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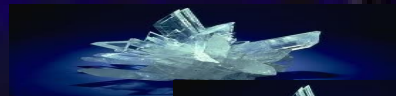
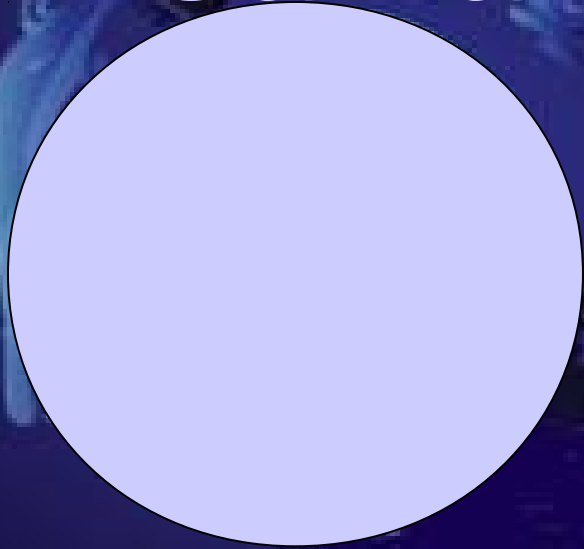
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# **WALKING ON A CARPET OF STARS UNDER THE MOONLIGHT**

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**EGU General Assembly 2011**

*Can a touch of romanticism  
come from science?*



We are using the beauty of the natural world to move young students into the rich and intriguing world of Geology.

Starting from a scenery in the moonlight (i.e. walking on selenite, reflecting the light of the moon), we elicit the desire to approach a series of topics, linked to each other. The final aim is to introduce an important, easy to reach and observe, local example of outstanding geological significance, the gypsum vein, while opening a window on the evolution of the Mediterranean basin.

The main feature of the teaching project is an excursion to the places of geological importance, where it is easier to appreciate the subject at hand and learn on the spot.

# IN THE LABORATORY



Firstly, examination of minerals and gypsum crystals samples, paying attention to physical properties, crystal varieties and chemical composition. We compare gypsum with some other minerals, like halite.

Secondly, a bit of chemistry, to examine solubility of salts and their precipitation, one after the other, the least soluble first. All the observations are immediately connected with evaporitic phenomena of the past causing deposition of strata. Emphasis is necessary in order to help students realize and appreciate the length of time taken for this development to occur and the extraordinary change in scenery as a consequence.



**Selenite**  
shows a  
moon-like  
pearly glow  
on cleavage  
fragments.





# EVAPORITE MINERALS



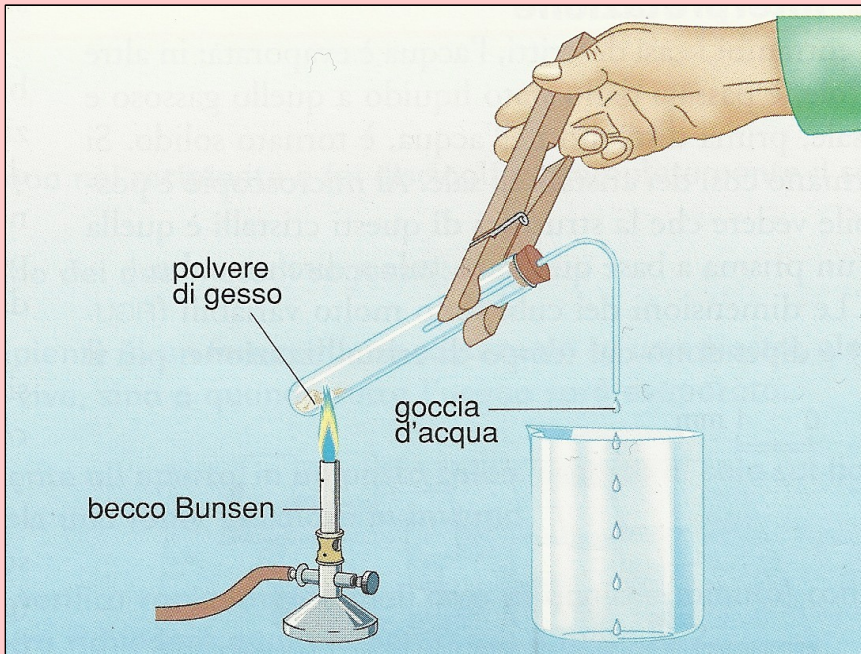
**gypsum**



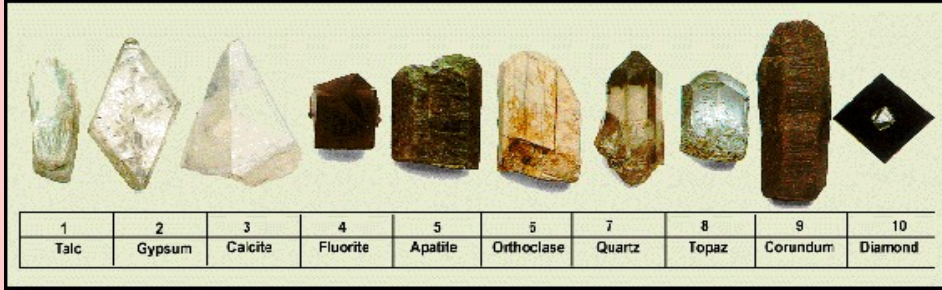
**anhydrite**



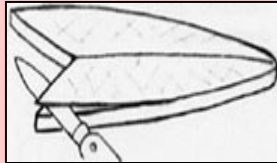
**alite**



# THE MINERAL GYPSUM



**Chemical  
formula:**  
 $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$



Gypsum prismatic  
crystals



bright orange selenite



Colorless  
gypsum



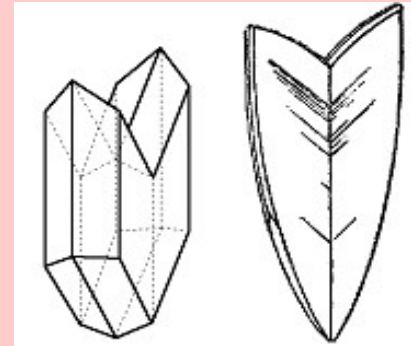
Gypsum satin



Gypsum rosette



Sand inclusions gypsum



Gypsum-selenite  
fishtail

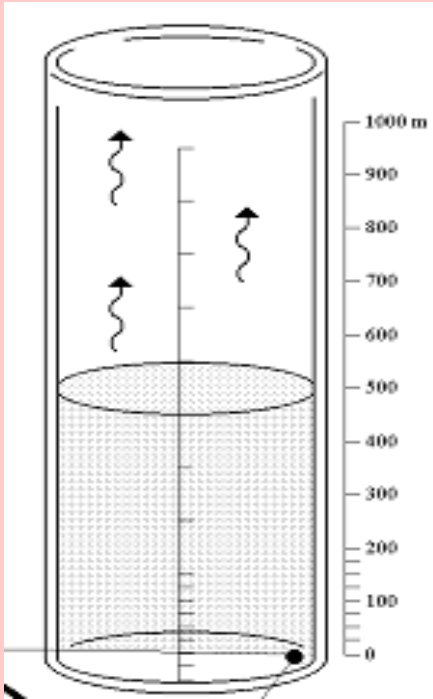


Yellow gypsum



Pseudo-hexagonal  
prismatic habit

# USIGLIO'S HISTORICAL EXPERIMENT (1849)



Sea water was evaporated to determine the sequence of salts precipitated:

1.  $\text{CaCO}_3$  0.11g when  $\text{vol}=1/2$
2.  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$  -  $\text{CaSO}_4$  1.74g  $\text{vol}=1/5$
3.  $\text{NaCl}$  29,64g  $\text{vol}=1/10$

In the lab: COMPARE solubility of  $\text{CaCO}_3$ , with that of  $\text{CaSO}_4$ , and  $\text{NaCl}$ .



# GROWING CRYSTALS from salt and copper sulfate solutions



**LET THE  
WATER  
EVAPORATE!**



NaCl



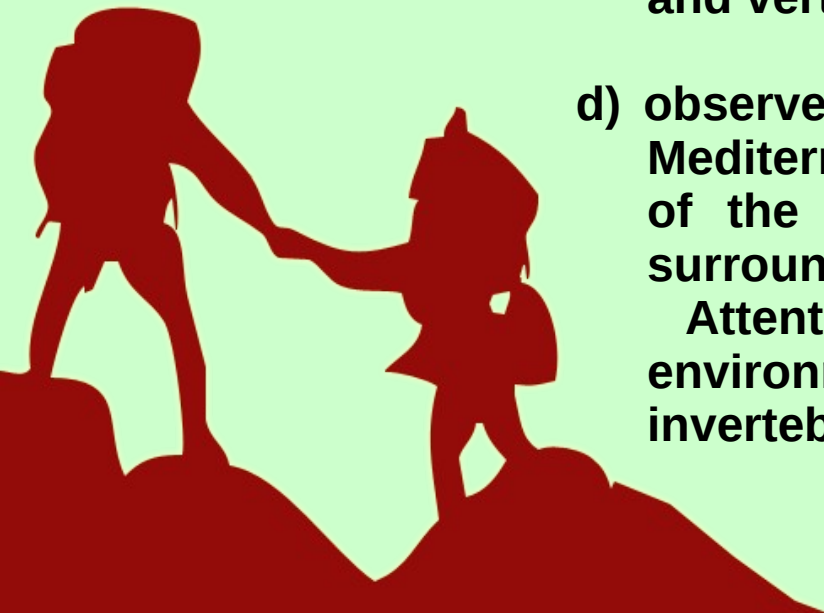
$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$   
Copper sulfate

Compare the  
crystal shapes.

# THE EXCURSION

The geological set of the gypsum vein is one of the best examples in order to:

- a) introduce the stratigraphic principles and relative dating
- b) focus later on the causes of its origin
- c) observe the territory characterized by the very noticeable strata of sedimentary gypsum deposits, and by the presence of dolines, close valleys, swallow holes, caves and vertical furrows
- d) observe fauna and flora of the outcrops, which includes Mediterranean species in the warm areas, typical species of the hills and mountain species in the cool areas surrounding the swallow holes.  
Attention will be given to adaptations to the hypogean environment: some species of Chiropters and rare invertebrates are interesting examples.





# STRATIGRAPHIC PRINCIPLES



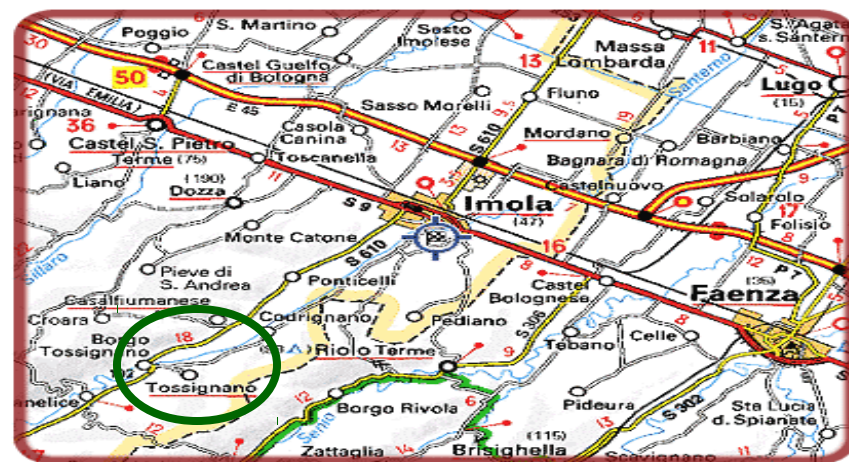
Principle of stratigraphic superposition  
Principle of original horizontality  
Principle of original lateral continuity



# THE GYPSUM VEIN



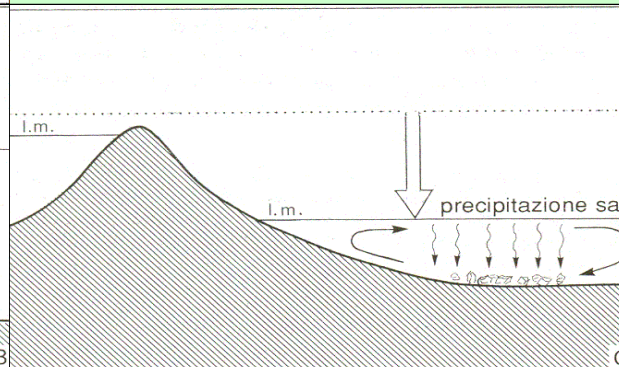
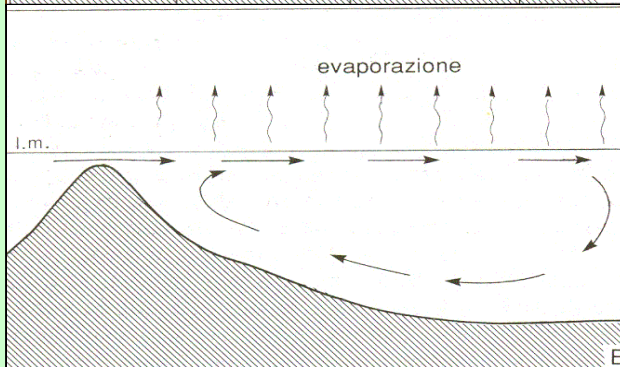
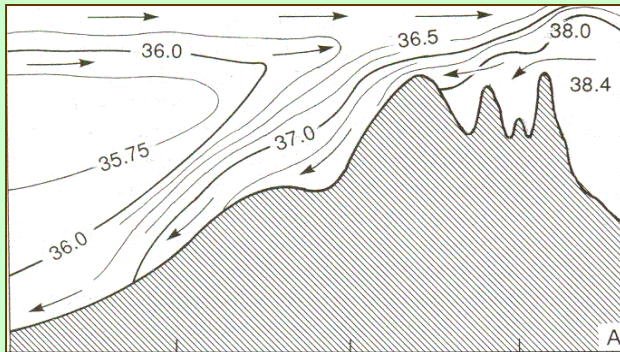
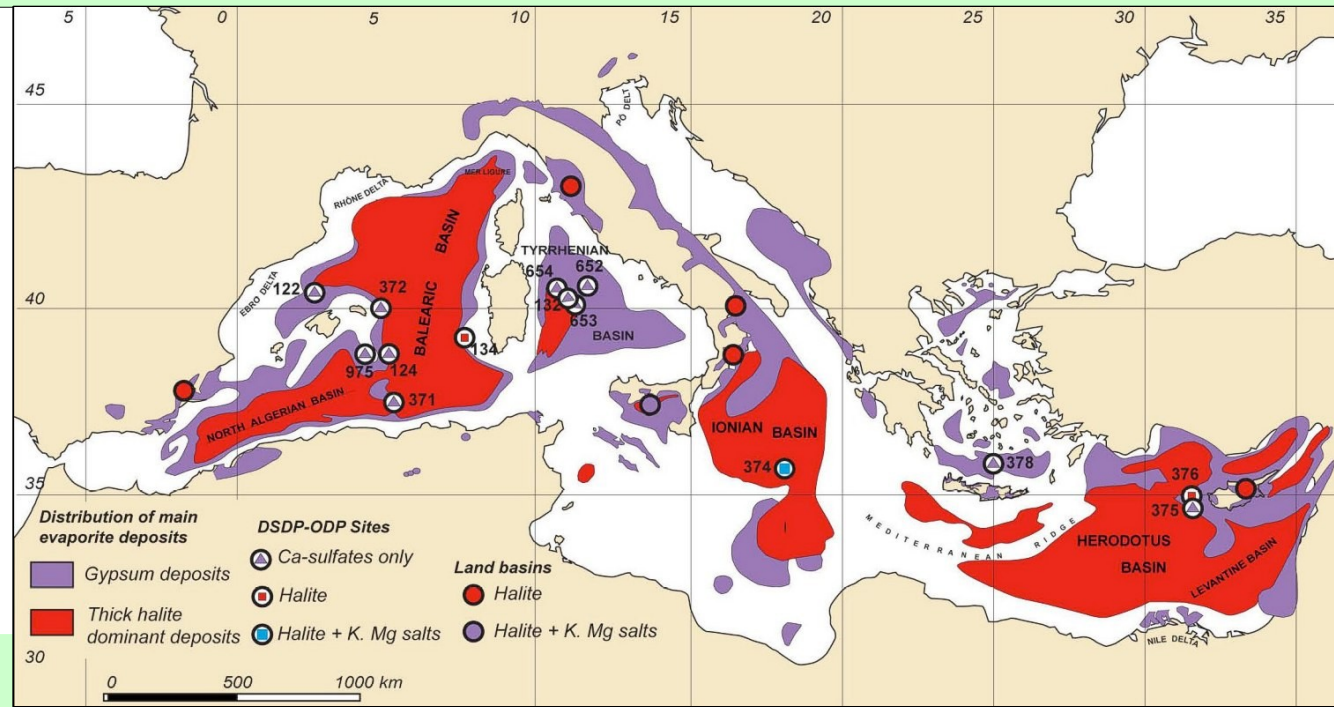
View from  
Tossignano





**GYPSUM IS A SEDIMENTARY  
ROCK, TYPICALLY FOUND IN  
THICK BEDS OR LAYERS.**





# ORIGIN



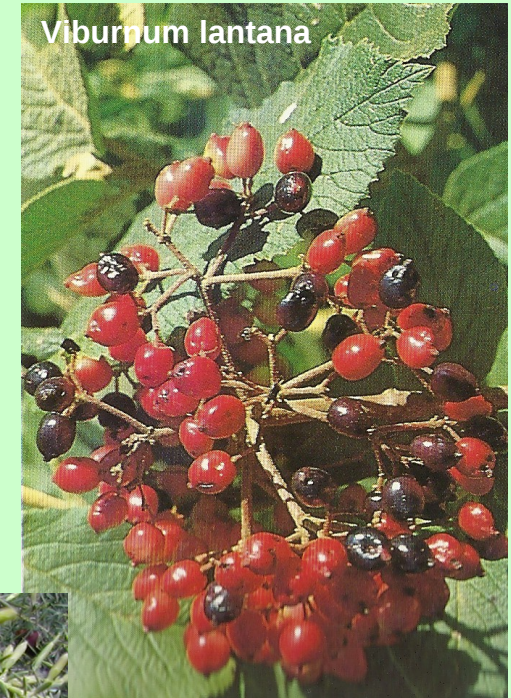


# THE TERRITORY



# FLORA

Vegetation characterized by Mediterranean species and species linked to higher altitudes.



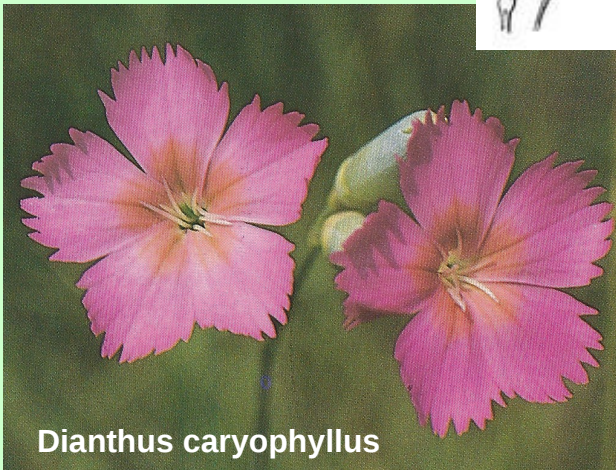
*Viburnum lantana*



*Juniperus oxycedrus*



*Staphylea pinnata*



*Dianthus caryophyllus*



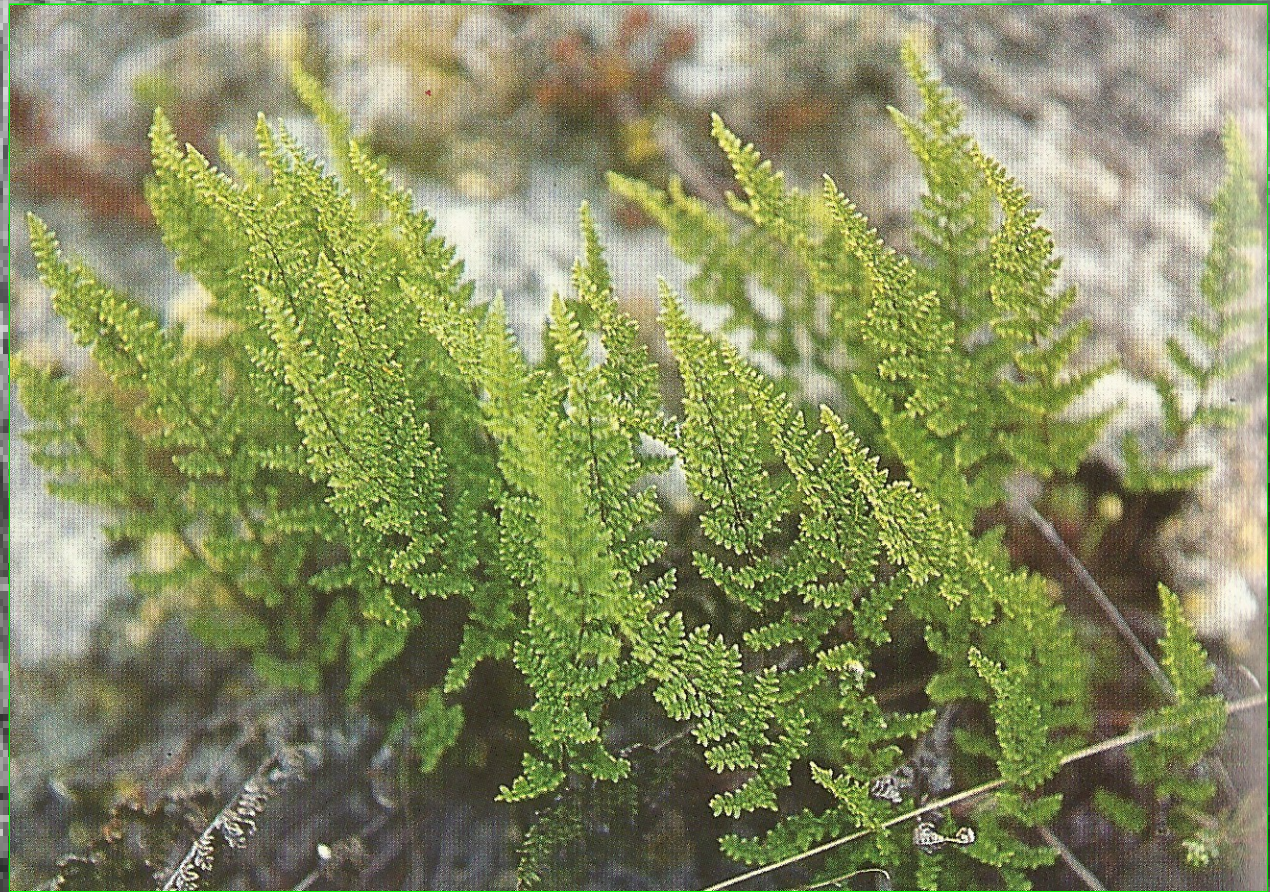
*Galanthus nivalis*



*Quercus pubescens*



The botanical symbol of the Vena del Gesso is a rare, small fern, the *Cheliantes persica*.

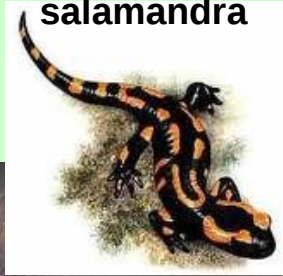




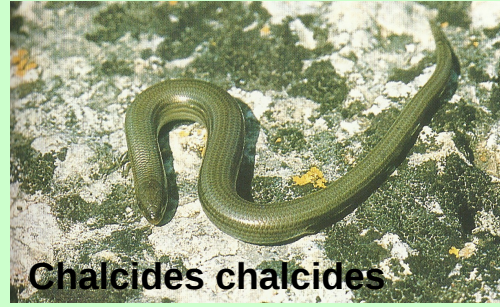
# FAUNA

## Animals of the hills

*Salamandra  
salamandra*



*Chalcides chalcides*



*Oedipoda coerulescens*



*Merops apiaster*



*Picus viridis*



*Sciurus vulgaris*



*Empusa pennata*



*Bombina variegata*





# FAUNA

## Animals of the caves

reduction in eye size  
depigmented body  
long antennae  
no wings  
reduced metabolic rate



*Dolichopoda palpata laetitia*

## Adaptations to the hypogean environment



*Nesticus eremita*



colonies of bats



the rare bat *Tadarida teniotis*



*Rhinolophus ferrumequinum*



*Niphargus*

# RELATIONSHIP BETWEEN MAN AND EARTH

Finally the human dimension of Earth Science comes into the teaching project:

- a) by visiting the city of Bologna to see the use of selenite in medieval architecture. The city is located close to major gypsum outcrops, and so the use of selenite has spread since ancient times. Blocks of selenite were used for their beauty, while the dehydrated mineral has been used for a long time to obtain mortars and plasters. We can still observe selenite in the remains of the city walls, in the bases of the XII century towers, in architraves, in Romanesque churches.
- b) by acknowledging that the gypsum vein is the main feature of the Gessi Bolognesi Park and Gessi Romagnoli Park, both protected areas of the Emilia Romagna region. The first one is related to the names of Luigi Fantini (1895-1978), whose studies promoted the environmental value of the Bolognese gypsum vein. The second one was created in 2005, on the 100<sup>th</sup> anniversary of the death of Giuseppe Scarabelli (1820-1905) of Imola, who was the first to have the correct insight about the origin of the gypsum deposits. As a consequence he realized the geological importance of the most significant gypsum vein in Europe.



# IMOLA



**TOSSIGNANO- TOWN HALL**  
columns and capitals in selenite

# TOSSIGNANO

**IMOLA- TOWN HALL**  
balustrade in selenite

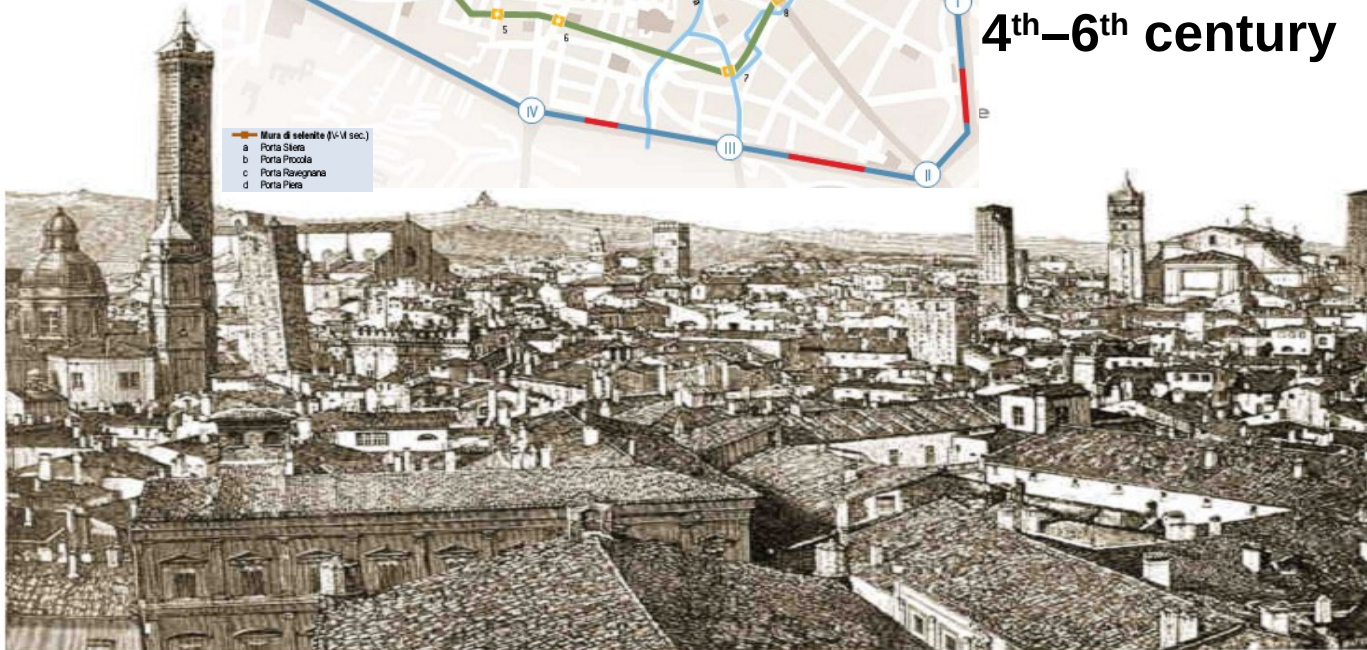


# BOLOGNA AND THE USE OF SELENITE IN ARCHITECTURE



## THE SELENITE CIRCLE

4<sup>th</sup>–6<sup>th</sup> century



remains of the ancient city walls



# WALL OF THE TORRESOTTI OR GATE-TOWERS (brick and selenite)

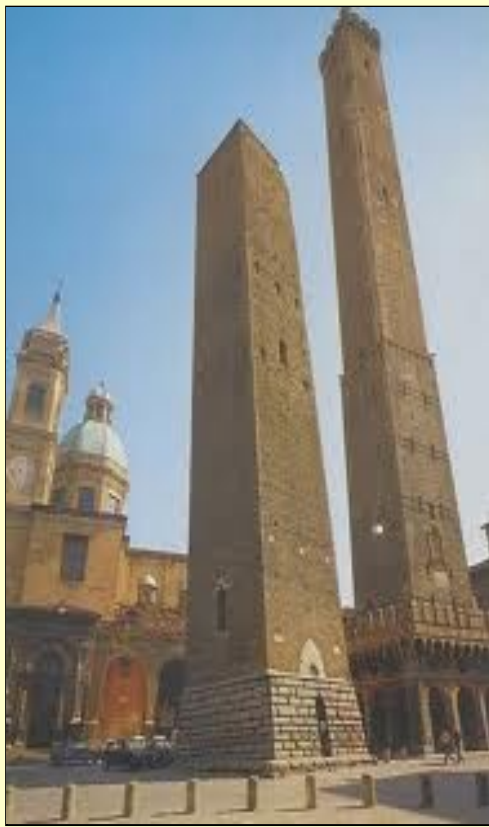


11<sup>th</sup> -12<sup>th</sup> century

One of the two  
pintles of Porta  
Nova (selenite)



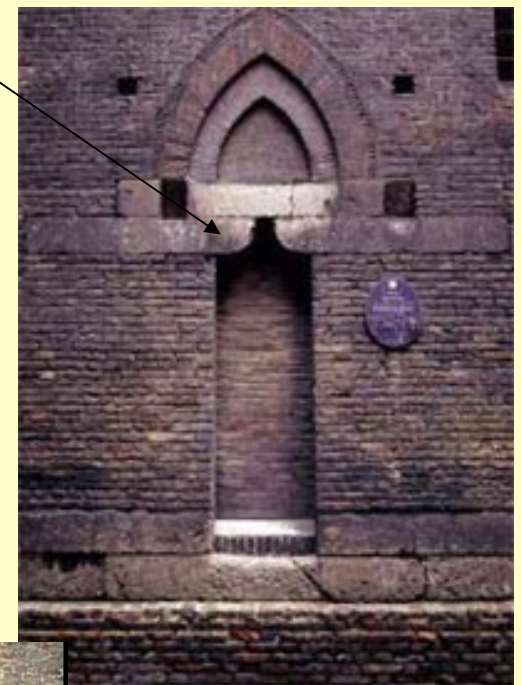




**GARISENDA  
TOWER**



**selenite**



**UGUZZONI TOWER:  
portal**



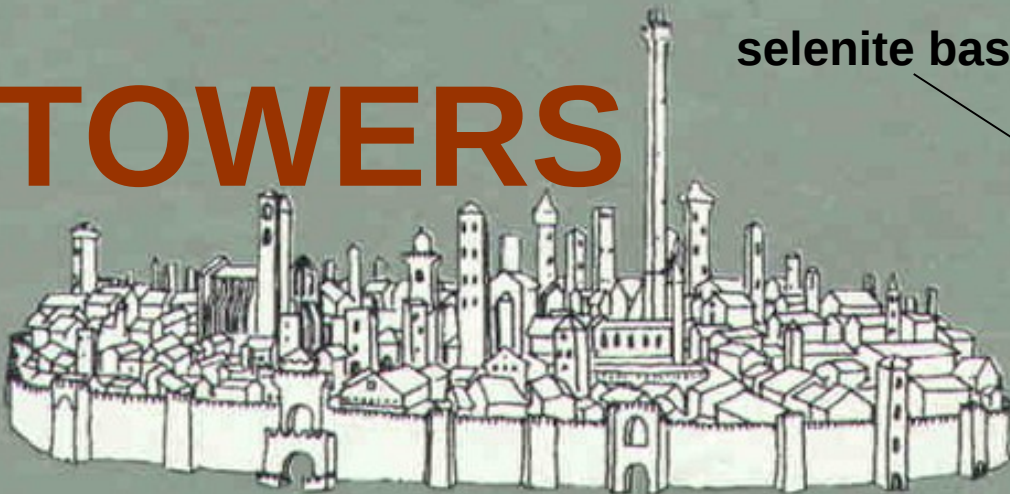
**PRENDIPARTE  
TOWER**



**BERTOLOTTO TOWER  
sill, pills, architrave  
in selenite**

**TOWERS**

**selenite base**





# THE SILVER CITY

CATALANI HOUSE



the facing door has a step, architrave and close-set modillions in selenite



plinth or base of wooden column in selenite



iron ring set into a block of selenite



Complex of Santo Stefano



capitals in selenite



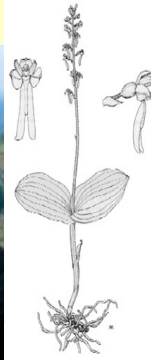
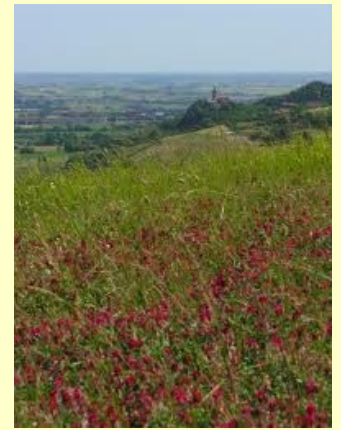
Capitals in selenite



# GESSI BOLOGNESI PARK

L.R. 2/04/1988 n. 11

4815 ha



L.R. 21/02/2005 n. 10



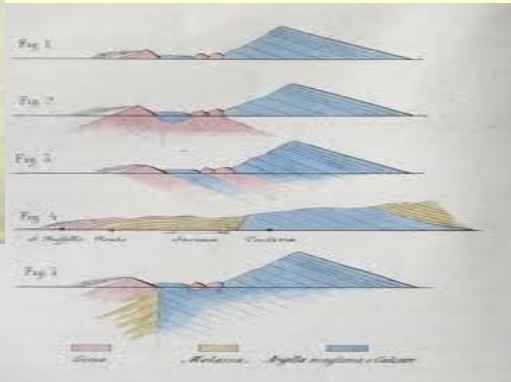
# GESSI ROMAGNOLI PARK 6064 ha





# GIUSEPPE SCARABELLI

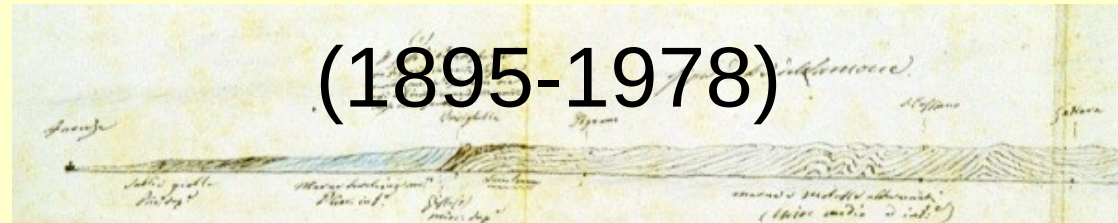
(1820-1905)



Scarabelli was the first to realize the geological importance of the most significant gypsum vein in Europe.

## LUIGI FANTINI

discovered the Spipola Cave in 1932, the largest european one in gypsum rocks.



(1895-1978)



*Diacebbe firmanni:*  
*Luigi Fantini.*  
*Ricercato Appenninico*

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