuX (bronzo)

.....

**Rame**

Fe (nativo)

FeO (wustite)

Fe<sub>2</sub>O<sub>3</sub> (ematite)

Fe<sub>3</sub>O<sub>4</sub> (magnetite)

FeO(OH) (idrossidi)

.....

**Ferro**

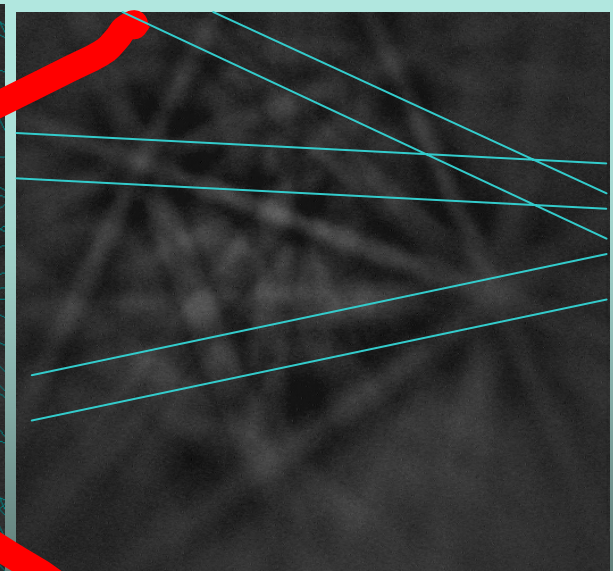
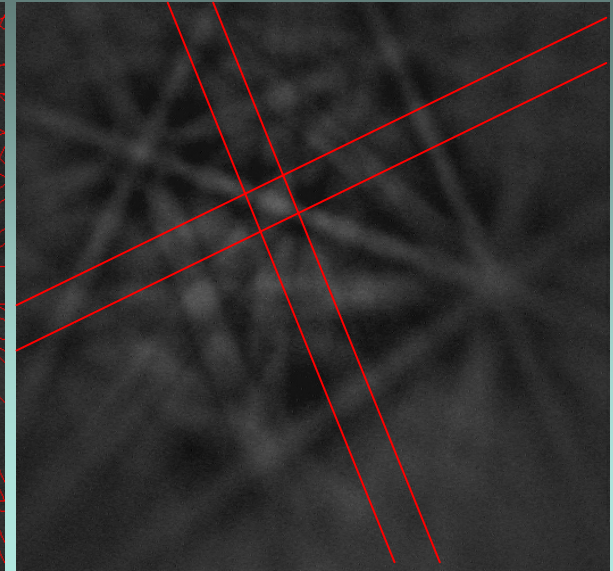
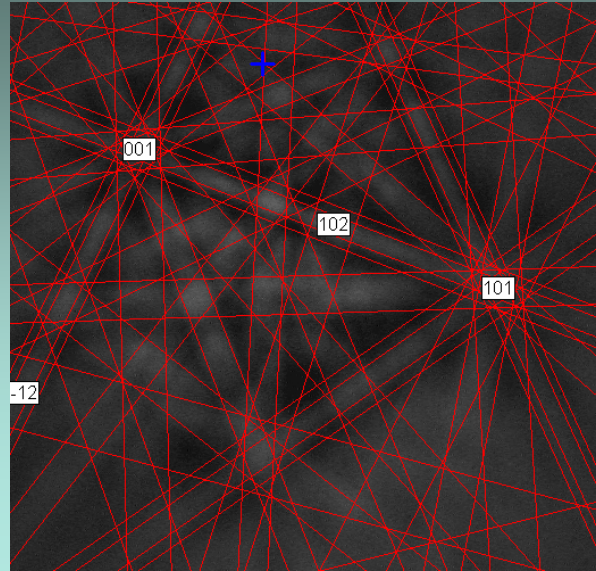
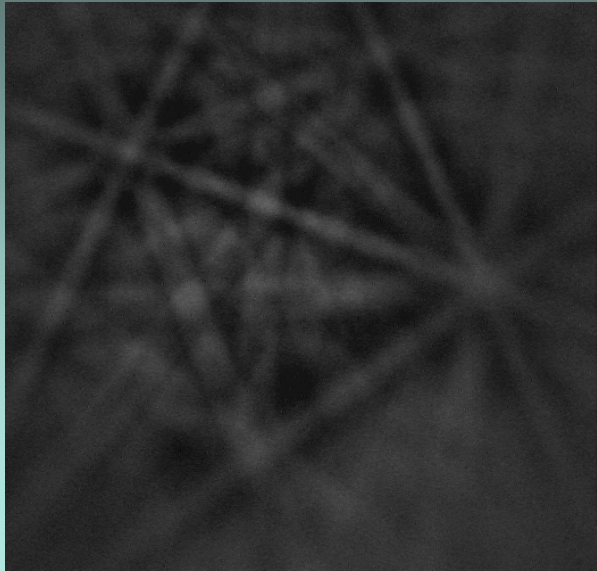
# Pani di vetro per la produzione di tessere da mosaico: **rosso opaco**

Name	Symbol	Symmetry Class	Space Group	a	b	c	$\alpha$	$\beta$	$\gamma$
Copper	Cu	cubic	Fm-3m	3.61496 Å	3.61496 Å	3.61496 Å	90.00°	90.00°	90.00°
Tenorite	CuO	monoclinic	C 2/c	4.653 Å	3.410 Å	5.108 Å	90.00°	99.48°	90.00°
Cuprite	Cu <sub>2</sub> O	cubic	P n3	4.2696 Å	4.2696 Å	4.2696 Å	90.00°	90.00°	90.00°
Bronze	Cu <sub>3</sub> Sn	cubic	Fm-3m	6.12 Å	6.12 Å	6.12 Å	90.00°	90.00°	90.00°
Hematite	Fe <sub>2</sub> O <sub>3</sub>	trigonal	R-3c	5.038 Å	5.038 Å	13.772 Å	90.00°	90.00°	120.00°
Magnetite	Fe <sub>3</sub> O <sub>4</sub>	cubic	Fd3m	8.3958 Å	8.3958 Å	8.3958 Å	90.00°	90.00°	90.00°



Rame

rame nativo

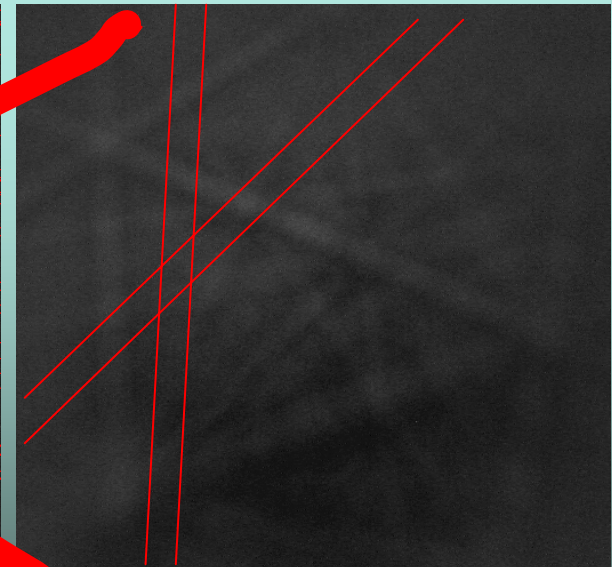
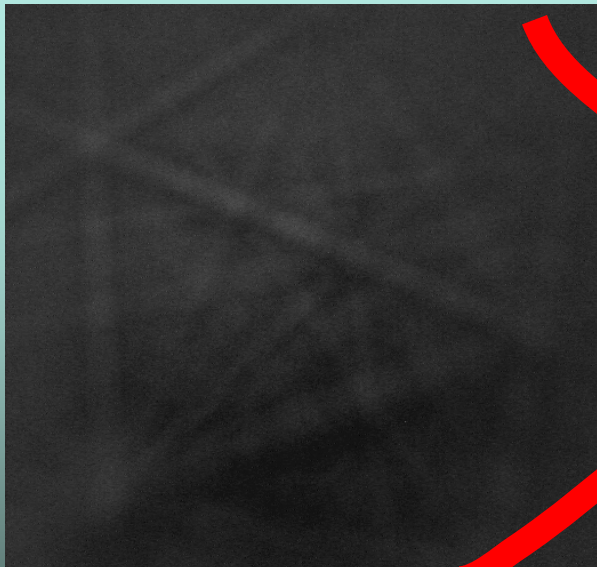
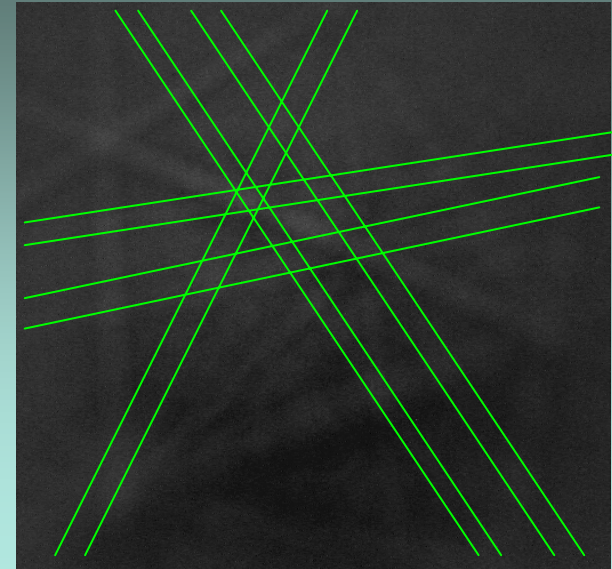
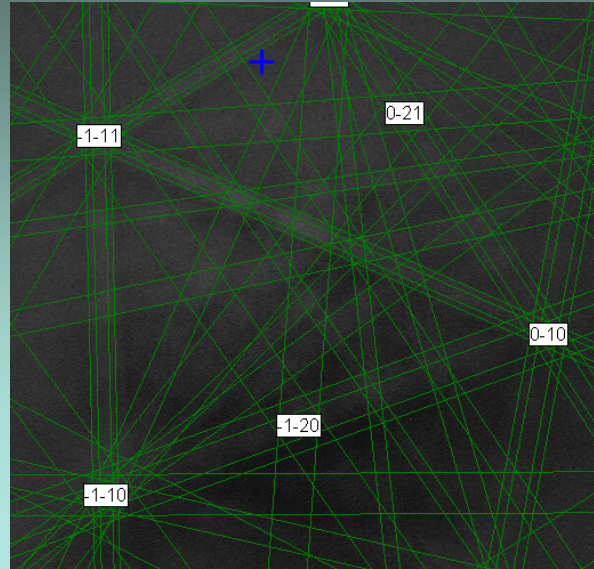
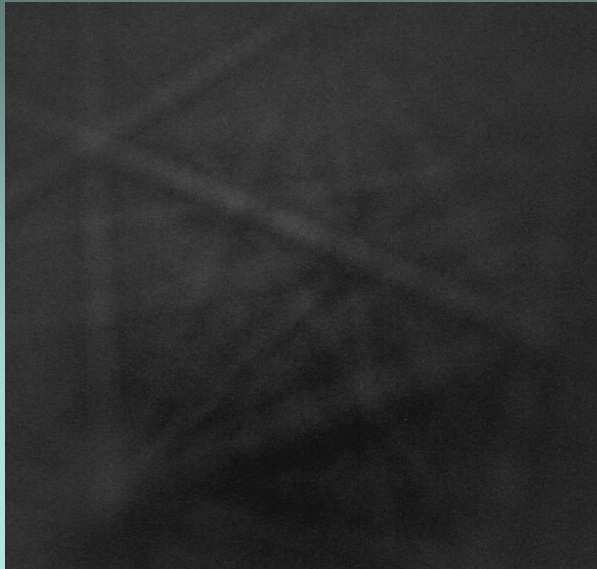


cuprite



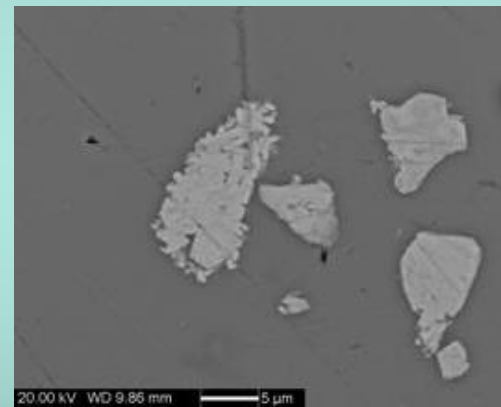
Ferro

magnetite



ematite

# Ceramica graffita: pigmento giallo a base di antimoniato di piombo

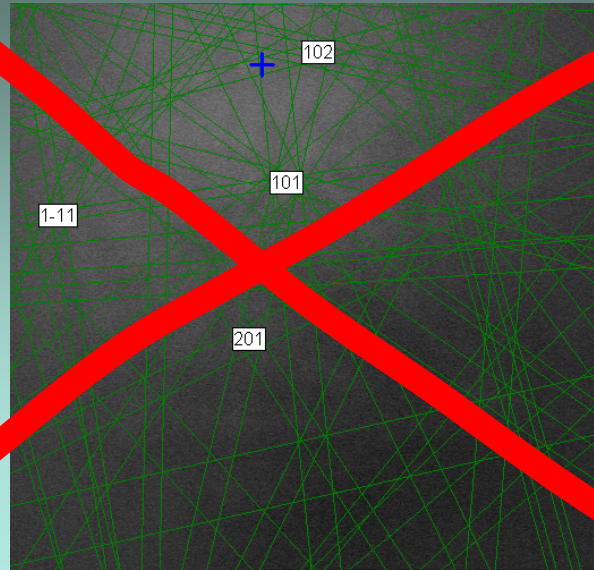


# Ceramica graffita: pigmento giallo a base di antimoniato di piombo

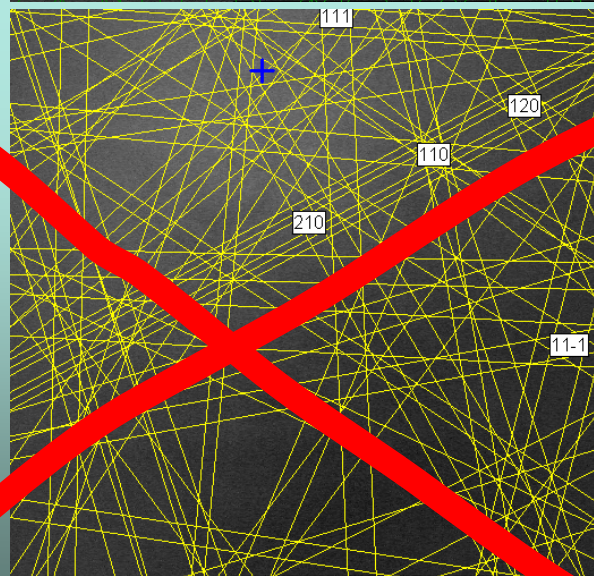
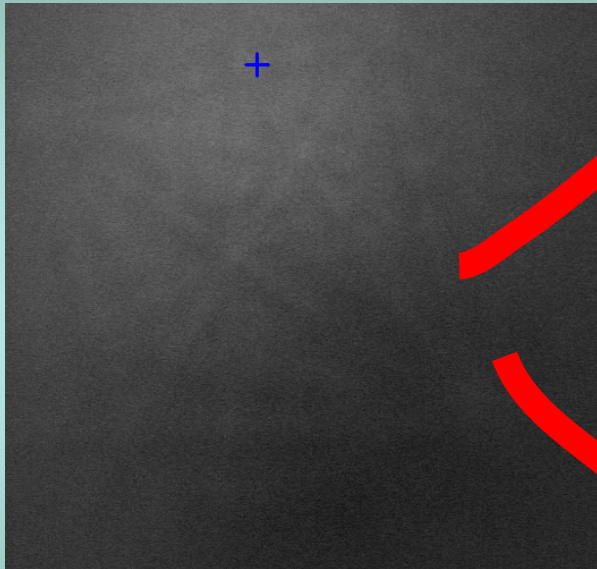
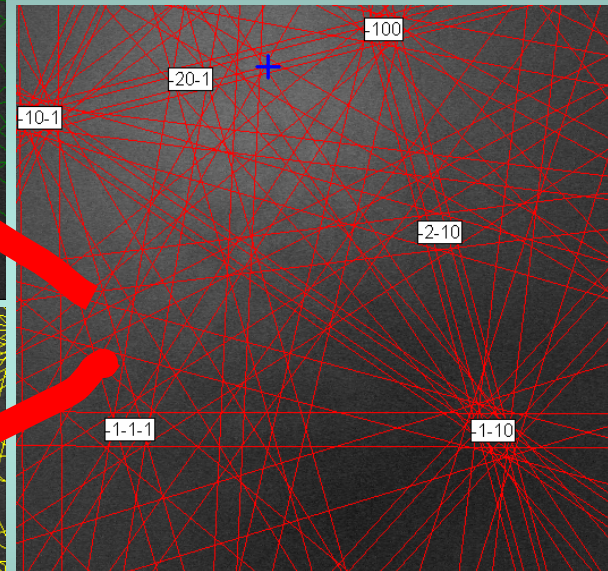
Name	Symbol	Symmetry Class	Space Group	a	b	c	$\alpha$	$\beta$	$\gamma$
Bindheimite	$\text{PbSb}_2\text{O}_7 \cdot 2\text{H}_2\text{O}$	cubic	Fd-3m	10.44 Å	10.44 Å	10.44 Å	90.00°	90.00°	90.00°
Bindheimite	$\text{PbSb}_2\text{O}_7$	cubic	Fd-3m	10.40 Å	10.40 Å	10.40 Å	90.00°	90.00°	90.00°
Rosiaite	$\text{PbSb}_2\text{O}_6$	trigonal	P-31m	5.295 Å	5.295 Å	5.372 Å	90.00°	90.00°	120.00°
Nadorite	$\text{PbSbO}_2\text{Cl}$	rombic	Cmcm	5.603 Å	12.245 Å	5.448 Å	90.00°	90.00°	90.00°

Antimoniato  
di Pb

rosiaite



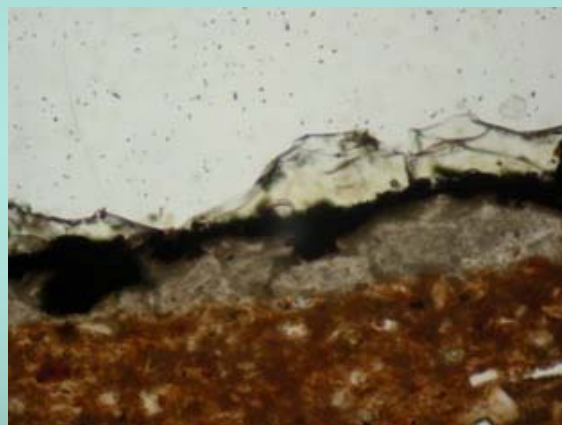
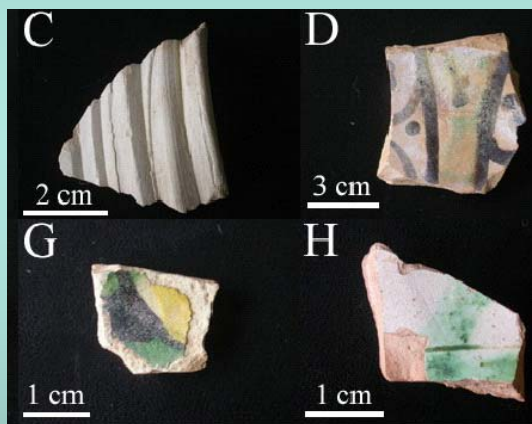
bindheimite



nadorite



# Ceramica decorata: pigmento nero a base di ossido di manganese



# Ceramica decorata: **pigmento nero** a base di ossido di manganese

Manganite

Groutellite

Ramsdellite

Manganosite

Hausmannite

Pyrolusite

Todorokite

ecc.....

Name	Symbol/ Formula	Crystal Group	Space Group	a	b	c	$\alpha$	$\beta$	$\gamma$
Manganite	Mn(OH)O	monoclinic	B2_1/d	8.86 Å	5.24 Å	5.70 Å	90.00°	90.00°	90.00°
Groutellite	MnO2	orthorhombic	Pnma	9.5155 Å	2.8644 Å	4.7061 Å	90.00°	90.00°	90.00°
Ramsdellite	MnO2	orthorhombic	Pnma	9.2734 Å	2.8638 Å	4.5219 Å	90.00°	90.00°	90.00°
Manganosite	MnO	cubic	Fm3m	4.4448 Å	4.4448 Å	4.4448 Å	90.00°	90.00°	90.00°
Hausmannite	Mn(Fe,Mn)2O4	tetragonal	I4 <sub>1</sub> /amd	5.7691 Å	5.7691 Å	9.4605 Å	90.00°	90.00°	90.00°
Pyrolusite	Beta-MnO2	tetragonal	P4 <sub>2</sub> /mnm	4.396 Å	4.396 Å	2.871 Å	90.00°	90.00°	90.00°
Todorokite	Mg,Ca,Ba,K,Na,H	monoclinic	P2/m	9.789 Å	2.834 Å	9.551 Å	90.00°	93.70°	90.00°
	Mn3O4	orthorhombic	Pmab	9.5564 Å	9.7996 Å	3.0240 Å	90.00°	90.00°	90.00°
	alpha-Mn2O3	orthorhombic	Pcab	9.4157 Å	9.4233 Å	9.4047 Å	90.00°	90.00°	90.00°
Aurorite	Ag, Ca, H	trigonal		7.514		20.734			
Cesarolite	Pb, H		No data						
Chalcophanite	Zn, Fe, H	trigonal	No data						
Coronadite	Pb	monoclinic	No data						
Cryptomelane	K	tetragonal	No data						
Iwakite	Fe	tetragonal		8.51		8.54			
Jianshuiite	Mg, H	triclinic		7.53	7.52	8.2	89.75	117.37	120
Magnetoplumbite	Pb, Fe	hexagonal		5.88		23.02			
Manjiroite	Na, K, H	tetragonal		9.91		2.86			
Quenselite	Pb, H	monoclinic		9.12	5.68	5.6		93	
Birnessite	Na, Ca, H	monoclinic	B2/m	5.175	2.85	7.337		103.18	
Rancieite	Ca, H	trigonal	P_3	2.485		7.485			
Takanelite	Ca, H	hexagonal		8.68		9			
Senaite	Pb, Ti, Fe	trigonal		10.42		20.86			
Bixbyite	Fe	isometric	Ia3	9.411					
Janggunitite	Fe, H	orthorhombic		9.324	14.05	7.956			
Jacobsite	Fe, Mg	isometric	Fd3m	8.457					
Vernadite	Fe, Ca, Na, H	hexagonal							
Galaxite	Fe, Mg, Al	isometric	Fd3m	8.271					
Filipstadite	Mg, Sb, Fe	orthorhombic		36.7	36.7	25.9			
Zenzenite	Pb, Fe	hexagonal		10		13.67			



# Ceramica decorata: **pigmento nero** a base di ossido di manganese

Fase NON cristallina



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DACOM 0SUB  
DPRINT 0.24▲▼  
DAUTO (Drag Here)  
HI 129 0▲▼  
LOW 96 0▲▼  
DISPLAY  
DRAW 0STH1  
DPRO 0GAM1  
DENH 0NEGA  
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DTIMER 0COMM  
DSCALE 0VIEW  
BRTO▲▼ 0SISP  
0COLOR02M  
MEASURE-▼  
DLINE 0AREA  
DTRACE 0SPEED  
DCOUNT 0CLR  
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