Caratteri morfochimici di polveri sottili nei contesti urbani di Perugia e Terni

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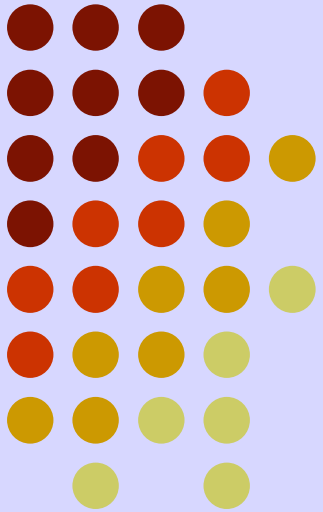


Campagna di campionamento

Maggio 2006 – Aprile 2007

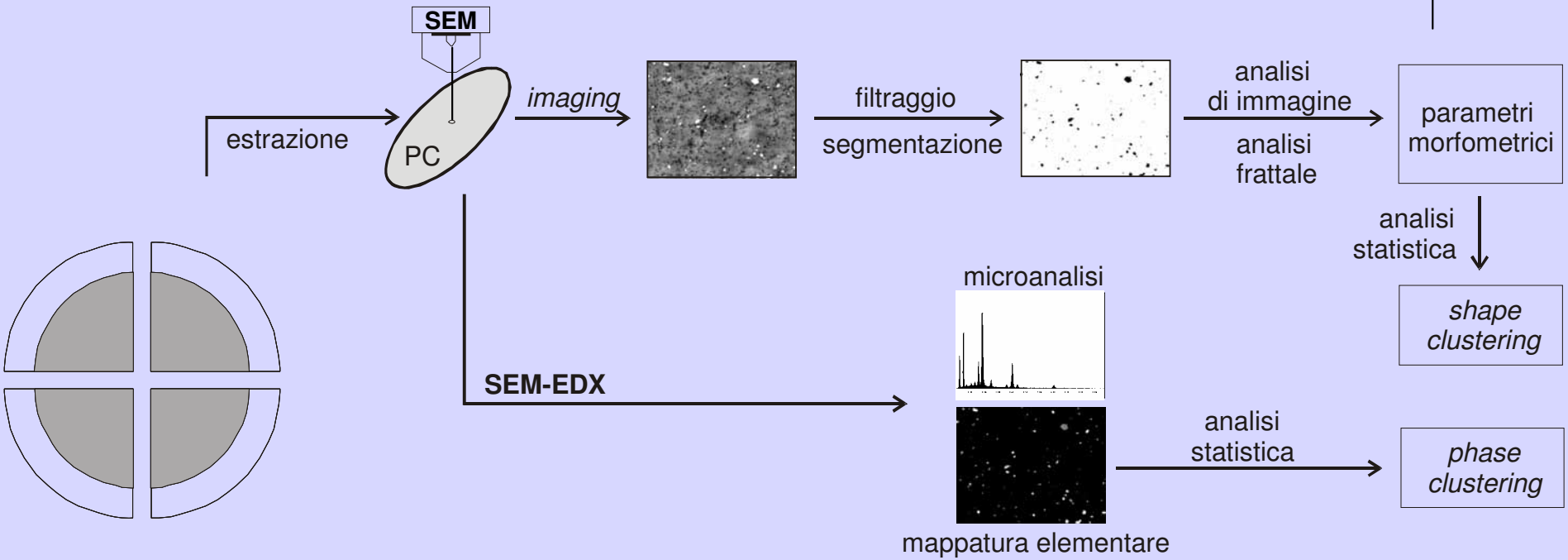
PERUGIA

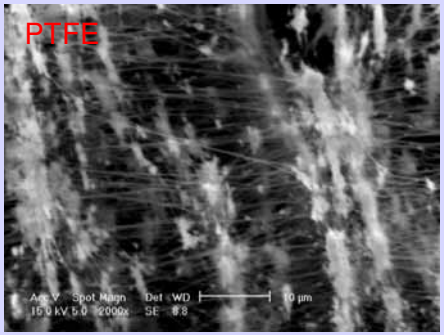
- *campionamento stocastico PM10 e PM2.5 (filtri PTFE)*
- *centralina di Piazza del Bacio (Staz. di Fontivegge)*
- *sito orientato a traffico veicolare*

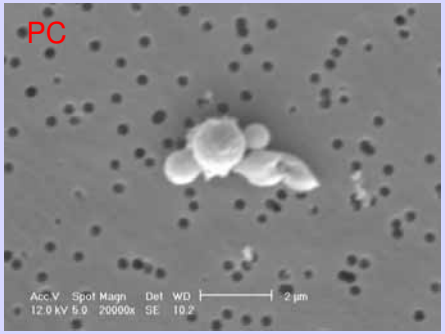
TERNI

- *campionamento sistematico PM10 e PM2.5 (filtri PTFE)*
- *tetto edificio ARPA (Terni centro)*
- *sito urbano (fondo)*

Procedura analitica





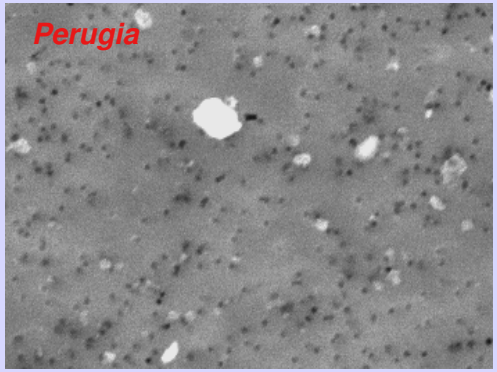


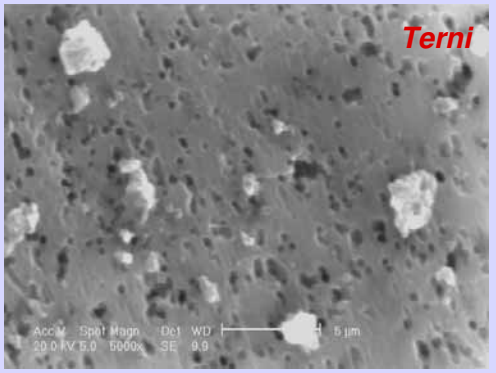
Parametri morfometrici

- *Area (A)*
- *Perimetro (P)*
- *Lunghezza degli assi (L, l)*
- *Elongazione (L/l)*
- *Arrotondamento ($4\pi/P$)*
- *Diametro di Feret ($(4A/\pi)^{1/2}$)*
- *Compattezza ($(4\pi A/L)^{1/2}$)*
- *Dimensione frattale (D)*

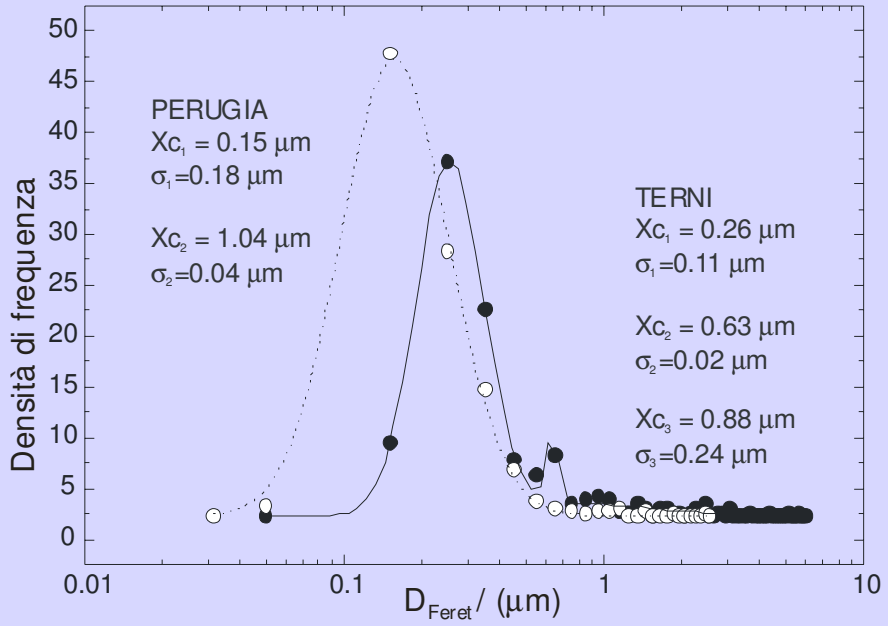
$Log[N(L)]=Log[c]-D(Log[L])$

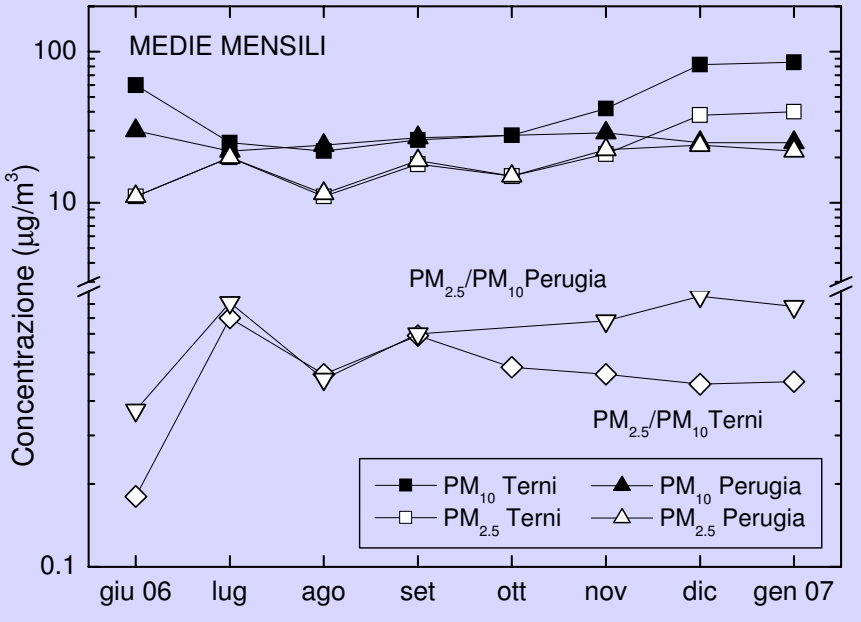
Morfometria

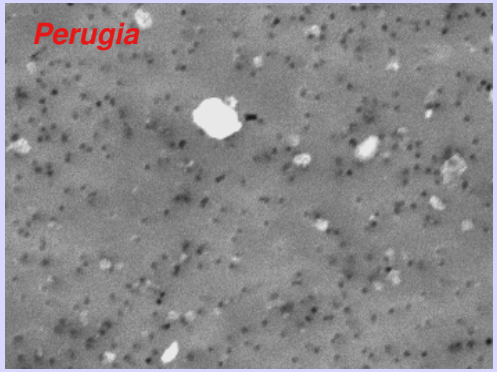


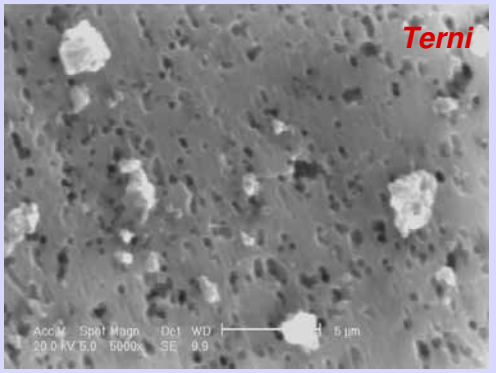


- *Dimensioni maggiori a Terni*
- *Dimensioni maggiori in estate*









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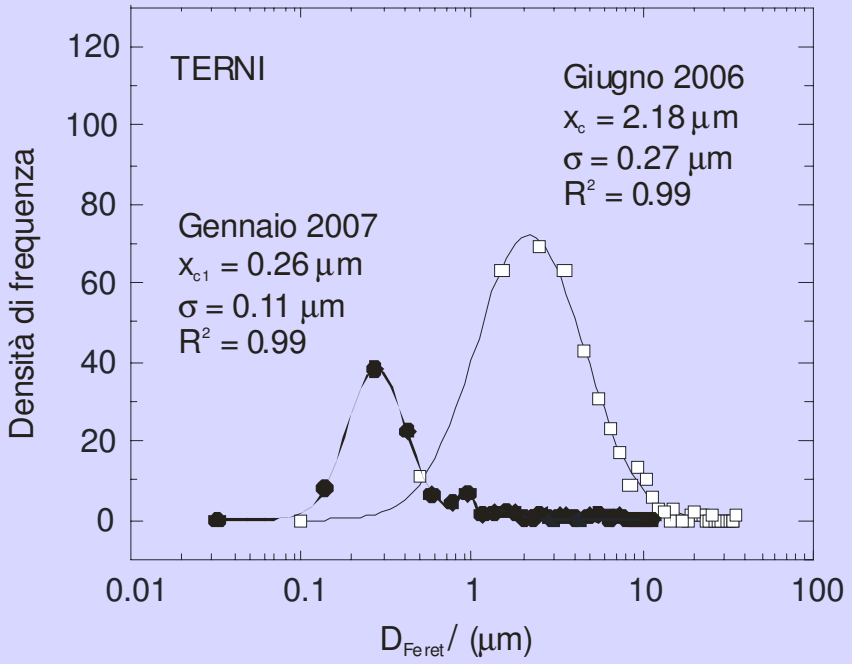
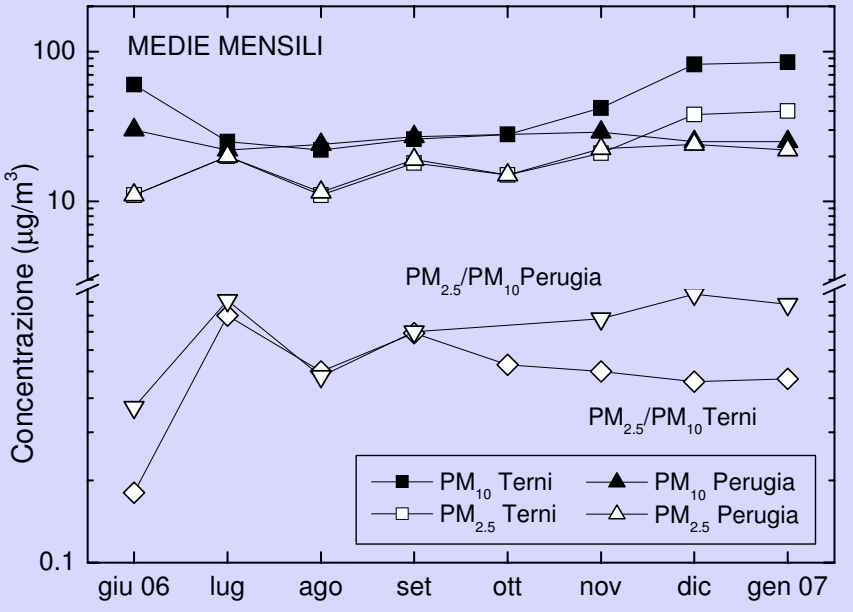
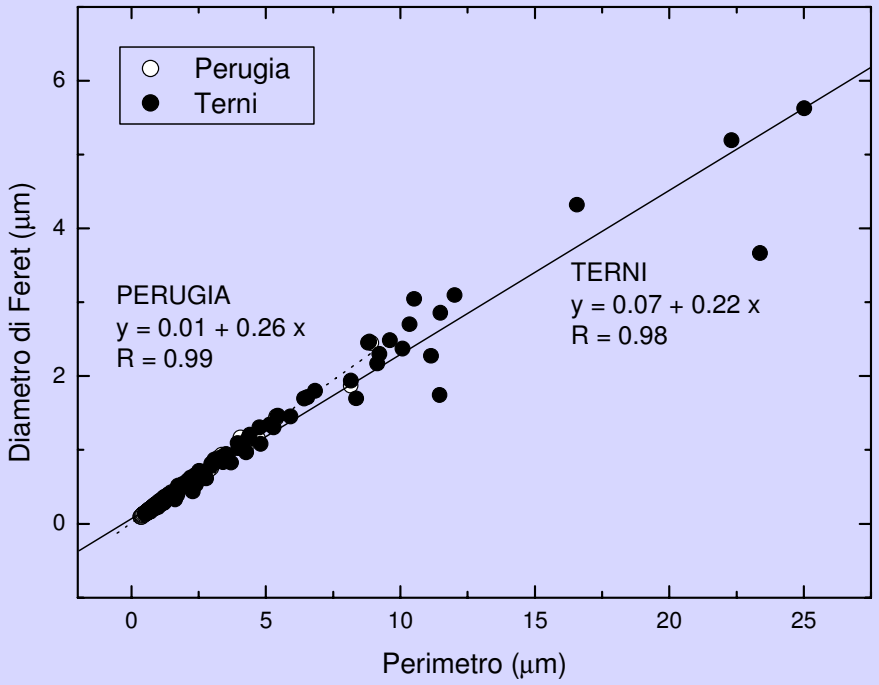
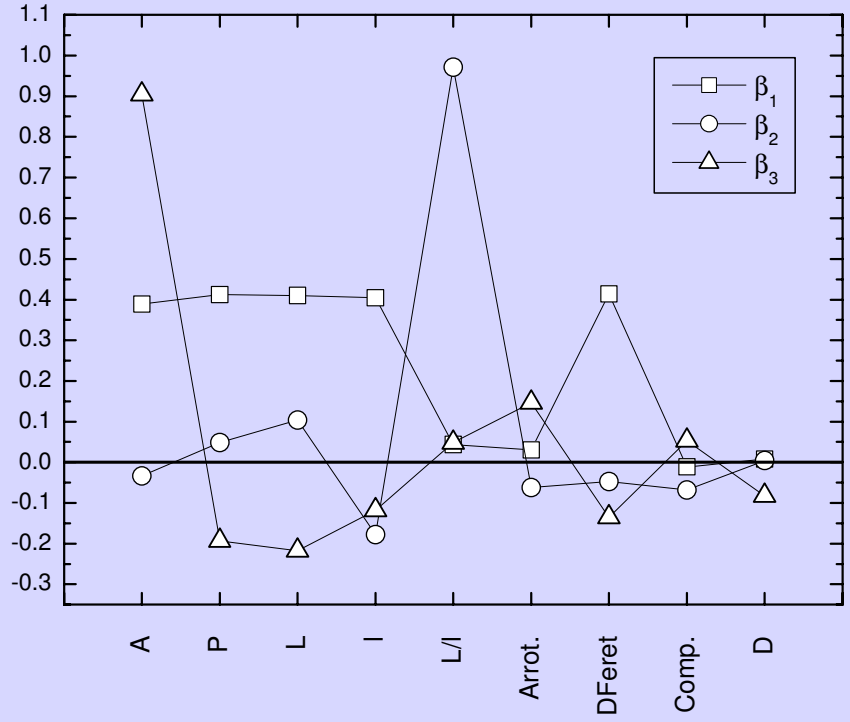




Morfometria

	Perimetro	Elongazione	Arrotondamento	Compattezza
PERUGIA	0.60±0.18	1.38±0.07	0.74±0.04	0.81±0.03
TERNI	0.93±0.13	1.35±0.06	0.72±0.04	0.81±0.03

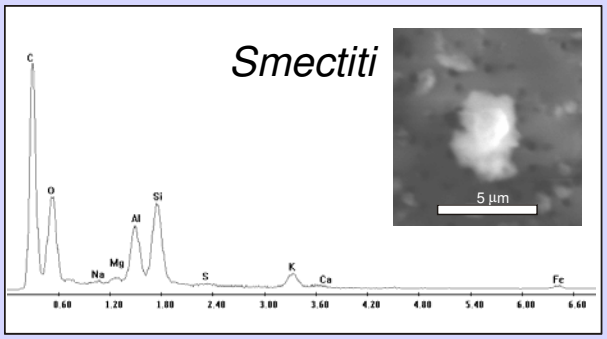


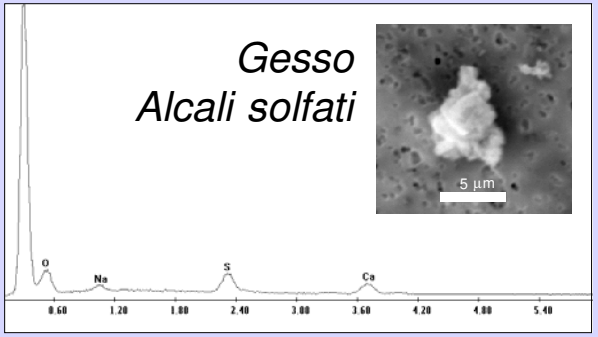


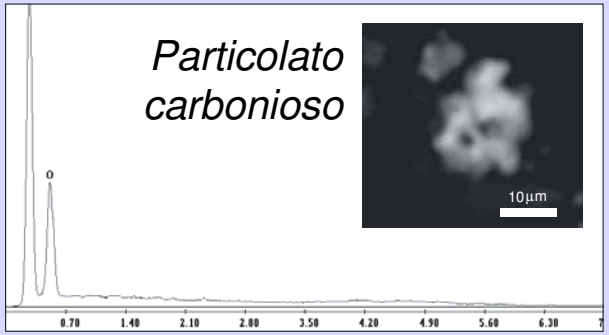
- *Area (Diametro di Feret), Perimetro, Elongazione variabili discriminative*
- *Maggiore grado di complessità morfologica a Terni*

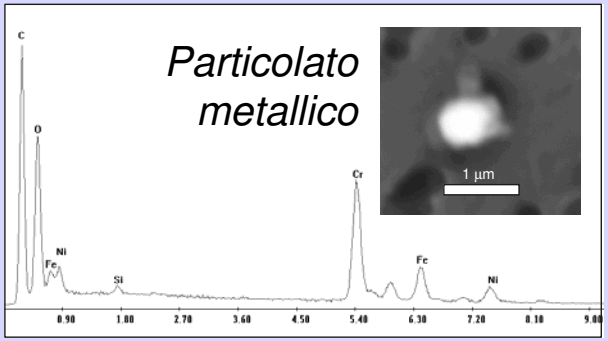
Chimica delle fasi

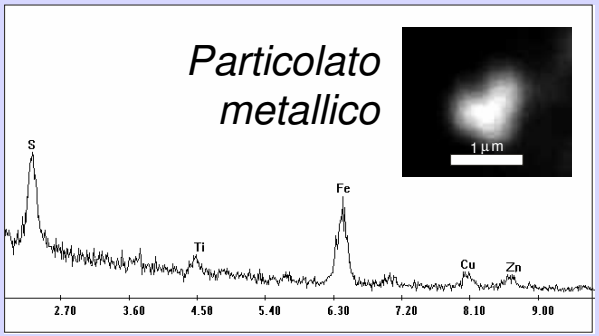
- *Silicati: quarzo, feldspati, smectiti*
- *Carbonati: calcite, dolomite, witherite*
- *Solfati: gesso, solfati alcalini (Na e K), barite*
- *Particolato metallico: ossidi di Fe, Ti, Cu, Cr, Ni, Mn, Zn*
- *Particolato carbonioso*
- *Altre fasi: fibre artificiali vetrose (MMVF), cloruri, ossido di bario*

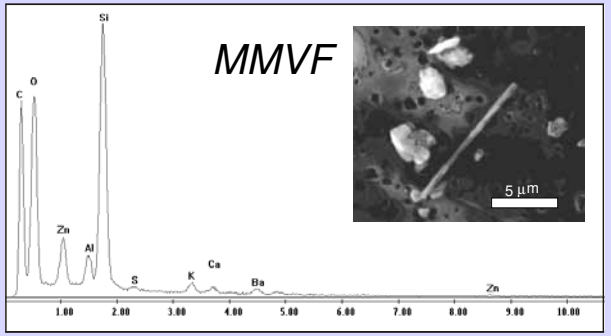




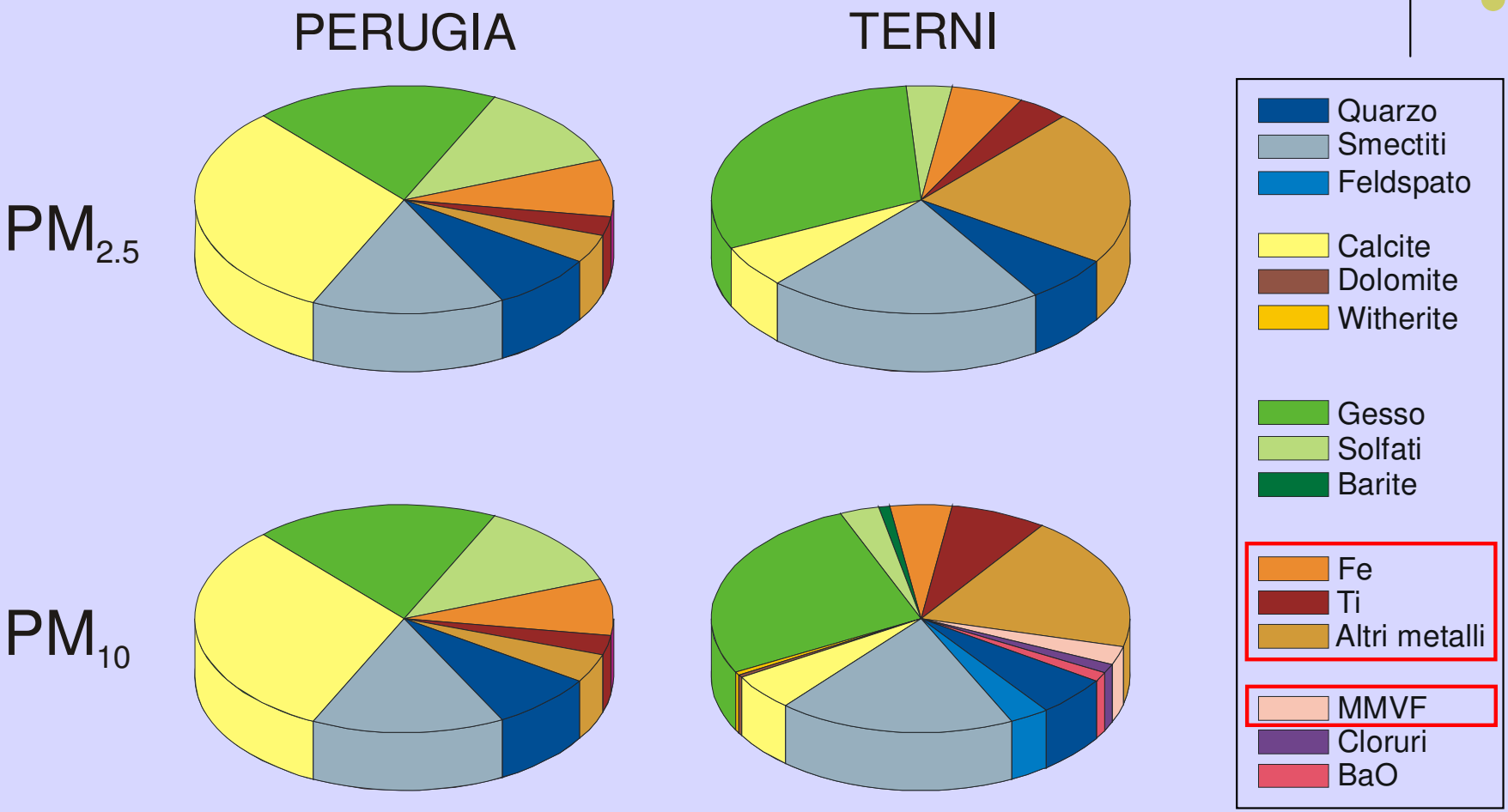








Chimica delle fasi



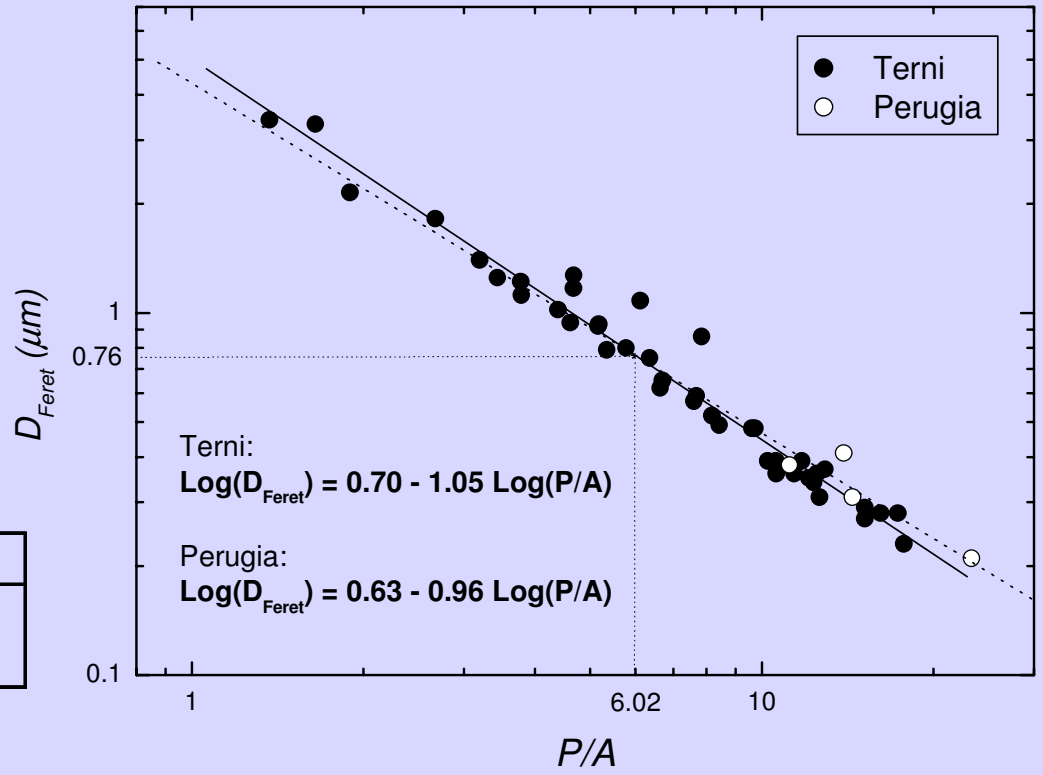
- *A Terni maggiore abbondanza di gesso e metalli; presenza di altre fasi*
- *A Perugia maggiore abbondanza di calcite e solfati alcalini*

Morfochimica
Particolato metallico

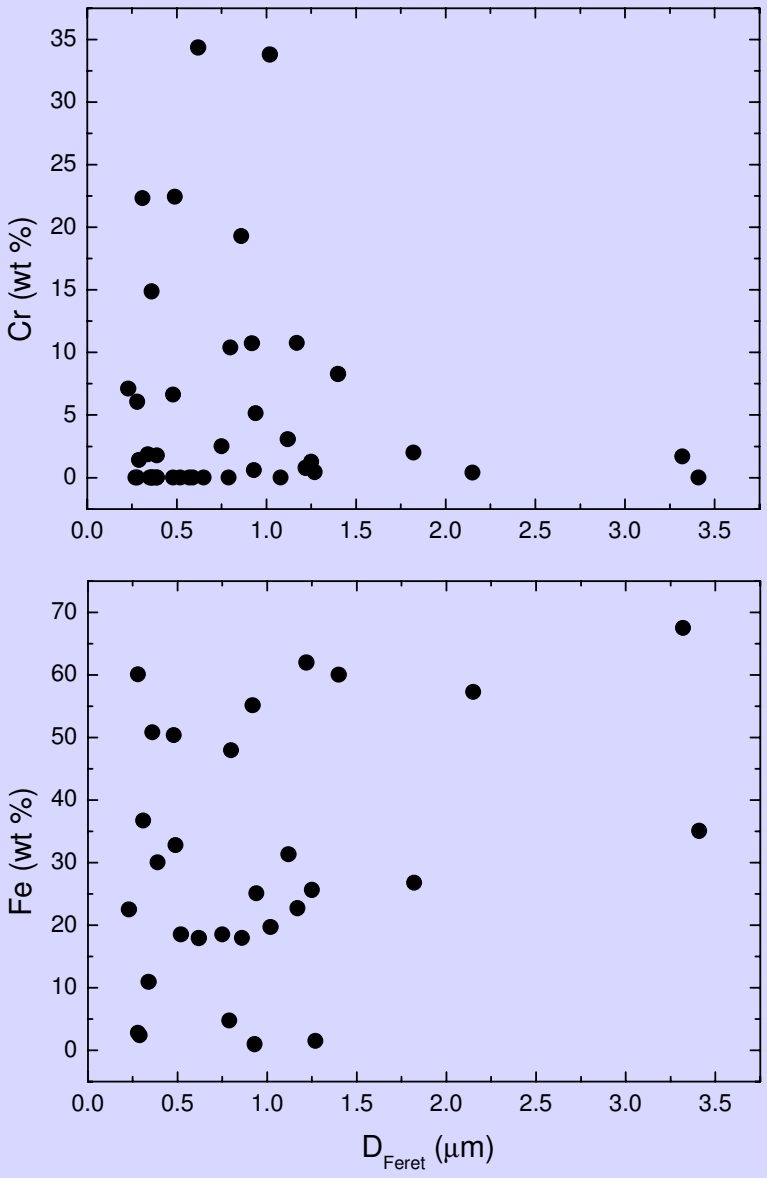
- *A Terni particelle più grossolane*
- *A Perugia particelle più irregolari*

	Terni	Perugia
Area	0.96 ± 1.91	0.07 ± 0.04
Perimetro	3.17 ± 2.85	1.02 ± 0.50
Elongazione	1.51 ± 0.52	1.28 ± 0.18
Arrotondamento	0.79 ± 0.17	0.96 ± 0.36
Diametro di Feret	0.85 ± 0.71	0.29 ± 0.10
Compattezza	0.84 ± 0.11	0.97 ± 0.17

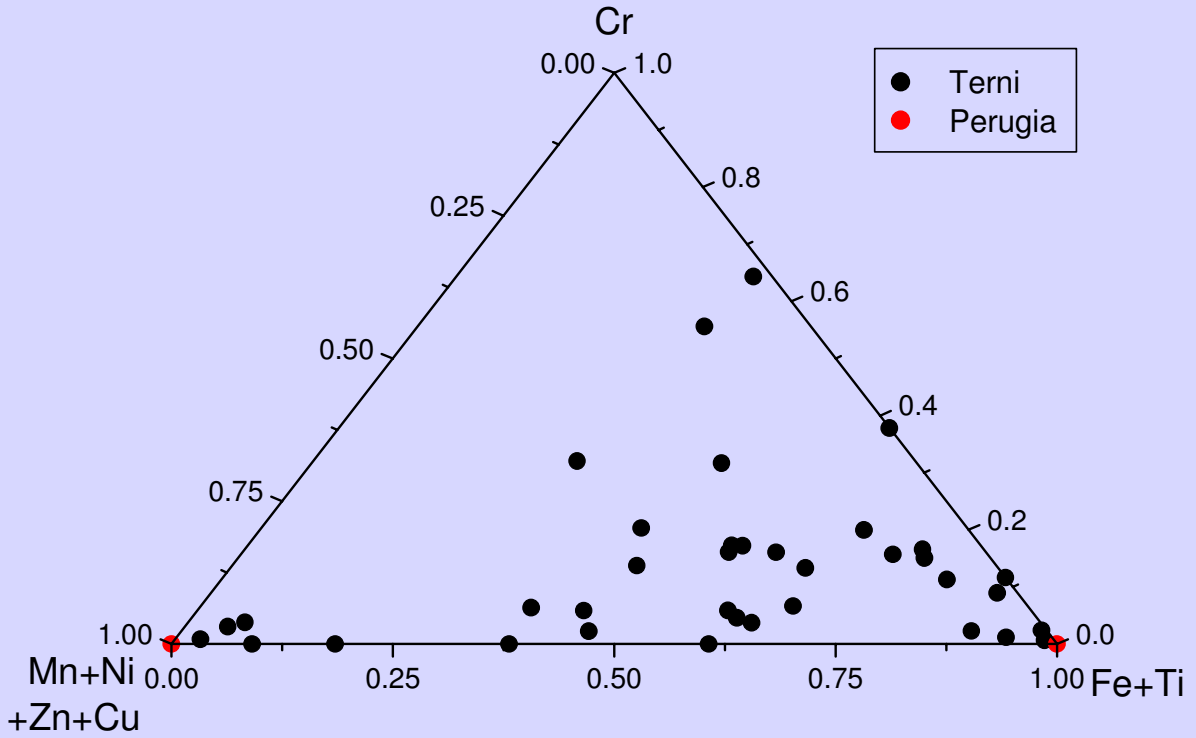
DFeret (µm)	Minimo	Massimo	Media	Mediana	Dev.st.
Terni	0.23	3.41	0.85	0.61	0.71
Perugia	0.14	0.41	0.29	0.31	0.10



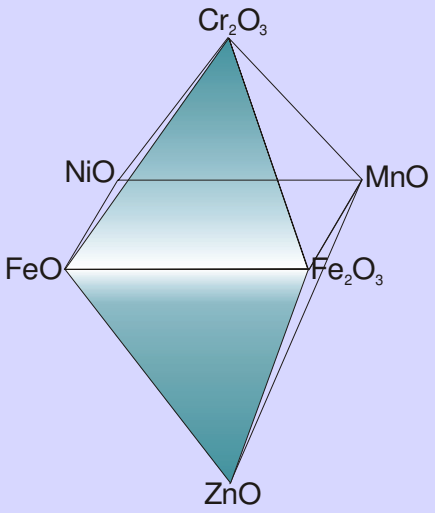
Morfochimica
Particolato metallico

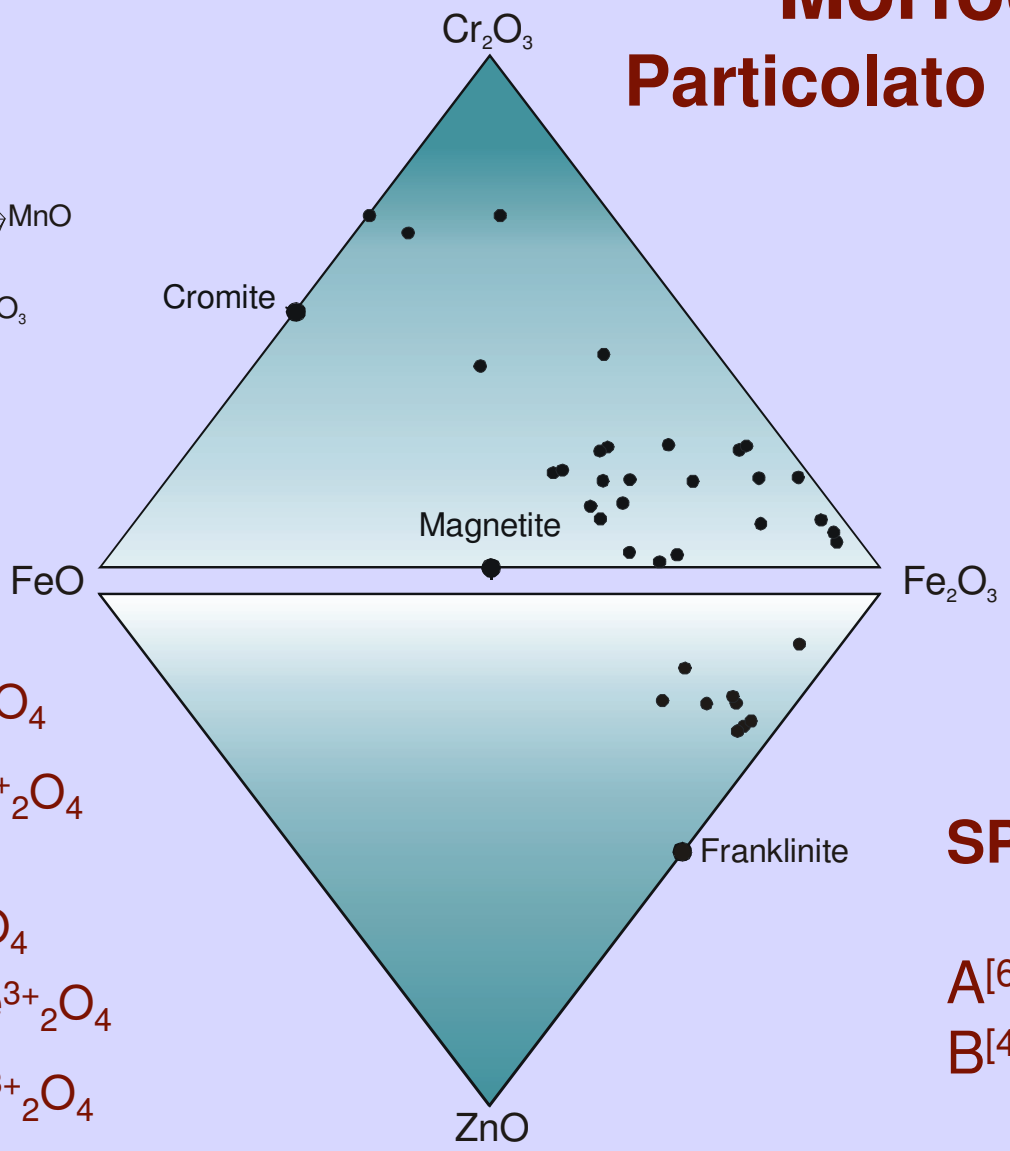


- *A Terni composizione molto più varia*
- *A Terni diverse correlazioni Metalli-D_{Feret}*



Morfochimica
Particolato metallico





Trevorite: $NiFe^{3+}_2O_4$

Jacobsite: $MnFe^{3+}_2O_4$

Cromite: $Fe^{2+}Cr_2O_4$

Magnetite: $Fe^{2+}Fe^{3+}_2O_4$

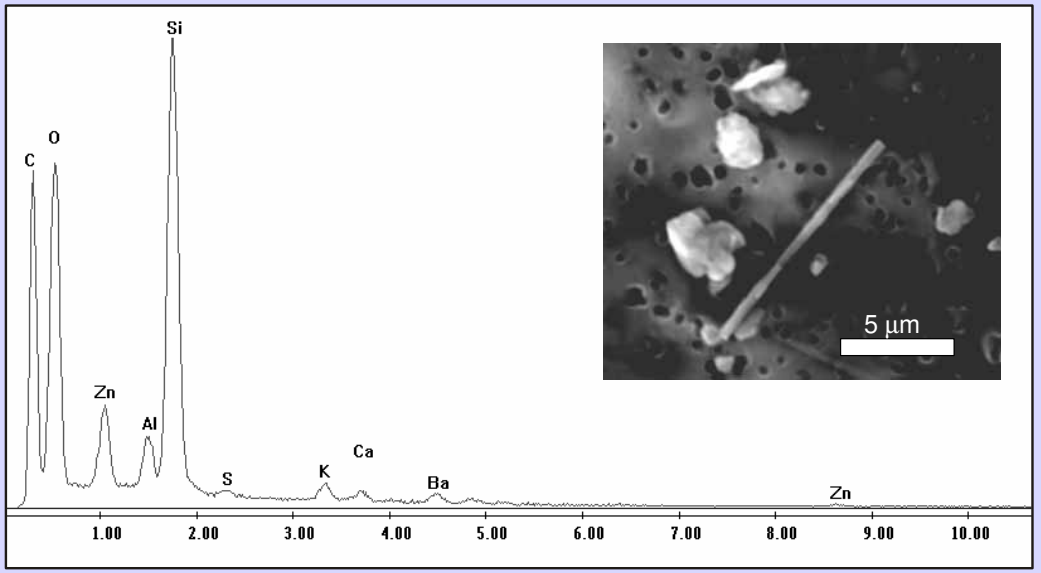
Franklinite: $ZnFe^{3+}_2O_4$

SPINELLI: AB_2O_4

$A^{[6]}$: Ni, Fe^{2+}, Mn, Zn
$B^{[4;6]}$: Si, Al, Cr, Fe^{3+}

- *Origine delle particelle: industria siderurgica*
- *Elementi chimici di interesse sanitario: Cr, Ni, Mn, Zn*

Morfochimica
MMVF



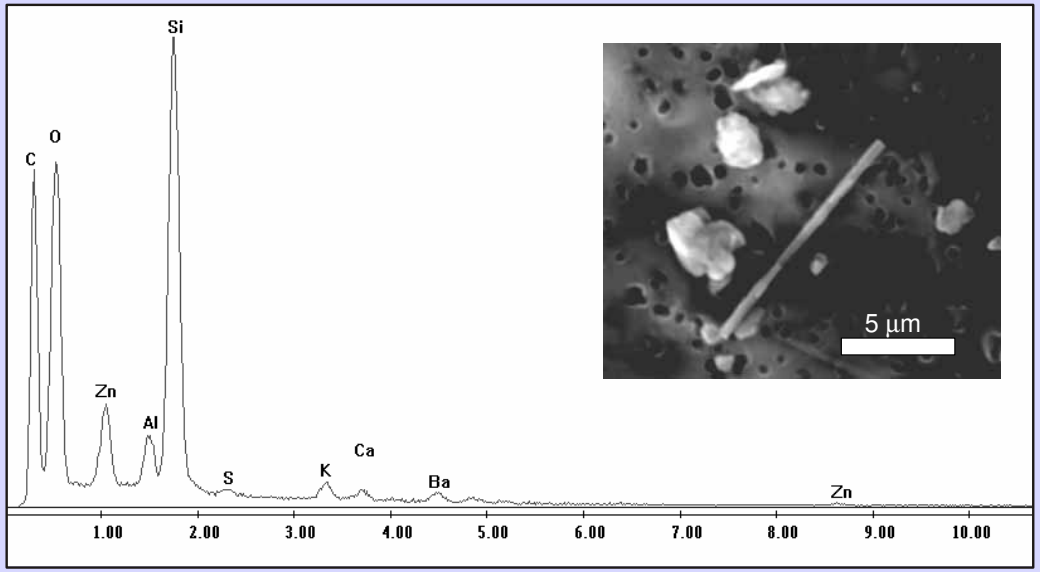
(N = 10)	Minimo	Massimo	Media	Dev.st.
L (µm)	3.7	21.1	7.9	4.6
Ø (µm)	0.4	1.3	0.6	0.3
L/Ø	6.0	21.3	13.1	4.9

Ø < 3 µm
L > 5 µm
L/Ø > 3

[MMVF] << 1.0 ff/cm^3 (ACGIH, 2001)

- *Particelle inalabili (ACGIH, 2001)*
- *Bassi valori di esposizione ambientale*

Morfochimica
MMVF

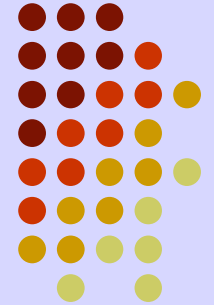


(N = 10)	Minimo	Massimo	Media	Dev.st.
Na_2O	9.4	13.4	11.7	1.3
MgO	0.0	3.3	1.0	1.3
Al_2O_3	6.9	10.3	8.2	1.1
SiO_2	66.3	72.0	69.2	2.1
K_2O	1.8	2.9	2.2	0.4
CaO	0.0	2.1	1.5	0.7
TiO_2	0.0	2.3	0.9	1.1
BaO	0.0	6.0	2.0	2.5
ZnO	0.0	6.4	3.4	2.0

ΣMeO > 18 wt% → LANE MINERALI (Cat. 3: *possibile cancerogeno per l'uomo;* CE 1997)
BaO, ZnO → FIBRE PER SCOPI SPECIALI (isolamento termo-acustico)

- *Origine delle particelle: edilizia*
- *Elementi chimici di interesse sanitario: Zn*

Conclusioni

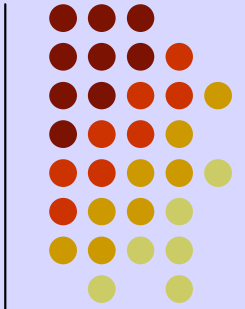


- *I dati raccolti delineano due diversi contesti emissivi:*

  a Perugia fonti naturali e antropiche (traffico, riscaldamento)
  a Terni fonti urbane e da sorgenti industriali (industria siderurgica)

- *Nell'ambito di tali contesti le particelle metalliche e quelle di natura fibrosa destano interesse dal punto di vista igienico-sanitario*

Prospettive di studio



- *Nuove indagini morfochimiche in prossimità delle principali sorgenti emissive*

- *Valutazione dell'impatto ambientale (abbondanza e diffusione) degli aerosol*

- *Valutazione dell'efficacia di eventuali strategie di abbattimento delle emissioni*

…Grazie per l'attenzione