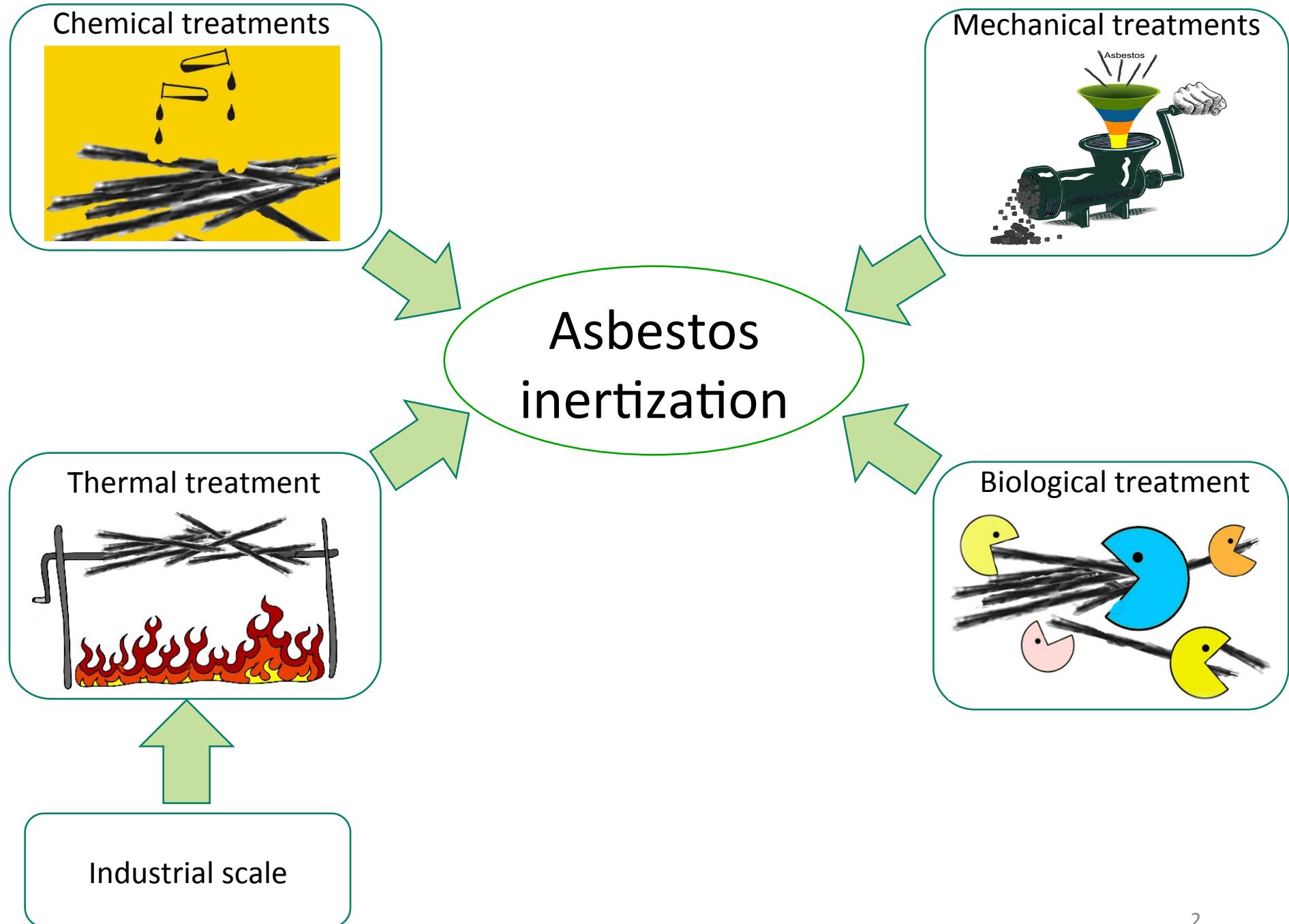




Le tecnologie di inertizzazione come alternativa alla discarica

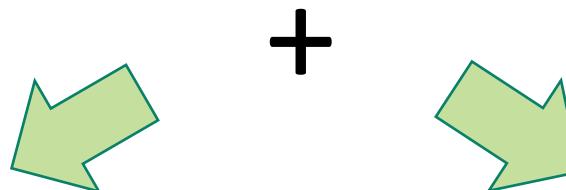
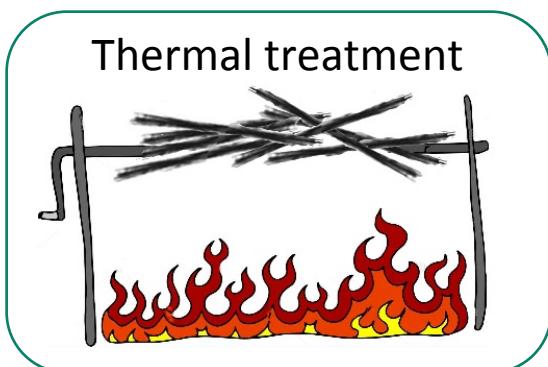
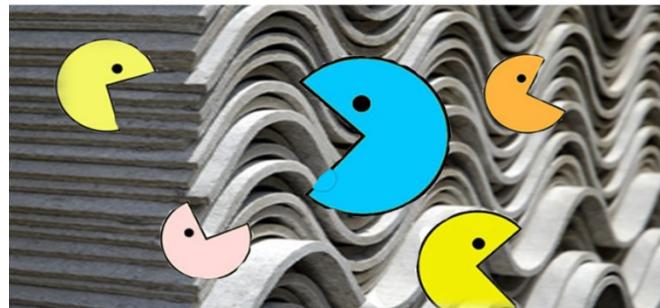
Bloise Andrea

Department of Biology, Ecology and Earth Sciences,
University of Calabria, I-87036 Arcavacata di Rende, CS, Italy

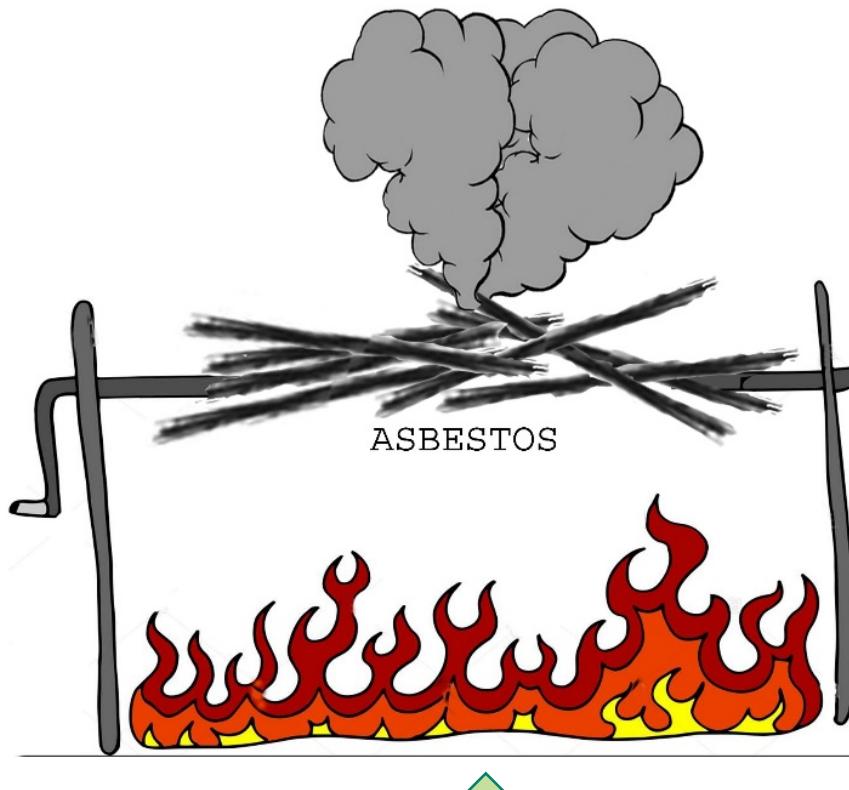


Pretreatment (lab-scale)

Lactic acid or dark fermentation



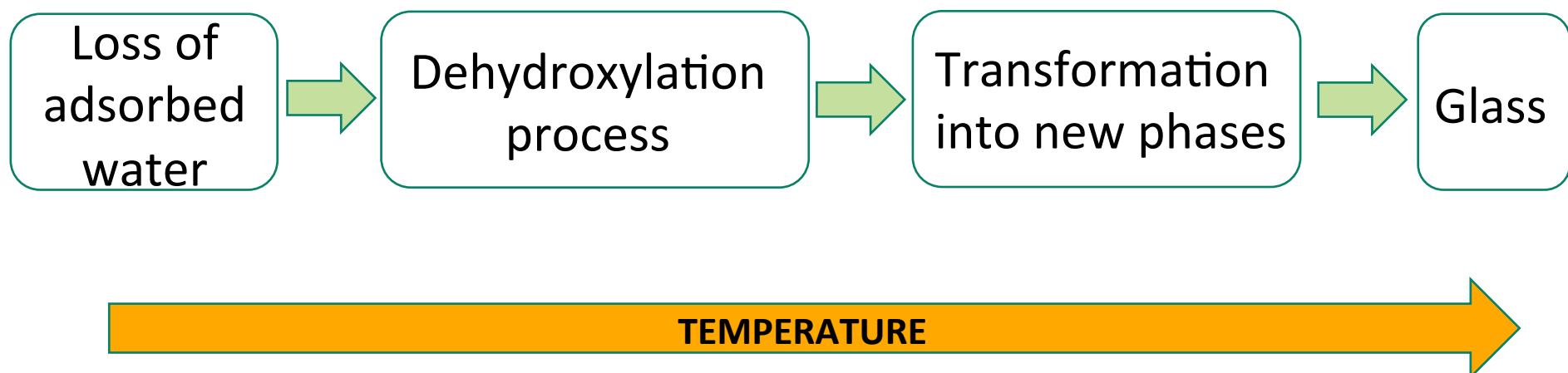
Thermal treatment is the most common asbestos destruction



Sources:
plasma, microwave, resistive heating

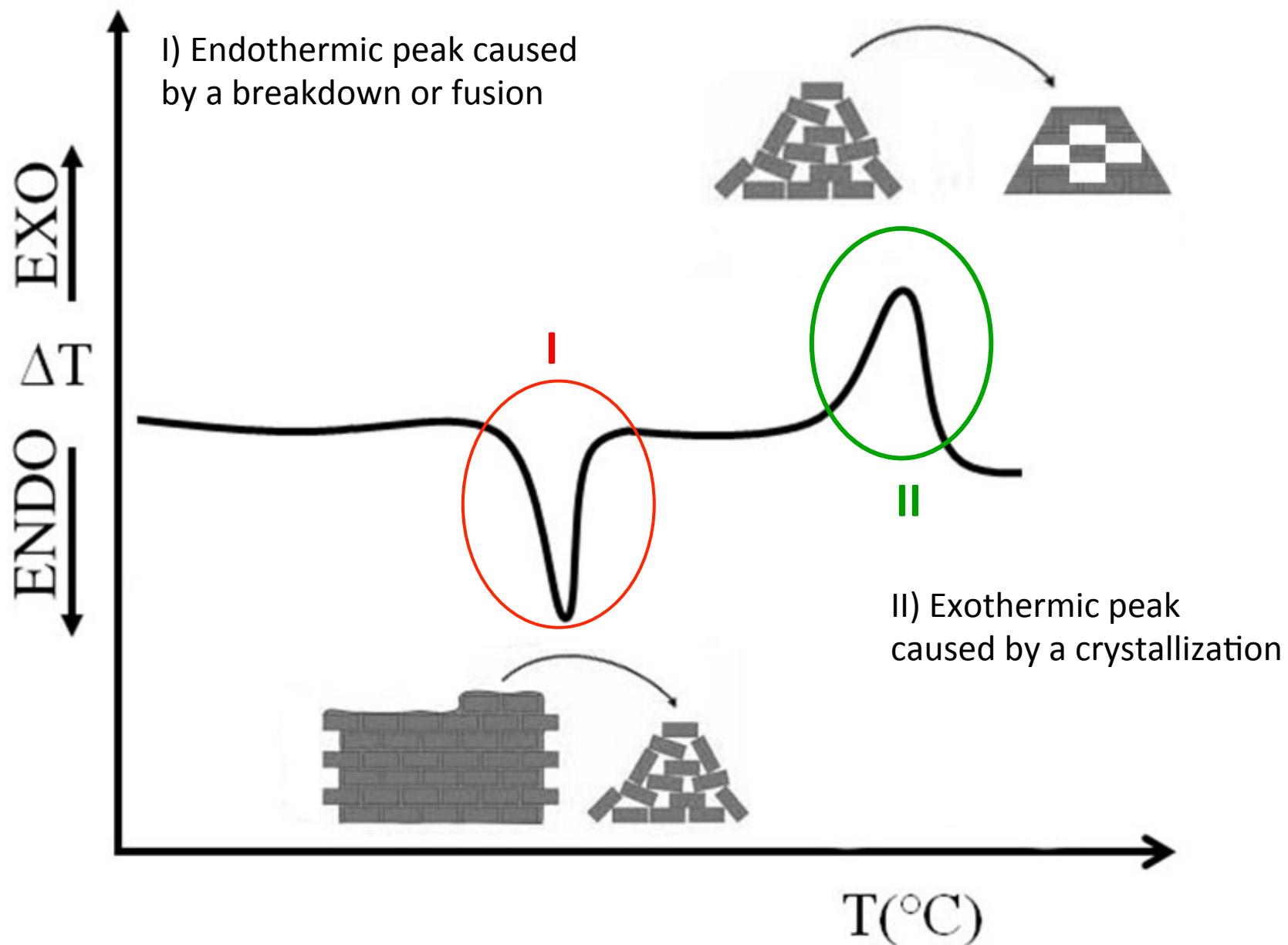
Asbestos remediation through thermal decomposition

Asbestos destruction via chemical-physical transformation (mostly temperature-induced recrystallization, sintering or melting) and recycling of the transformation product as secondary raw material is actually the only viable alternative to landfill disposal.



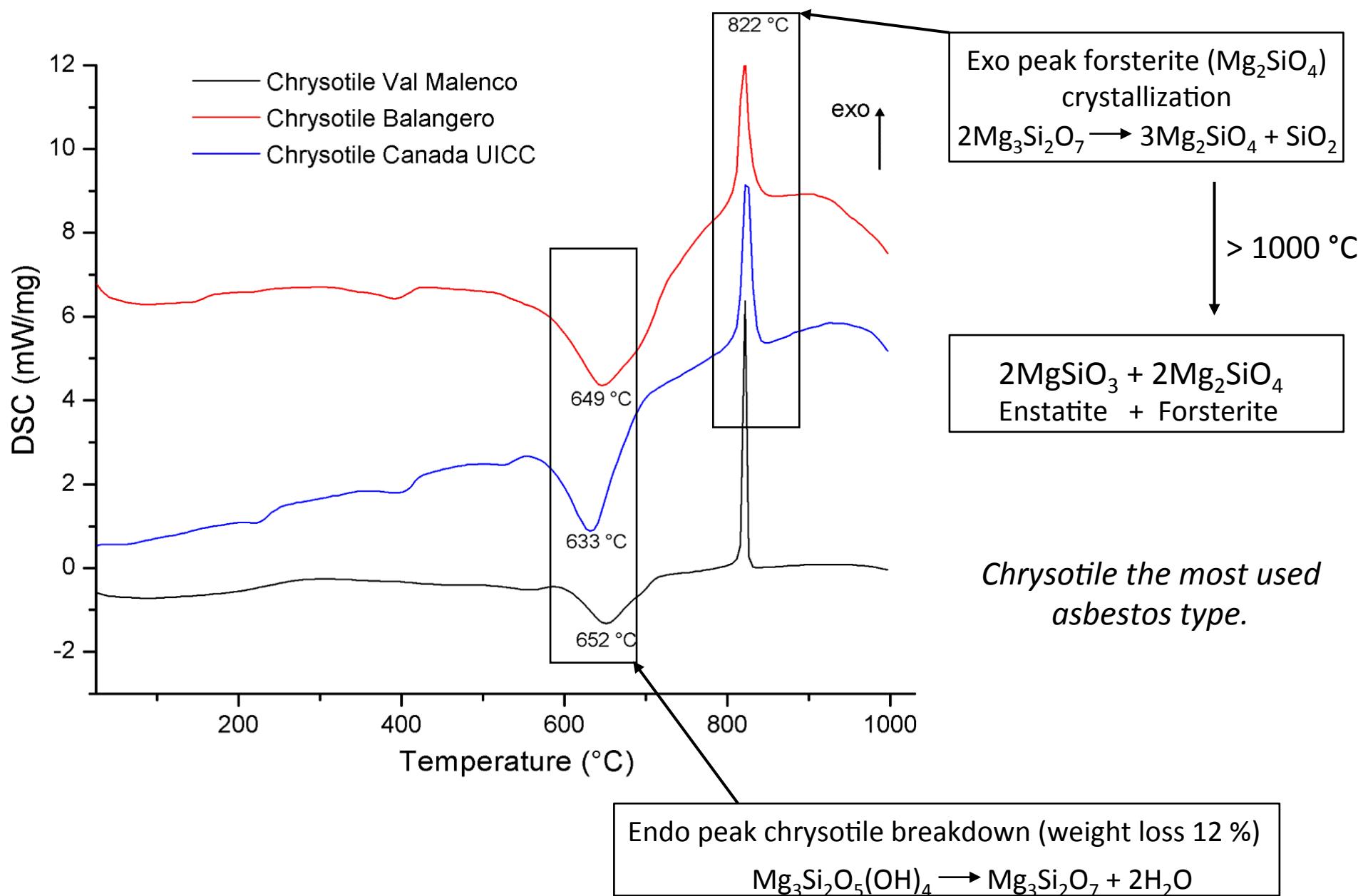
The preference for recycling over landfill disposal is well indicated in the European Resolution EU-P7_TA, 2013; Directive2008/98/EC.

Generalized asbestos thermal behavior



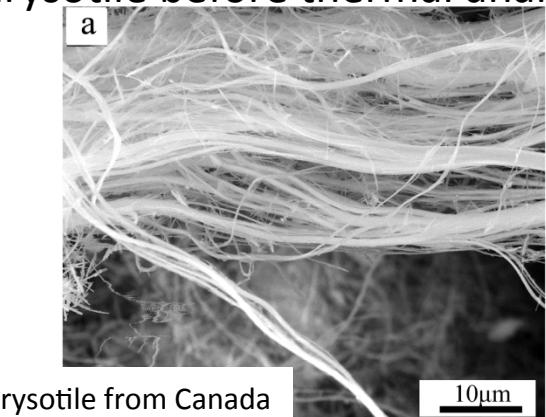
Differential Scanning Calorimetry (DSC) measures the heat flow into and out of a sample as a function of temperature, while the sample is subjected a controlled temperature program..

Comparison of the thermal behavior of chrysotile from: Val Malenco, Balangero, Canada



Chrysotile pseudomorphosis

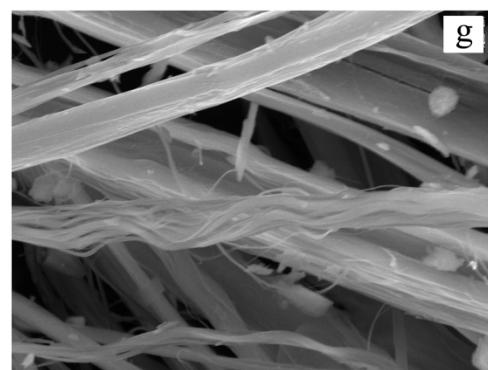
Chrysotile before thermal analysis



Chrysotile from Canada

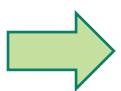
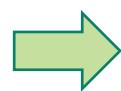
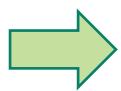
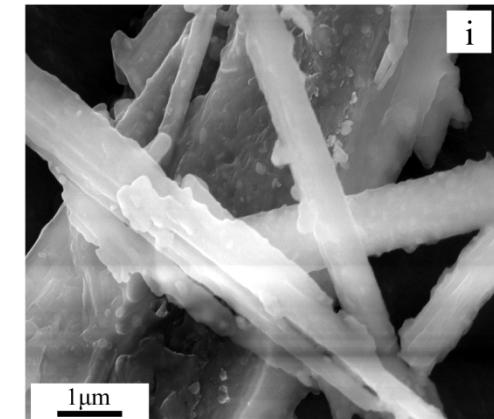
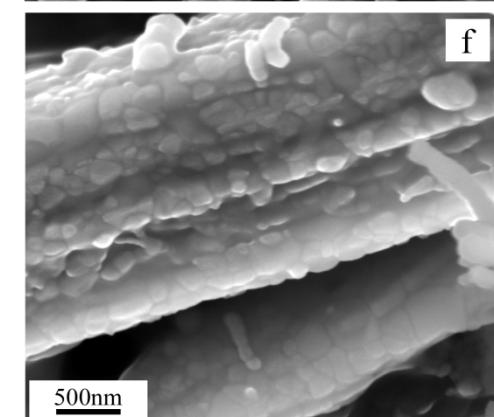
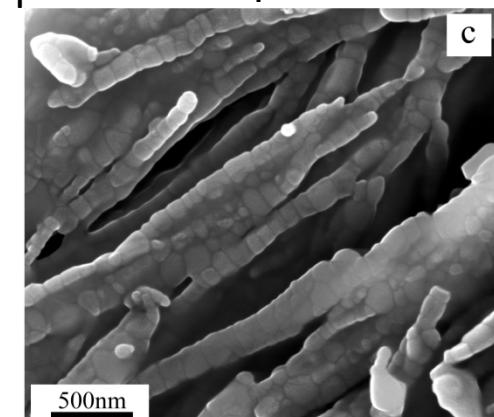
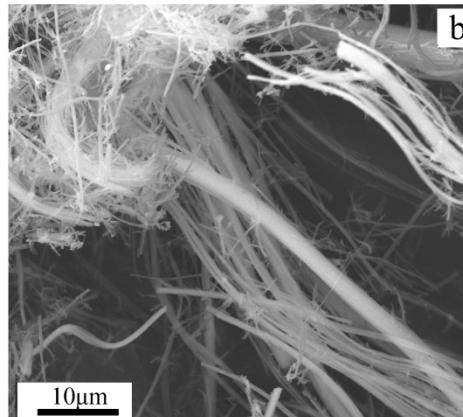


Chrysotile from Balangero

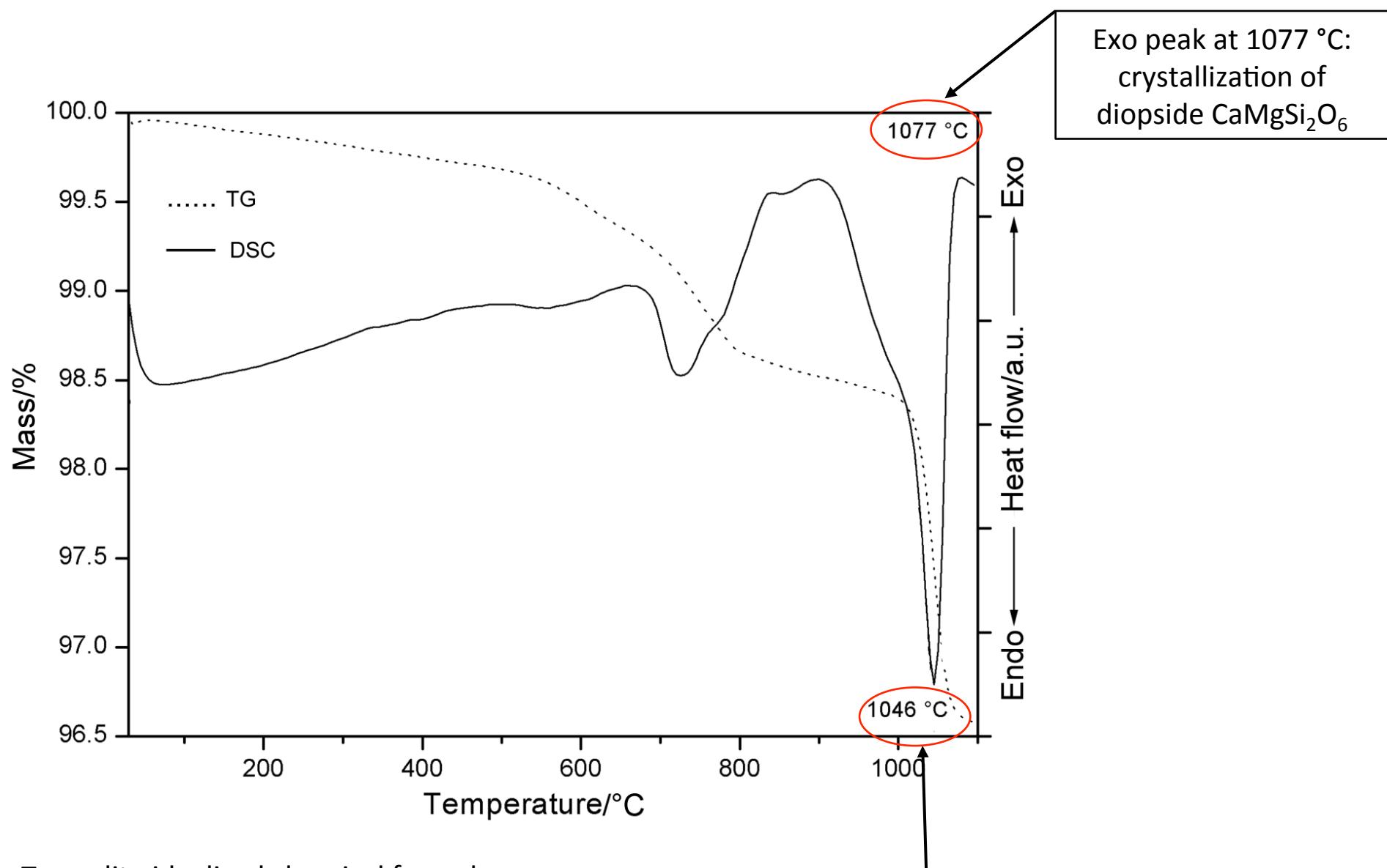


Chrysotile from V. Malenco

After thermal analysis 1000 °C: pseudo-morphic forsterite



Thermal analysis of tremolite asbestos from Val d'Ala (Italy)



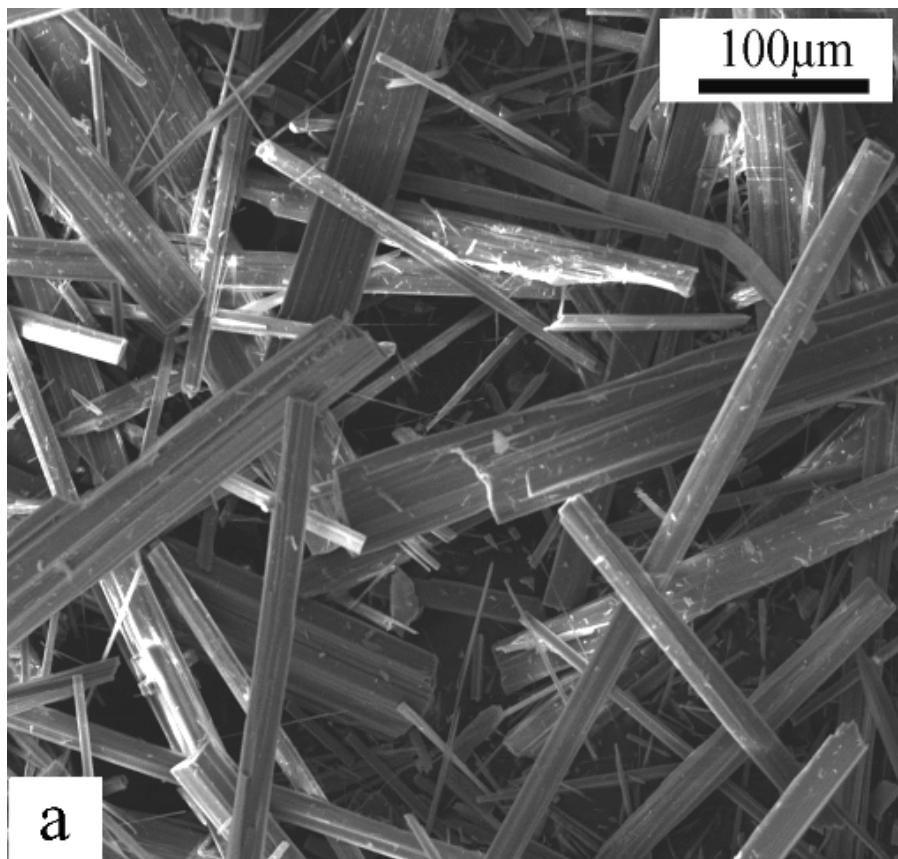
Tremolite idealized chemical formula



breakdown of tremolite (weight loss 2 %)

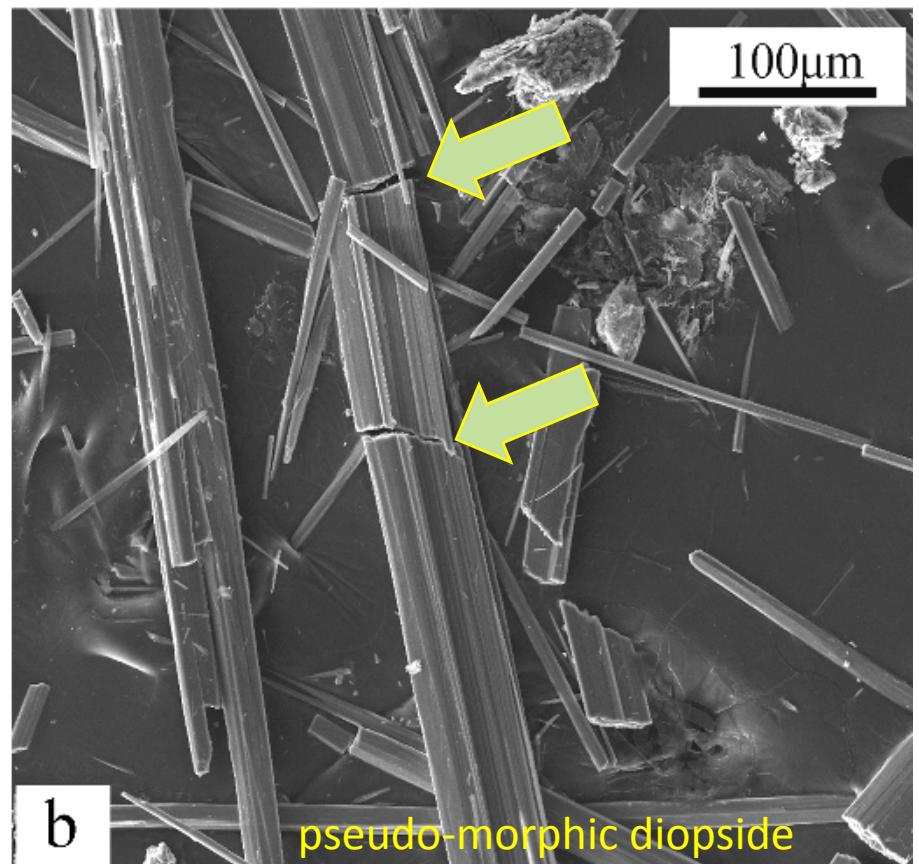
Tremolite asbestos from Val d'Ala (Italy)

Tremolite before thermal treatment



a

after thermal treatment at 1100°C

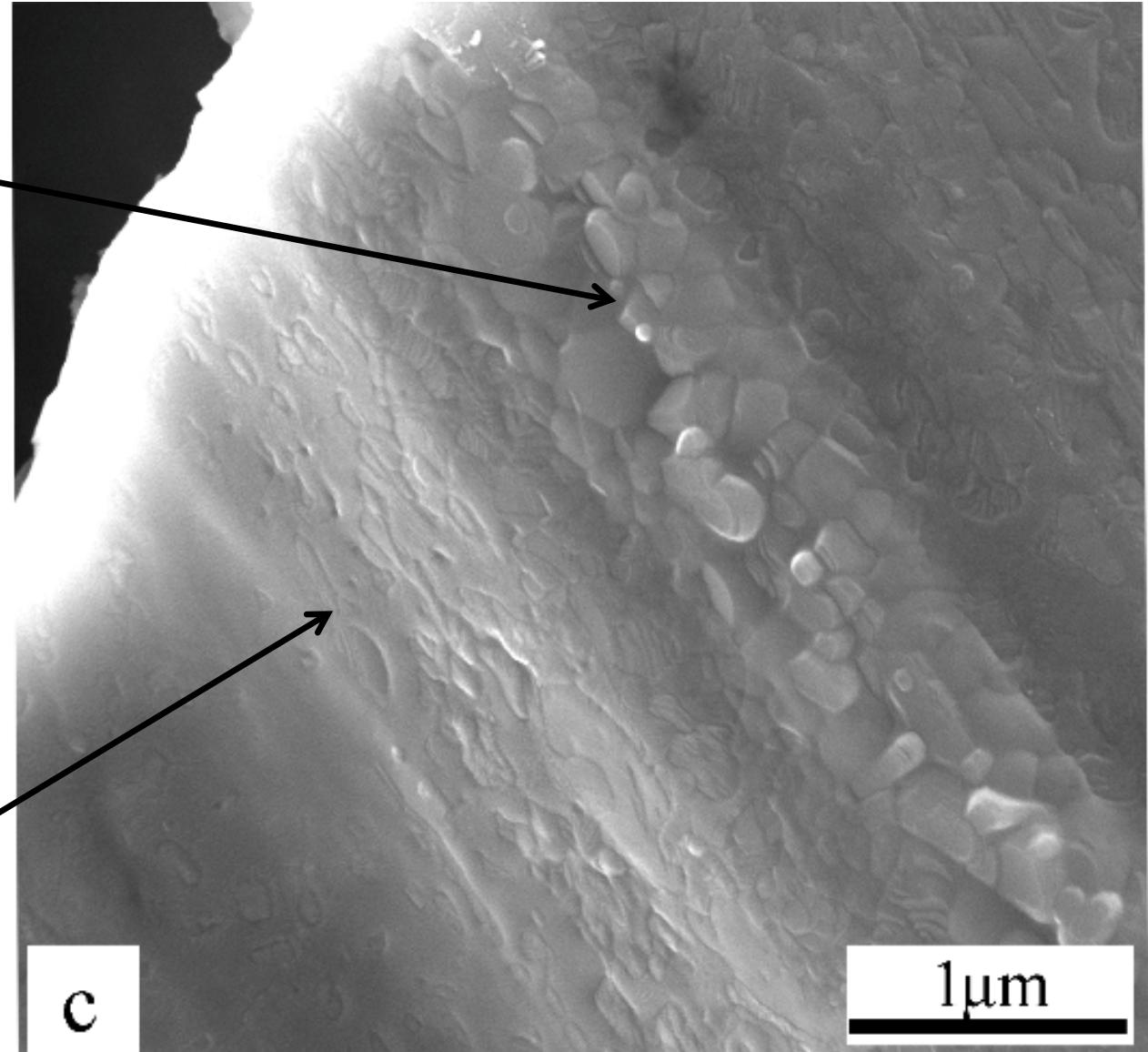
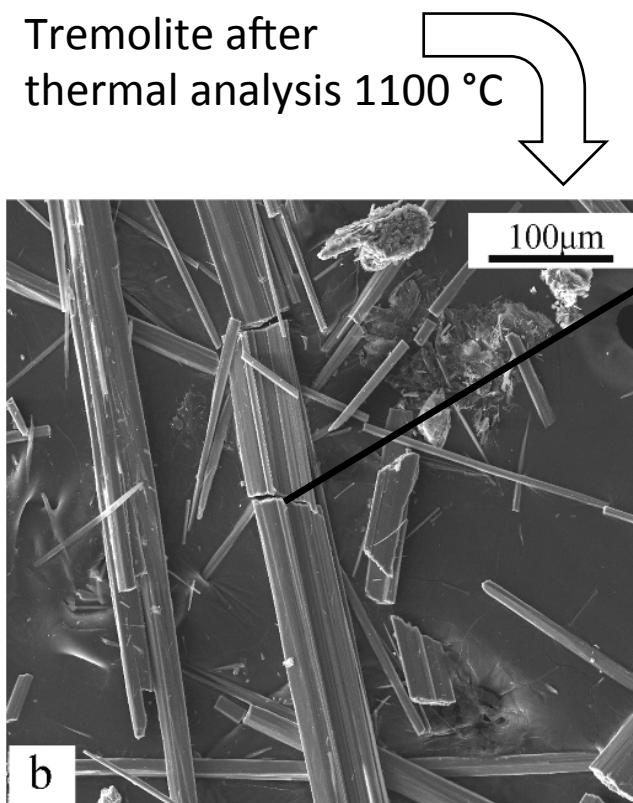


b

pseudo-morphic diopside

SEM images of tremolite asbestos: a) before heating treatment; b) after thermal treatment (diopside).

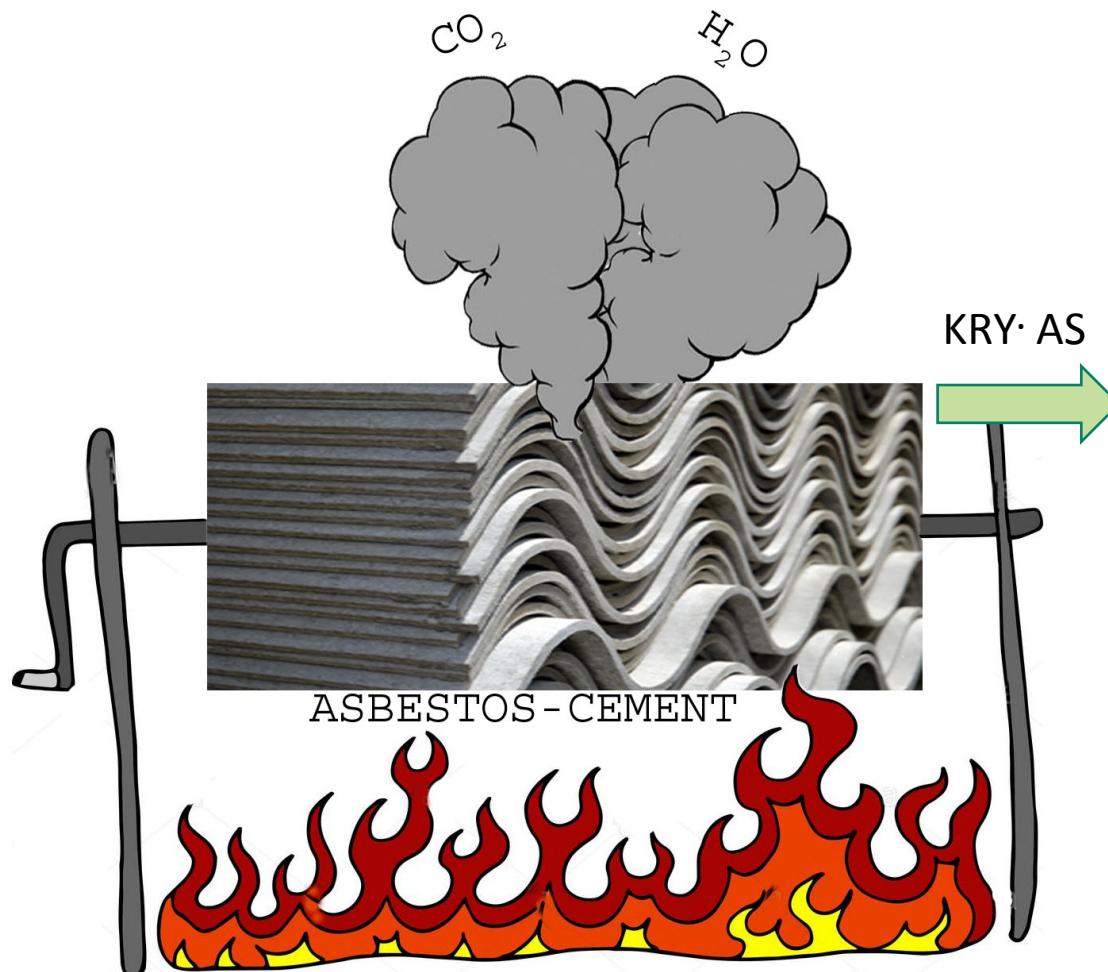
Newly formed polyhedral crystals on the surface of the pristine tremolite asbestos



Diopside

	Asbestos	T remediation	Phase after thermal treatment up to 1100 °C
Amphiboles Asbestos	Tremolite	1050 °C	Diopside
	Actinolite	1035 -1050 °C	Augite
	Anthophyllite	860 - 1100 °C	Enstatite>> cristobalite
	Amosite	878 °C	Ferrosilite>>hematite> cristobalite
	Crocidolite	850 °C	Aegirine>> hematite> cristobalite
Phyllosilicate Chrysotile	Chrysotile, Italy	660 °C	Forsterite> enstatite
	Chrysotile, Italy	652 °C	Forsterite> enstatite
	Chrysotile Canada	633 °C	Forsterite> enstatite

Asbestos cement the most used Asbestos Containing Products (ACP)



Chemical and mineralogical composition of the thermally transformed asbestos-slates, used as secondary raw material (after Gualtieri et al., 2008a).

Chemical composition (wt%)										
SiO_2	Al_2O_3	Fe_2O_3^a	TiO_2	CaO	MgO	Na_2O	K_2O	SO_3	L.O.I.	
37.1	6.25	4.24	0.27	41.5	8.44	0.58	0.38	0.61	0.45	

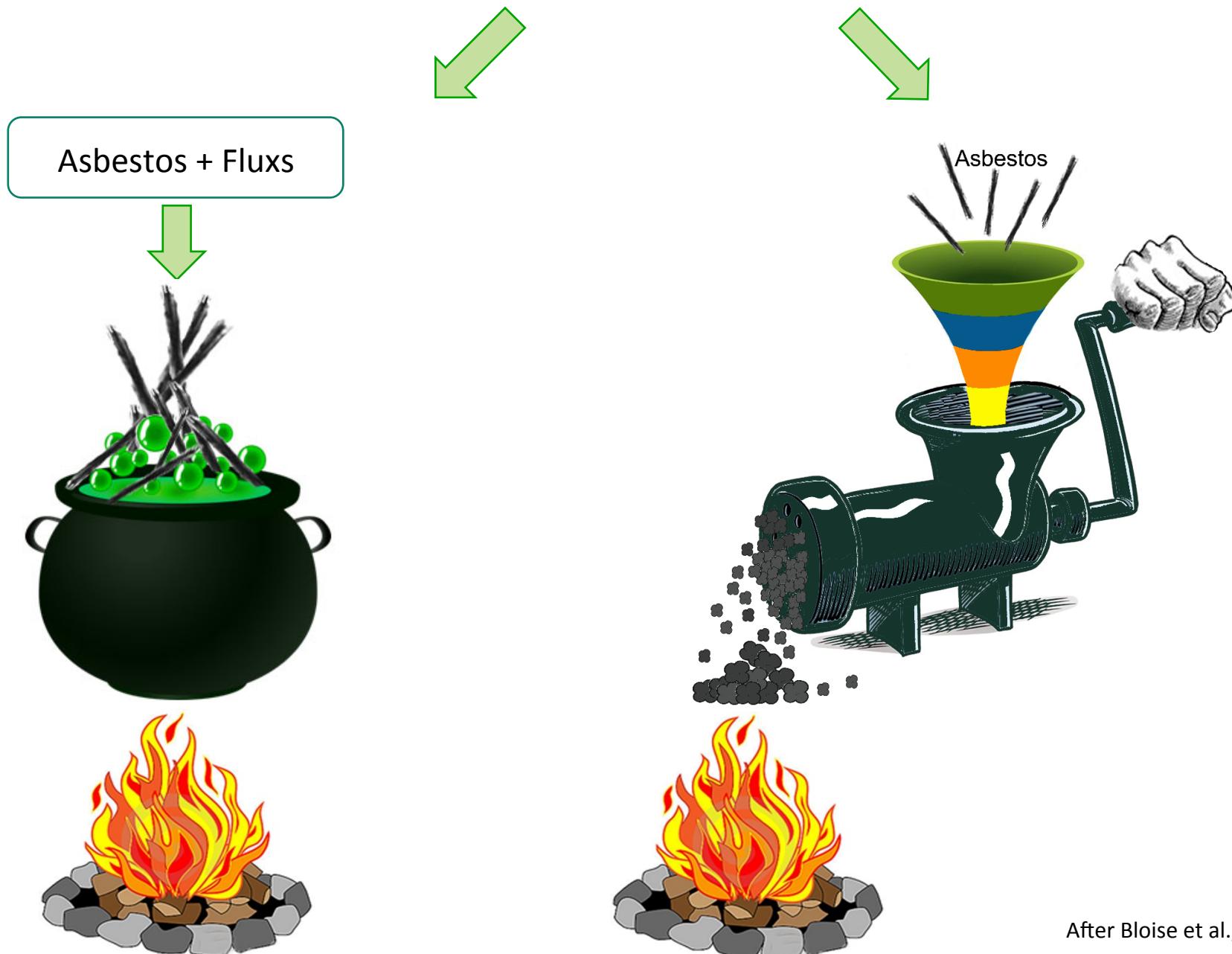
Mineralogical composition (wt%)										
Akemanite	Ferrite	Larnite	Merwinite	Glass						
46.2 (2)	0.7 (1)	10.0 (4)	14.0 (3)	29 (1)						

^a 0.09 wt% is FeO and 4.18 Fe_2O_3 (Giacobbe et al., 2010).



Plastics, tiles, bricks, cement, concrete, glass, ecc

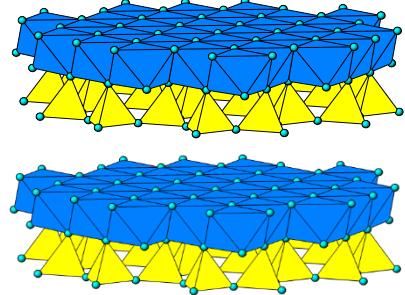
Treatments to reduce the temperature/energy of asbestos inertization



After Bloise et al., 2018.

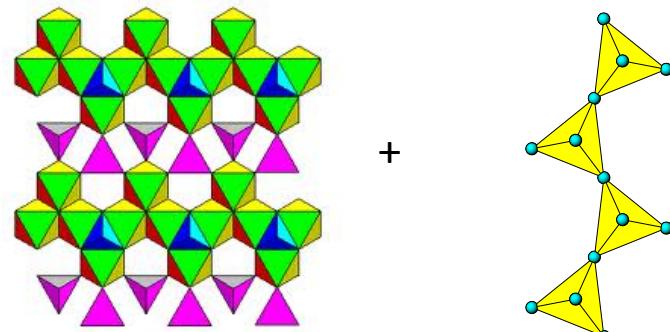
Summarize

Phyllosilicate Chrysotile asbestos

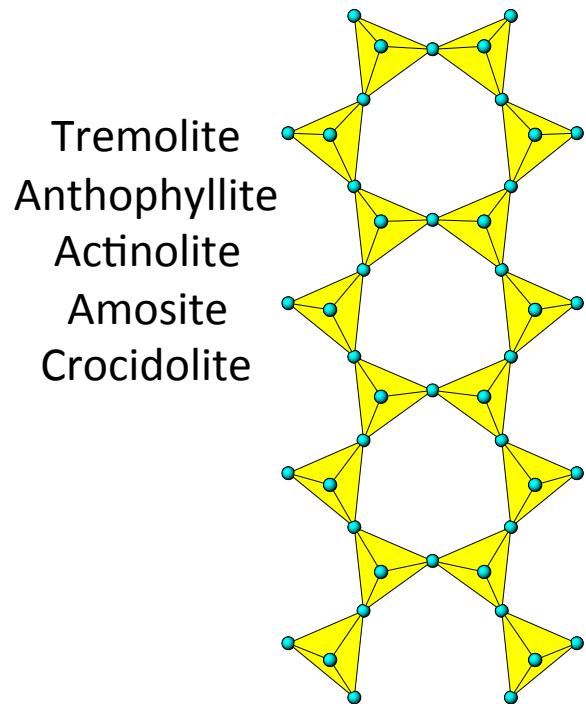


→
After thermal treatment
> 1000 °C

Forsterite + Enstatite

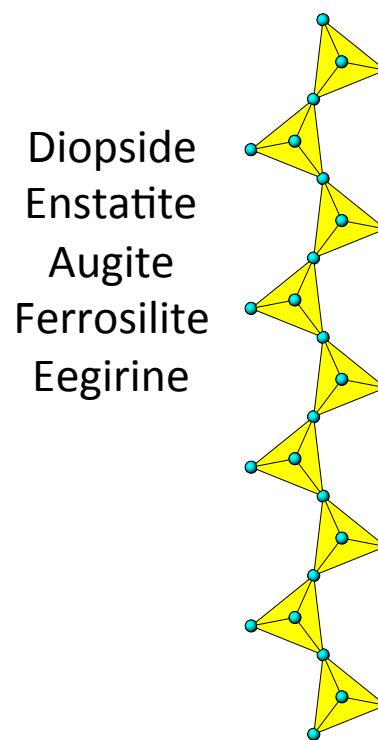


Amphiboles asbestos



→
After thermal treatment
to 1100 °C

Pyrossene



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**Thank you
for your attention**