

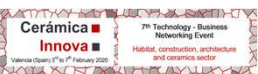


**Cerámica** ■  
**Innova** ■  
Valencia (Spain) 3<sup>rd</sup> to 7<sup>th</sup> February 2020

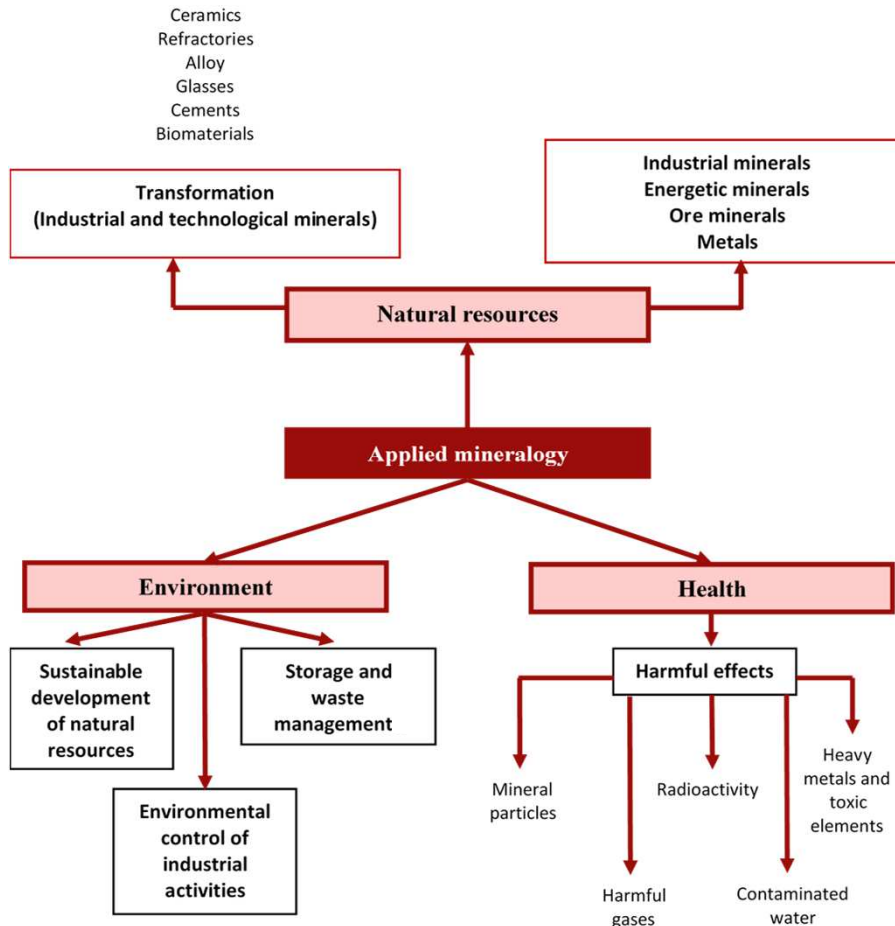
7<sup>th</sup> Technology - Business  
Networking Event  
Habitat, construction, architecture  
and ceramics sector

# QuantiROCK (IMDEEA/2019/28)

Strategy of mineral speciation and quantification by  
advanced spectroscopic techniques



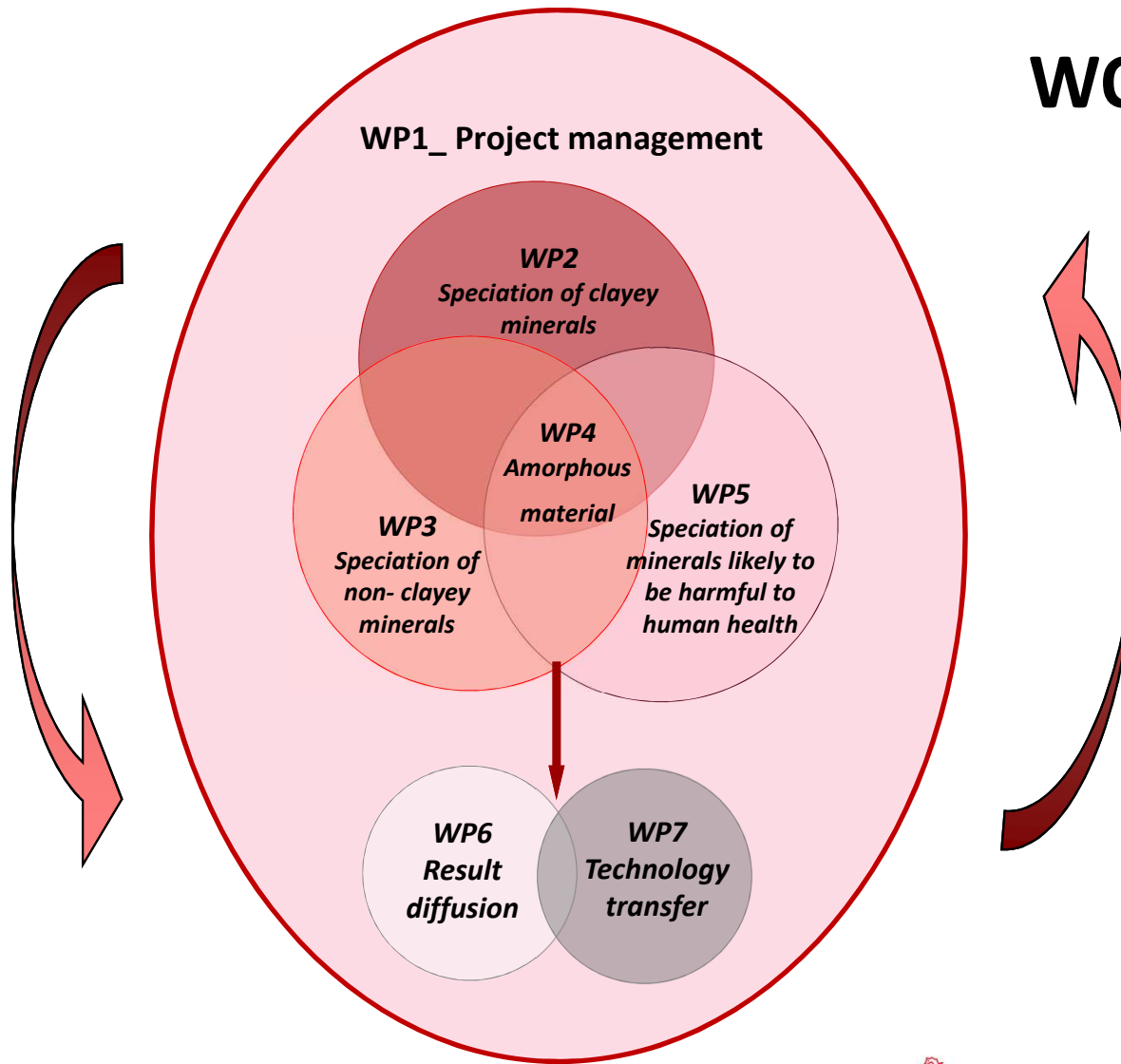
# GENERAL OBJECTIVE



To define **new specification and quantification product strategies**, obtaining specific control and characterization lab procedures of rocks and materials with a total or partial clay nature.



# WORKING PLAN



# SPECIFIC OBJECTIVES

## Speciation and quantification of non-clayey minerals

Feldspars, carbonates and silica



## Speciation and quantification of clayey minerals

Di and trioctahedral phyllosilicates of different typologies



## Speciation and quantification of minerals harmful to human health

SWerFCs and asbestos minerals



## Quantification of amorphous content

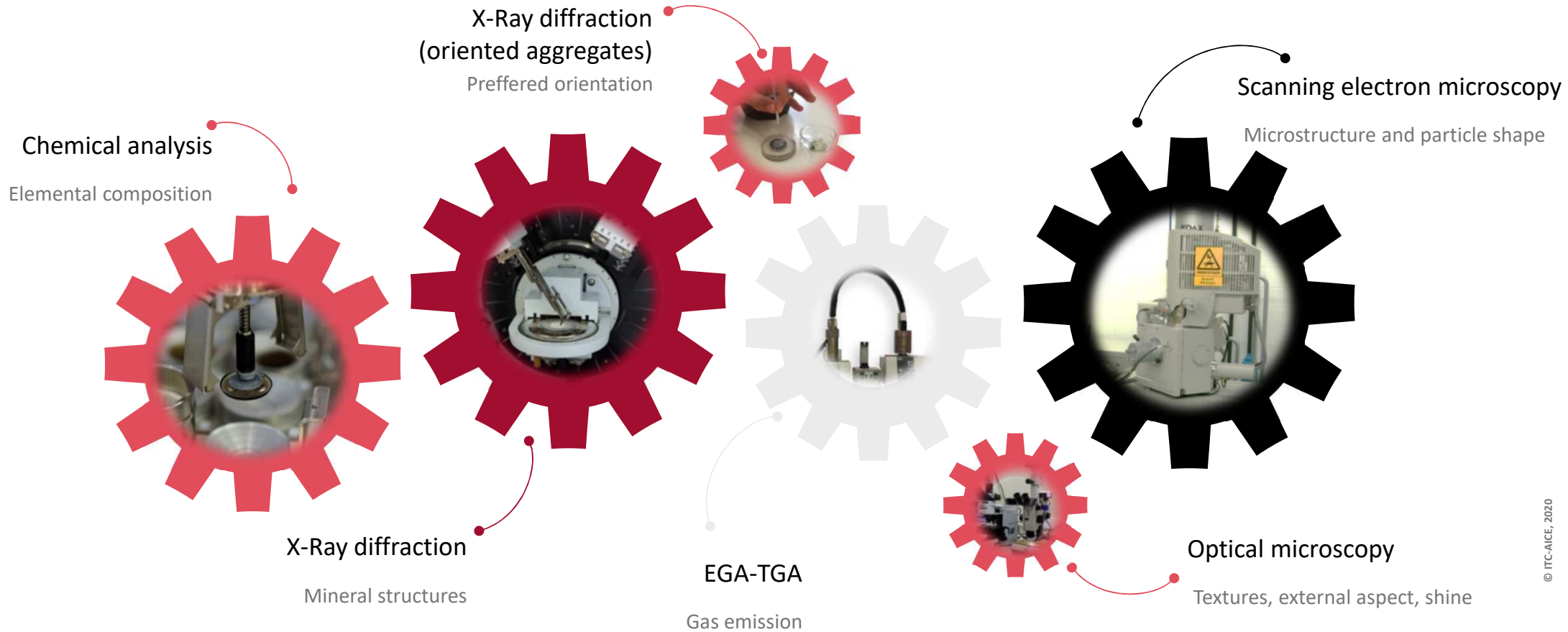
Opal, diatomaceous earth, organic material, hydroxides, iron gel



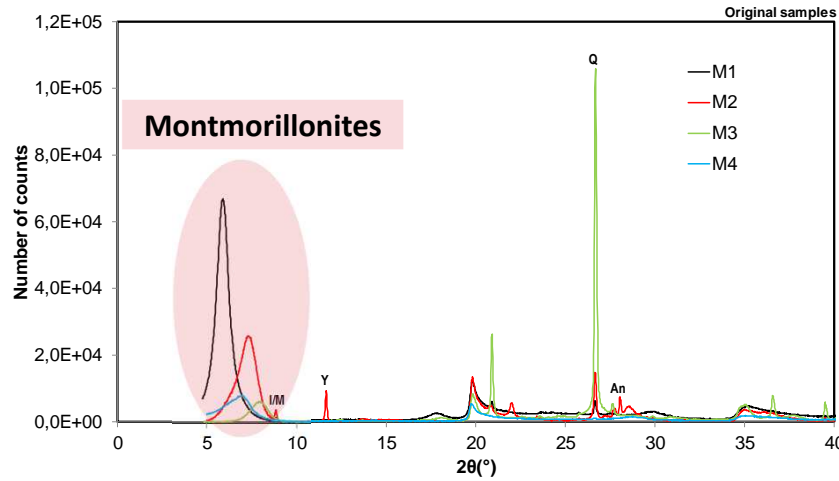
# WP2: SPECIATION OF CLAYEY MINERALS

Group	Structure	Mineral	Formula
Phyllosilicates 1:1 Kaolinite and serpentine	Diocahedral	Kaolinite, Dickite, Nacrite, Halloysite	$Al_2Si_2O_5(OH)_4$
	Triocahedral	Crisotile Antigorite Lizardite	$Mg_3Si_2O_5(OH)_4$
Phyllosilicates 2:1 Without intelaminal cations	Diocahedral	Pirophyillite	$Si_4Al_2O_{10}(OH)_2$
	Triocahedral	Talc	$Si_4Mg_3O_{10}(OH)_2$
Phyllosilicates 2:1 Mica and illite	Diocahedral	Muscovite Paragonite Illite Glauconite	$KAl_2(Si_3Al)O_{10}(OH)_2$ $NaAl_2(Si_3Al)O_{10}(OH)_2$ $K(Al_{1.75},(R^{2+})_{0.25}(Si_{3.5}Al_{0.5})O_{10}(OH)_2$ $K(R^{3+})_{1.33}(R^{2+})_{0.67}(Si_{3.7}Al_{0.3})O_{10}(OH)_2$
	Triocahedral	Phlogopite Biotite	$KMg_3(Si_3Al)O_{10}(OH)_2$ $K(Mg,Fe)_3(Si_3Al)O_{10}(OH)_2$
Phyllosilicates 2:1 Smectite	Diocahedral	Montmorillonite Beidellite Nontronite	$Al_{2-y}Mg_ySi_4O_{10}(OH)_2 \cdot yH_2O$ $Al_2(Si_{4-x}Al_x)O_{10}(OH)_2 \cdot xH_2O$ $Fe^{3+}_2(Si_{4-x}Al_x)O_{10}(OH)_2 \cdot xH_2O$
	Triocahedral	Saponite Hectorite	$Mg_{3-y}(Al,Fe)_y(Si_{4-x}Al_x)O_{10}(OH)_2 \cdot yH_2O$ $(Mg_{3-y}Li_y)Si_4O_{10}(OH)_2 \cdot yH_2O$
Phyllosilicates 2:1 Vermiculite	Triocahedral	Vermiculite	$Mg_x(Mg,Al,Fe)_3(Si,Al)_4O_{10}(OH)_2 \cdot nH_2O$
Phyllosilicates 2:1:1 Clinochlore	Diocahedral	Dombasite	$Al_{4+x/3}(Si_{4-x}Al_x)_3O_{10}(OH)_8$
	Triocahedral	Clinochlore Chamosite	$(Mg_5Al)(Si_3Al)O_{10}(OH)_8$ $(Fe_5Al)(Si_3Al)O_{10}(OH)_8$
	Di-triocahedral	Cookeite Sudoite	$(LiAl_4)(Si_3Al)O_{10}(OH)_8$ $(Al_{2.7}Mg_{2.3})(Si_{3.3}Al_{0.7})O_{10}(OH)_8$
Fibrous Phyllosilicates Sepiolite y paligorskite	---	Sepiolite Paligorskite	$(M_{5-y-z}R_y^3[ ]_z)Si_{12-x}R_x^{3+}O_{30}(OH)_4(H_2O)_4R^{2+}_{(x-y+2z)/2} \cdot (H_2O)_8$ $(M_{5-y-z}R_y^3[ ]_z)Si_{8-x}R_x^{3+}O_{20}(OH)_2(H_2O)_4R^{2+}_{(x-y+2z)/2} \cdot (H_2O)_4$
Interstratified minerals	Diocahedral	Rectorite Tosudite	Illite/esmectite Chlorite/smectite
	Triocahedral	Alietite	Talc/saponite

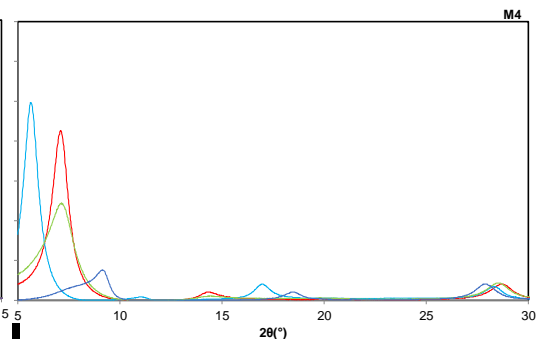
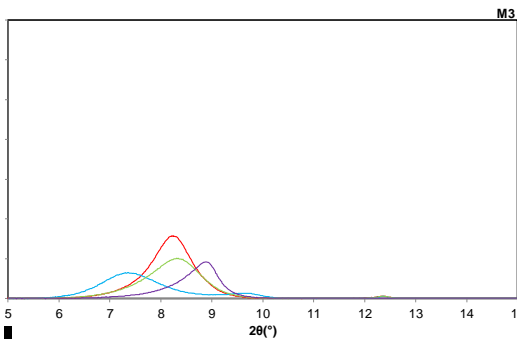
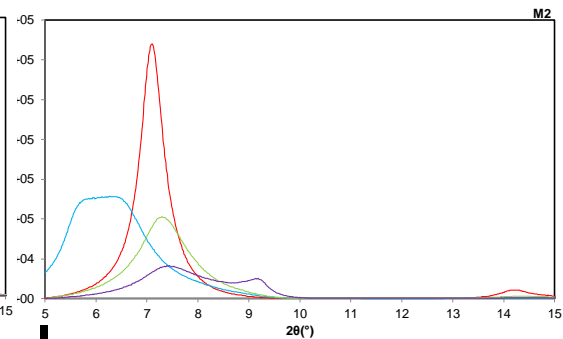
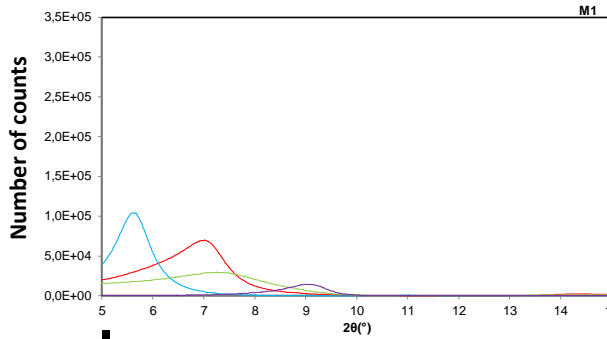
# WP2: SPECIATION OF CLAYEY MINERALS



# WP2: SPECIATION OF CLAYEY MINERALS



- Oriented aggregates
- Or. Agg. Glicolated
- Or. Agg. Gl. treated at 350°C
- Or. Agg. Gl. treated at 550°C



96  
%

Ca-Montmorillonite



82  
%

Na-Montmorillonite



20  
%

Regular interstratified  
illite-vermiculite



100  
%

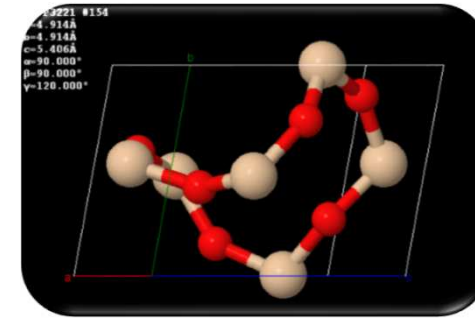
Na,Ca- montmorillonite  
(Low crystallinity)



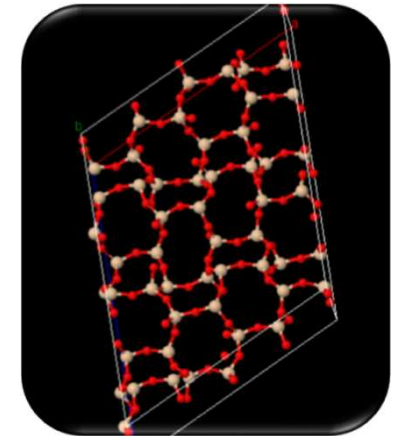
# WP3 and WP4: SPECIATION OF NON-CLAYEY MINERALS

Group	Structure	Minerals	Formula
Feldspars	Feldspar	Albite	NaAlSi <sub>3</sub> O <sub>7</sub>
		Anorthite	CaAlSi <sub>3</sub> O <sub>7</sub>
		Orthoclase	KAlSi <sub>3</sub> O <sub>7</sub>
		Celsian	BaAlSi <sub>3</sub> O <sub>7</sub>
	Feldespathoid	Nepheline	Na <sub>3</sub> KAl <sub>4</sub> Si <sub>4</sub> O <sub>16</sub>
Silica	Crystalline (Polymorphs)	Quartz	SiO <sub>2</sub>
		Tridymite	SiO <sub>2</sub>
		Cristobalite	SiO <sub>2</sub>
Carbonates	Hexagonal	Calcite	CaCO <sub>3</sub>
		Dolomite	(Ca,Mg)CO <sub>3</sub>
	Orthorhombic	Magnesite	MgCO <sub>3</sub>
		Witherite	BaCO <sub>3</sub>

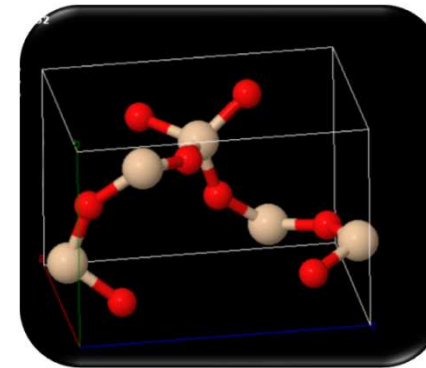
Quartz  
(Trigonal SiO<sub>2</sub>)



Tridymite  
(Rhombic SiO<sub>2</sub>)



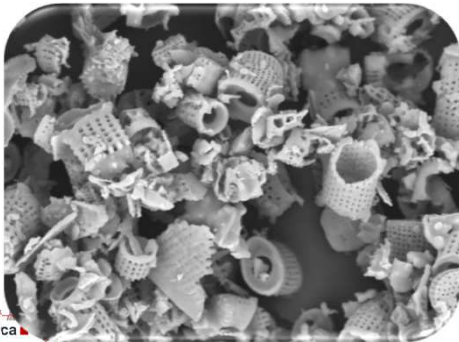
Cristobalite  
(Tetragonal SiO<sub>2</sub>)



Opal  
(SiO<sub>2</sub>·nH<sub>2</sub>O)



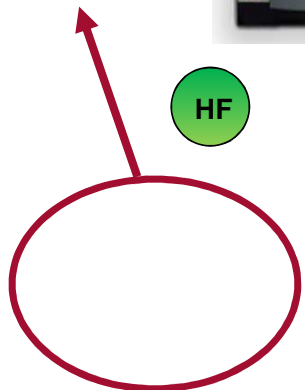
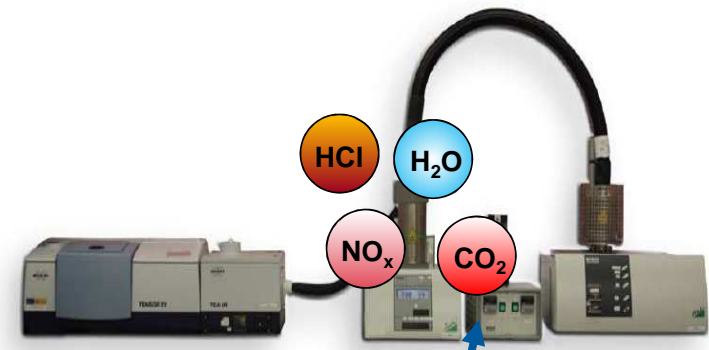
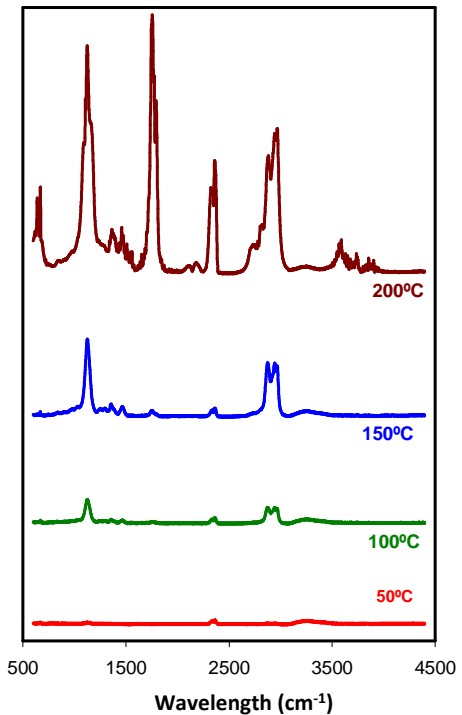
Diatomeaceous earth  
(amorphous SiO<sub>2</sub>)



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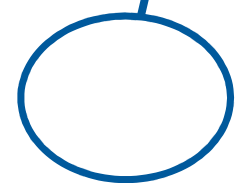


# WP3: SPECIATION OF NON-CLAYEY MINERALS



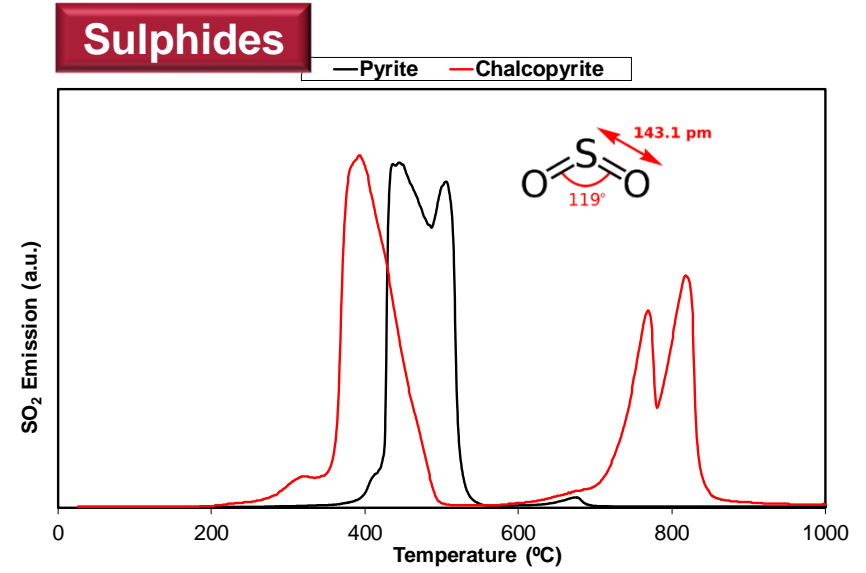
FTIR

DSC-TG



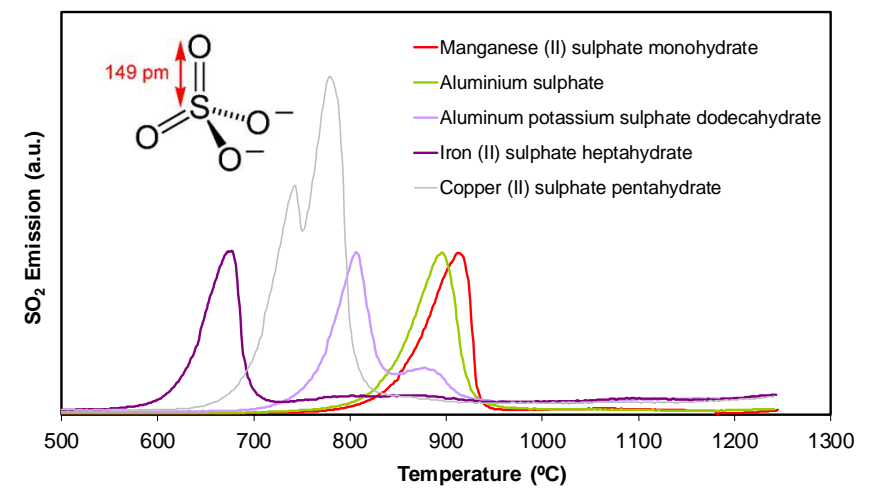
QMS

HF



## Sulphides

## Sulphates



# WP5: SPECIATION MINERALS HARMFUL FOR HUMAN HEALTH



SWeRF determination

Limit of quantification <0.1%



Asbestos determination

Limit of quantification <0.5%

Listado de proyectos recientes

ID	Nombre del Proyecto	Entidad	Año Inicio	Año Fin	Región	Coordinador
21	PG Nano - Exposición laboral a n...	IVACE - Instituto de la Pequeña y...	2019	2020	Regional	Coordina: ITC - Participantes: UNI...
22	PRESTILE - Mejora de las prestaci...	IVACE - Instituto de la Pequeña y...	2019	2020	Regional	Coordina: ITC -
23	Propuesta innovadora para la cre...	Agencia Valenciana de Innovació...	2019	2019	Regional	Coordina: FACSVA - Participantes: E...
24	QuantIRock - Estrategia de espe...	IVACE - Instituto de la Pequeña y...	2019	2021	Regional	Coordina: ITC -
25	SIMALV - Estrategia hacia una Ec...	IVACE - Instituto de la Pequeña y...	2019	2019	Regional	Coordina: ITC -
26	SINCERAM - Búsqueda y análisis...	IVACE - Instituto de la Pequeña y...	2019	2019	Regional	Coordina: ITC -

# WP6: DIFFUSION ACTIONS

Noticias: El ITC, a través del proyecto QuantIRock, innova en la caracterización de

Título: QuantIRock - Estrategia de especificación y cuantificación de minerales mediante técnicas espectroscópicas avanzadas  
 Inicio: 01/04/19 Fin: 30/04/21

**QuantIRock - Development of mineral speciation and spectroscopic techniques**  
 María Pilar Gómez Tena • Estable Zamarqueo  
 Javerica Gilabert • Colaboradores  
 Show all 4 collaborators  
 Goal: Nowadays, the European industrial sector is evolving towards 4.0 industry through an integrated system of resource and material management. This means that there is an increasing effort towards recycling raw materials belonging to different ceramic sectors, raising by-products and studying the possibility of adding new sustainable raw materials into the ceramic products and adapting the necessary technical specifications and regulations to meet this new framework, everyday more and more technical specifications and regulations must be fulfilled by raw materials depending on the sector they are intended to leading to new partially resolved analytical challenges.  
 The main objective of QuantIRock is to define new strategies for product speciation and characterization, as well as to obtain specific protocols for the control and characterization of clayey non-clayey amorphous and crystalline materials, or quantification of fibrous minerals related to asbestos or other hazardous materials.  
 The project will be helpful to the community by public and available to any professional. As a result, it will be able to control their products and processes in a sustainable way.  
 2019-2021

**El ITC, a través del proyecto QuantIRock, innova en la caracterización de minerales arcillosos**  
 El Instituto Tecnológico Cerámico (ITC) ha desarrollado el proyecto QuantIRock dirigido a especificación y cuantificación de minerales mediante técnicas espectroscópicas avanzadas. Este proyecto, financiado por el Fondo FEDER de Desarrollo Regional, busca mejorar la caracterización de los minerales arcillosos presentes en las arcillas, lo que permitirá optimizar los procesos de fabricación de cerámica y reducir las emisiones de CO2.



**Cerámica Innova**  
 7th Technology - Business Networking Event  
 Habitat, Occupation, architecture and innovation sector  
 Valencia (Spain) 16-17 February 2020

**QuantIRock: Estrategia para la caracterización de minerales arcillosos**  
 M. P. GÓMEZ TENA, J. GILABERT, M. P. GÓMEZ TENA, M. P. GÓMEZ TENA  
 INSTITUTO TECNOLÓGICO CERÁMICO (ITC) A SOCIEDAD DE INVESTIGACIÓN DE LA INDUSTRIA CERÁMICA (IACS), UNIVERSITAT JAUME I, CAPELLON, E. SPAIN.

1. Introducción	4. Resultados
2. Metodología y materiales	5. Conclusiones
3. Metodología y materiales	

**QuantIRock (IMDEEA/2019/28)**  
 Strategy of mineral speciation and quantification by advanced spectroscopic techniques

**El ITC, a través del proyecto QuantIRock, innova en la caracterización de materiales**  
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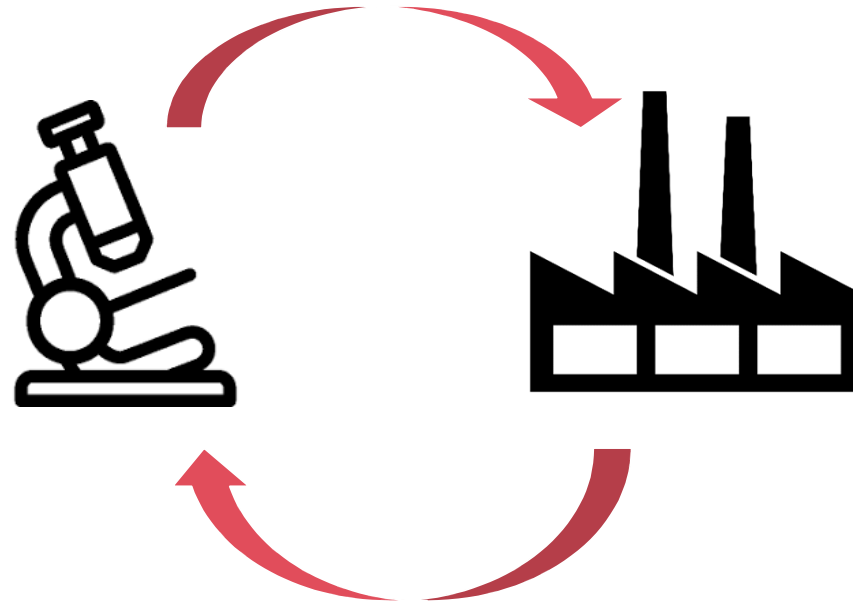
**Quantification of minority minerals present in clays related to acid emissions in tiles manufacturing by Evolved Gas Analysis methodology**

International conference on clay science and technology  
**EUROCLAY**  
 July 2019  
 GENERALITAT VALENCIANA  
 IVACE INSTITUTO VALENCIANO DE COMPETITIVIDAD EMPRESARIAL  
 UNIVALLE VALLE DE LA UNIVERSIDAD DE VALÈNCIA  
 IACS INSTITUTO TECNOLÓGICO CERÁMICO

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# WP7: TECHNOLOGY TRANSFER

Companies which cooperate  
**GENERATING KNOWLEDGE,**  
from the beginning to the end of the project



Companies which participate  
**VALUATING RESULTS**  
obtained during the project



**EUROARCE\_SAMCA  
ARCIBLANSA  
QUIMIALMEL**



**AGC FLAT GLASS  
IBÉRICA**

# THANK YOU

**Dra. Jessica Gilabert Albiol**

Physico-structural characterization laboratory

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