

# Les silex de Volgu une découverte mystérieuse

Classes  
**Solutré**

Which is the geologic origin of flints from which arises the laurel leaves points of Volgu ?

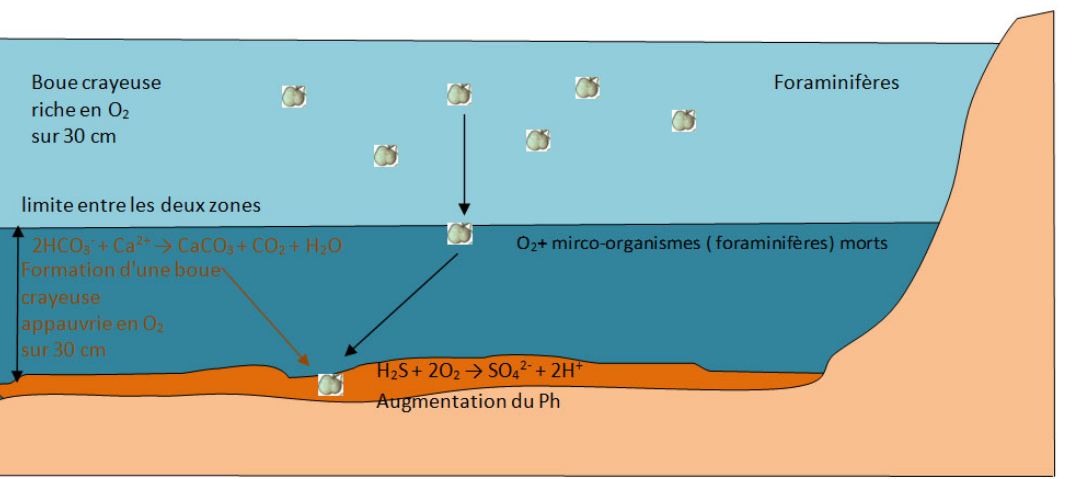
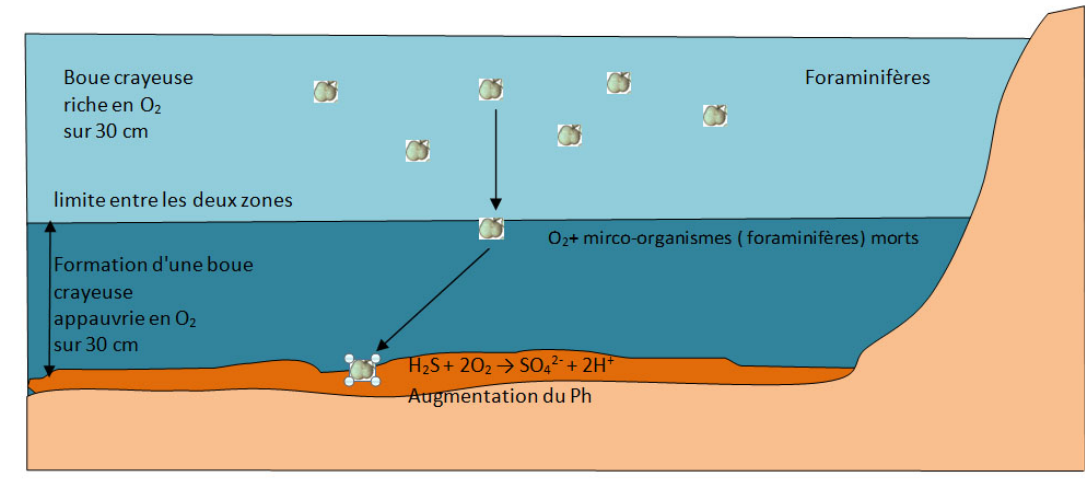
## Formation of a flint

### STEP 1

The formation of a flint happens at sea bottoms where water is calm, shallow and where temperature is warm. Technically this is silica precipitation.

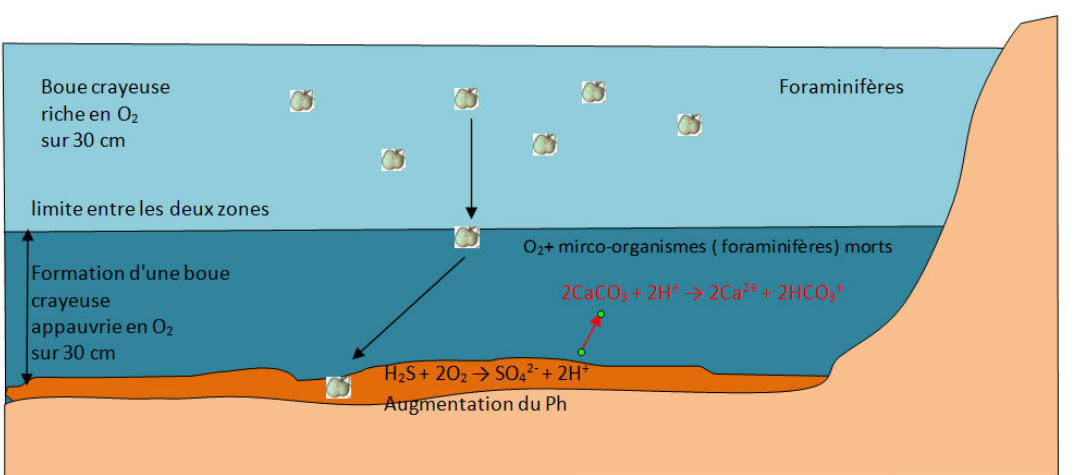
The sea bottoms can be compared to a layer of mud containing microscopic dead animal bodies – called « foraminifera » - and dioxygen. These foraminifera decompose by bacteria that use sulphur contrary to their shells that don't decompose.

This reaction brings about the production of hydroxide ions that are going to decrease pH, so the water is going to be more acid.

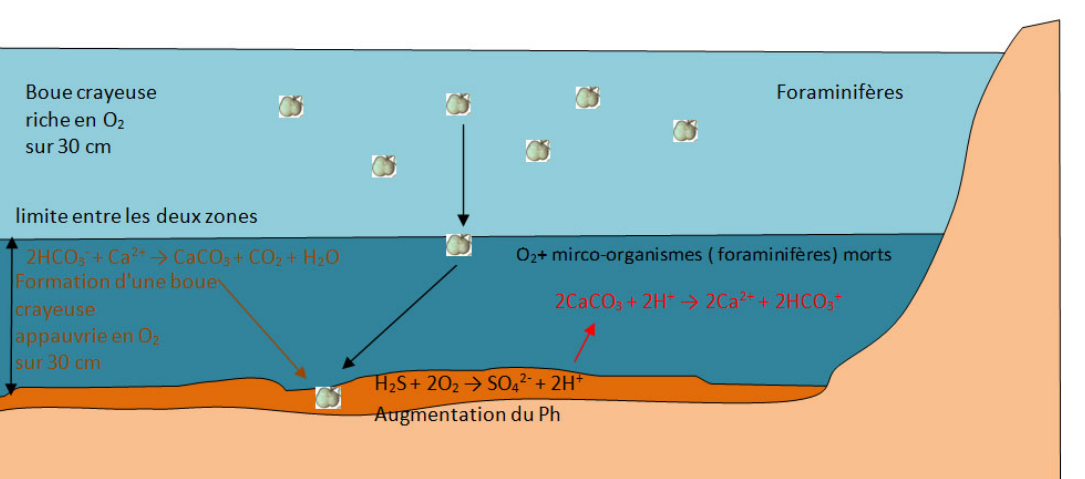


### STEP 2

Along with the first step, calcium carbonate – in other words « limestone » - is made at the sea bottom around the shells of foraminifera.

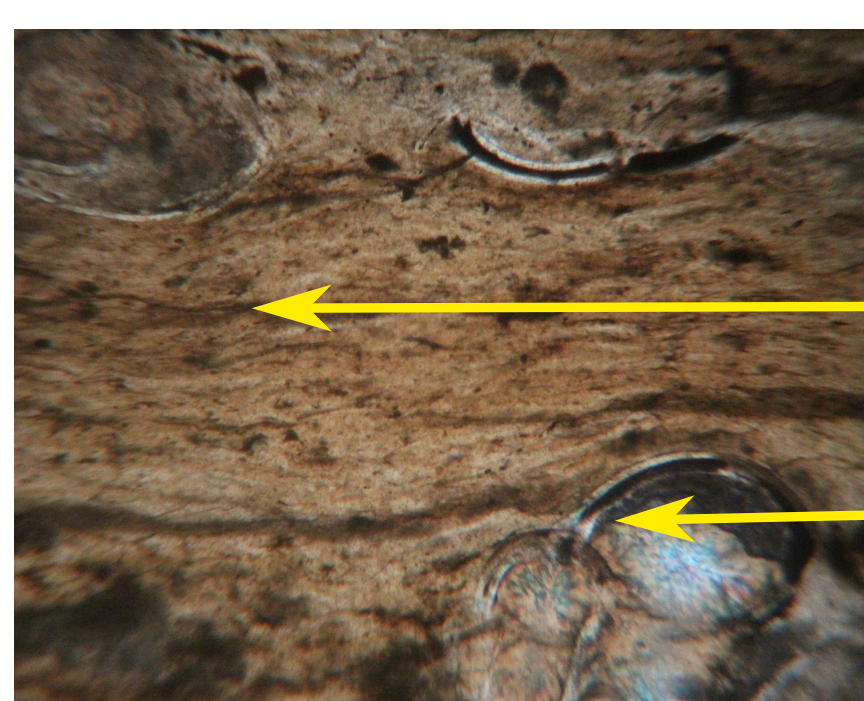


Close to the areas where organic matter decomposes, water gets more acid, This brings about a new dissolution of calcium carbonate, which creates some hydrogen carbonate and a new increase in pH for water.

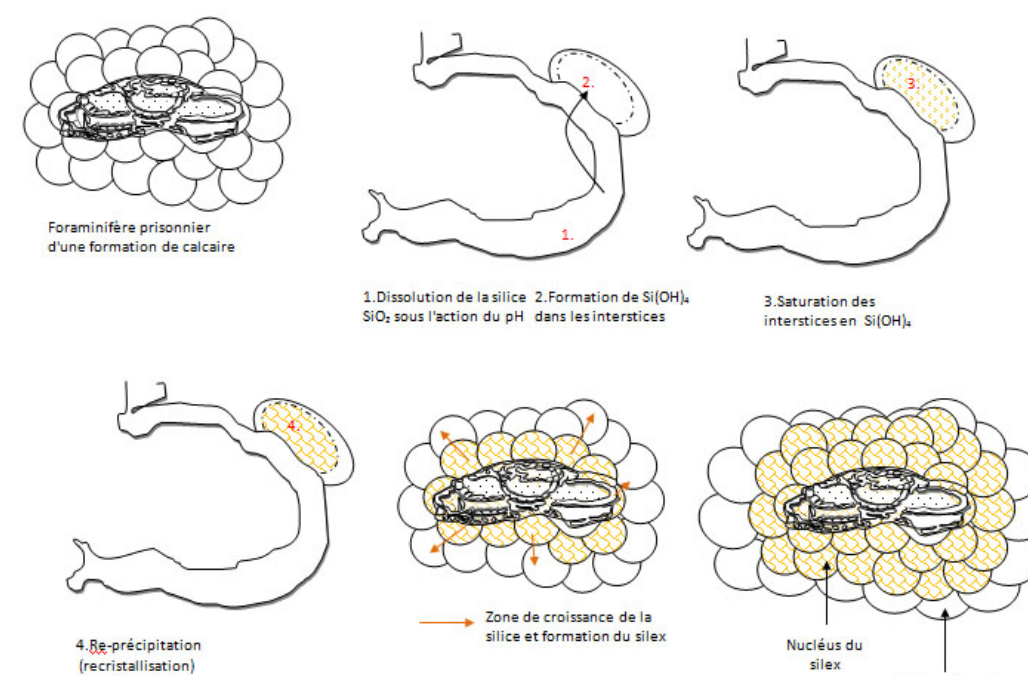


Precipitated silica comes from a shift in balance between silica in its ionic state and non-ionic silica. Foraminifera are animals whose shells are rich in silica. SiO2 silica contained in these shells is going to be transformed into Si(OH)4 with the action of pH.

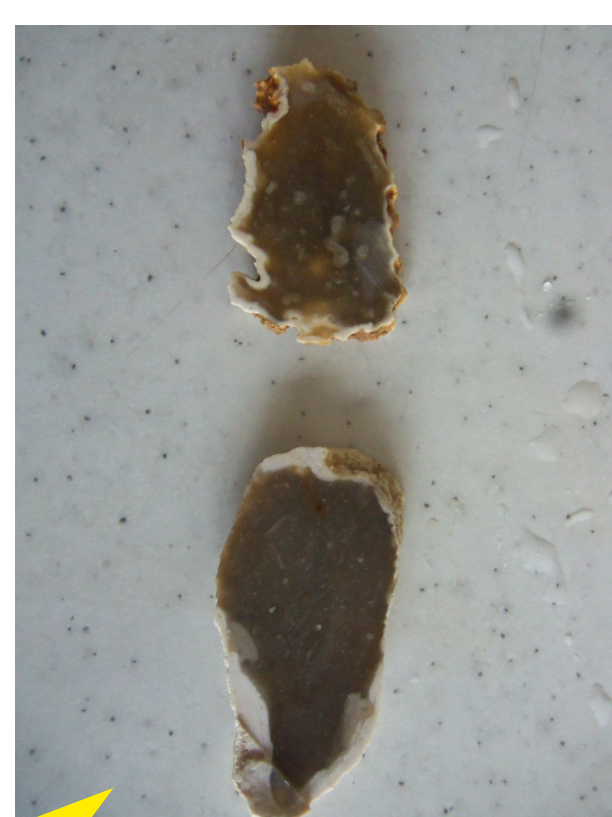
This same Si(OH)4 is going to saturate water that is present inside and around the shells. The remains of shells are going to be places where silica is going to recrystallize and give SiO2.



Foraminifera shell  
Area with layers showing different chalk deposits  
Foraminifera shell



## Identification criteria for flints



- Layer around nucleus : limestone
- Texture packstone
- Color : orange and yellow
- Fine grain
- Small fragments of vegetal
- Size from 20 cm to 60cm
- Long shape

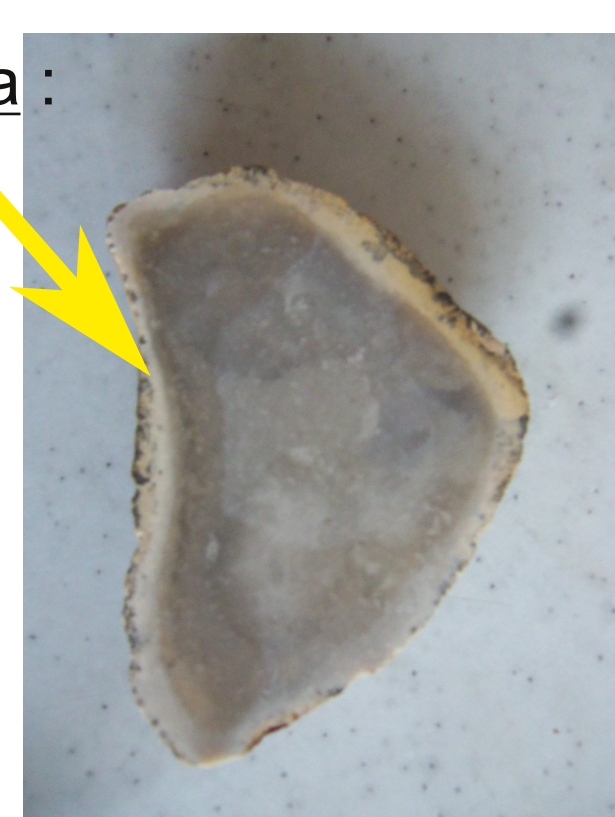
Flint from Gien region

The layer around the nucleus can be :

- limestone
- silica
- clay

Following the translucent silica area :

- texture
- color
- structure
- micro-fossil
- size
- shape



- Layer around nucleus : clay
- Texture : packstone
- Color : light grey
- Fine grain
- Translucent area
- Small fragments of vegetal
- Size from 10cm to 20cm
- Long shape

Flint from Solutré region

## Localization of Volgu flint spikes

The Volgu flint spikes are big laurel leaves (30 cm). These spikes were discovered during the digging of a canal not far from the Arroux (an affluent of Loire river) in 1874. The spikes must have been carved out of a big flint block in order to avoid breaks.

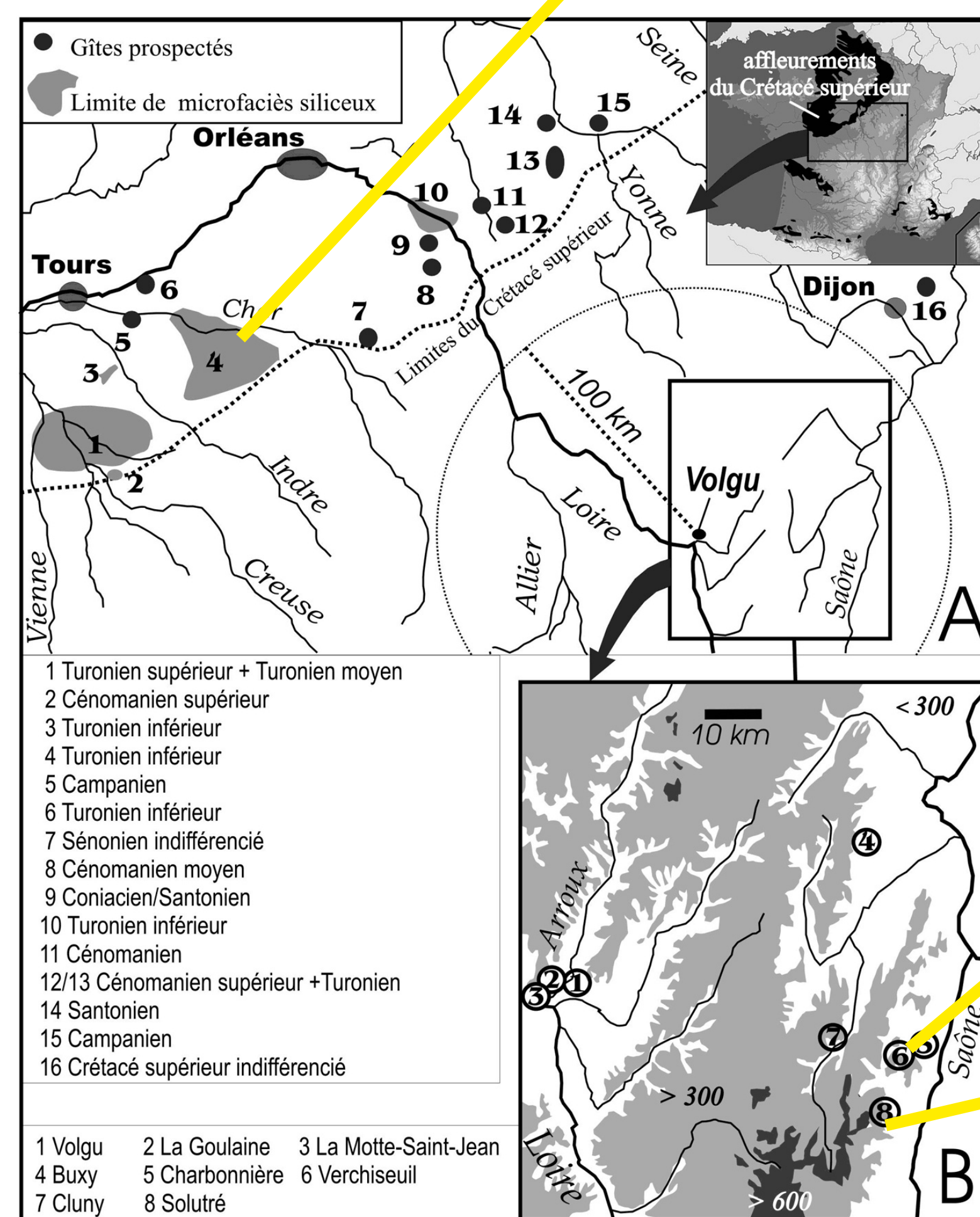
So, we got interested in the fact we could find the origins of these flints from the structure of the rock where they were carved out. We looked for the characteristics of some flints coming from two zones : Solutré and Gien.

### Hypothesis 1

Flints come from Solutré

### Hypothesis 2

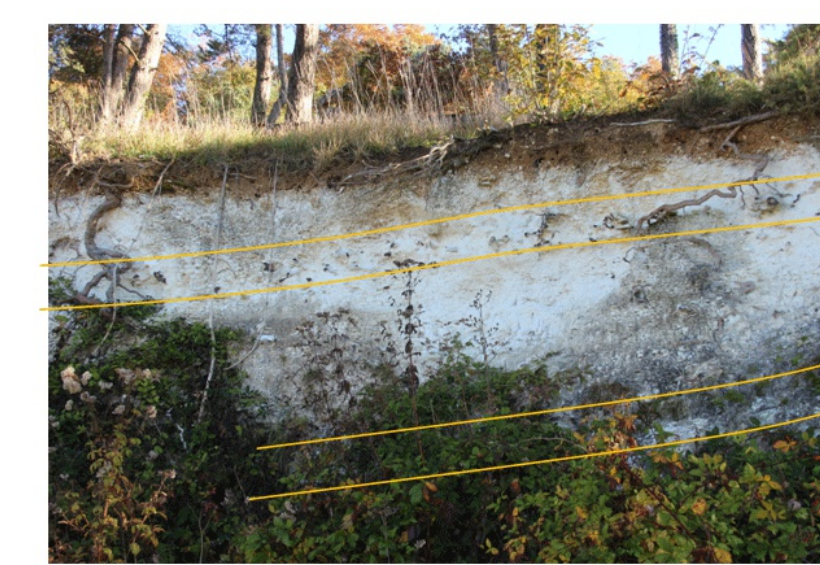
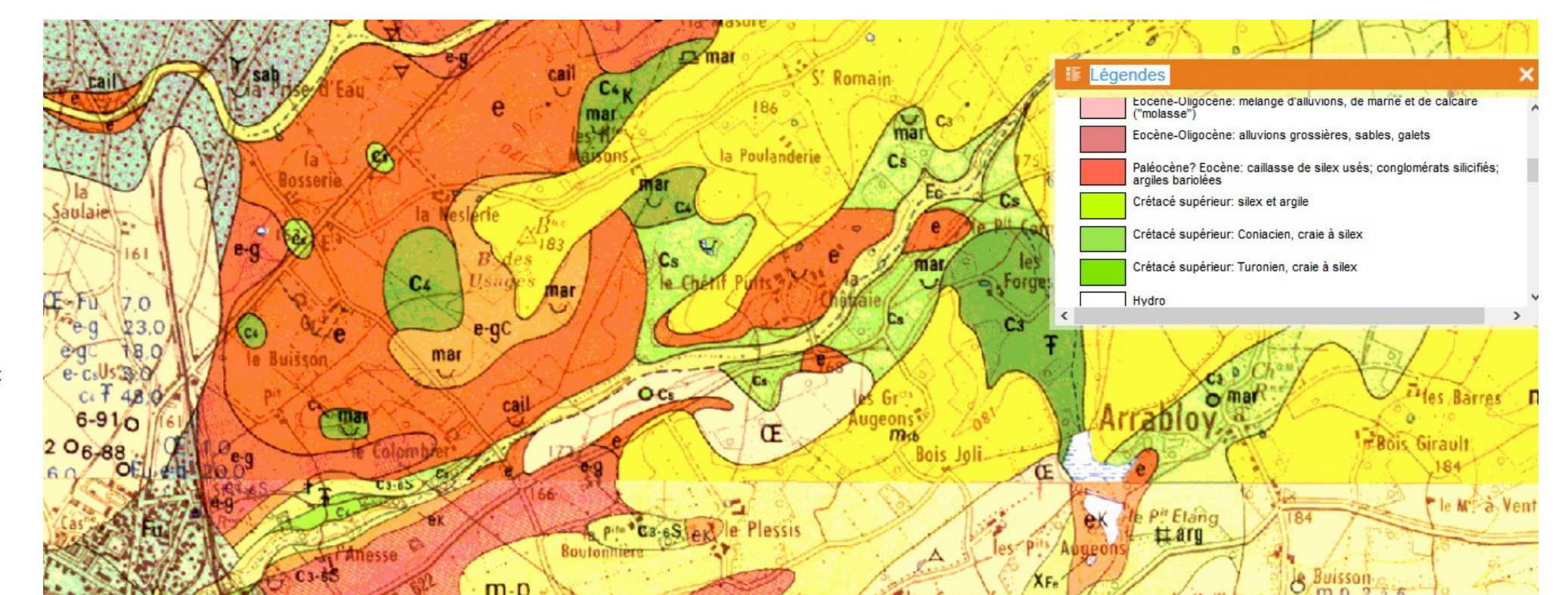
Flints come from Gien



## Geology of Gien area

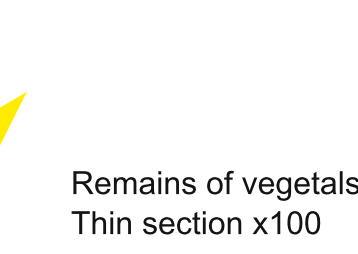


Nodule de silex



Outcrop of chalk of lower Turonien letting appear nodules of flint

Upper Cretaceous (different green colours) Paleocene (orange colour) Gien is an area created in different successive times. Indeed the three different green colours correspond to grounds dating back to Upper Cretaceous. Here we can find flint, clay, and flint chalk, especially in the grounds of Lower Turonian time. In the orange zones we can find bits of used flints, clusters including silica, and multicolored clay.

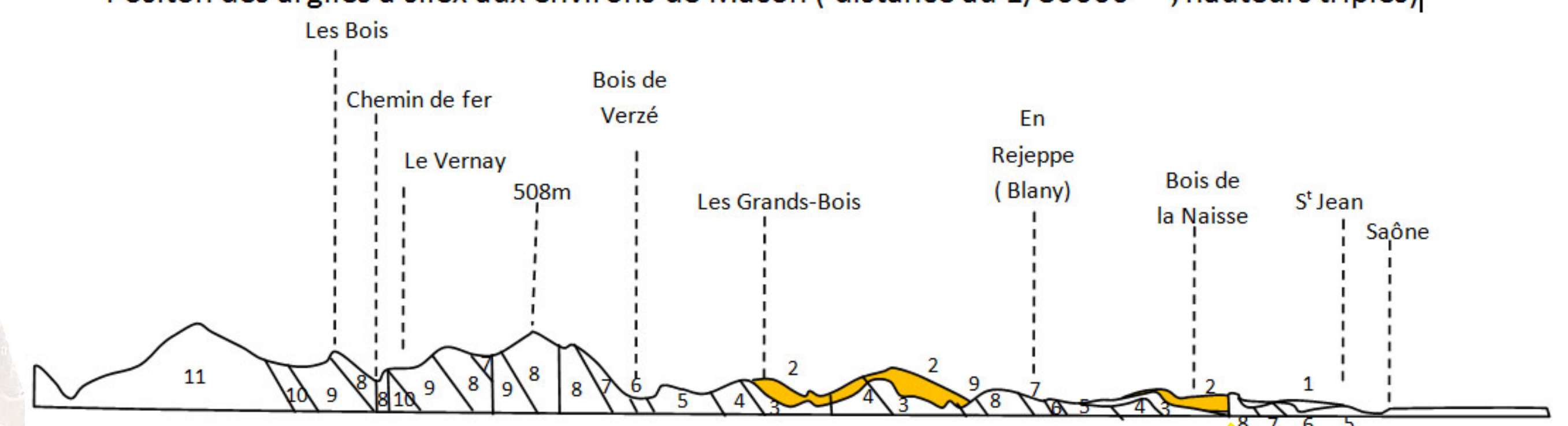


Sea Urchin Spicules  
Thin section x100

Characeae Leaf  
Thin section x100

## Geology of Solutré area

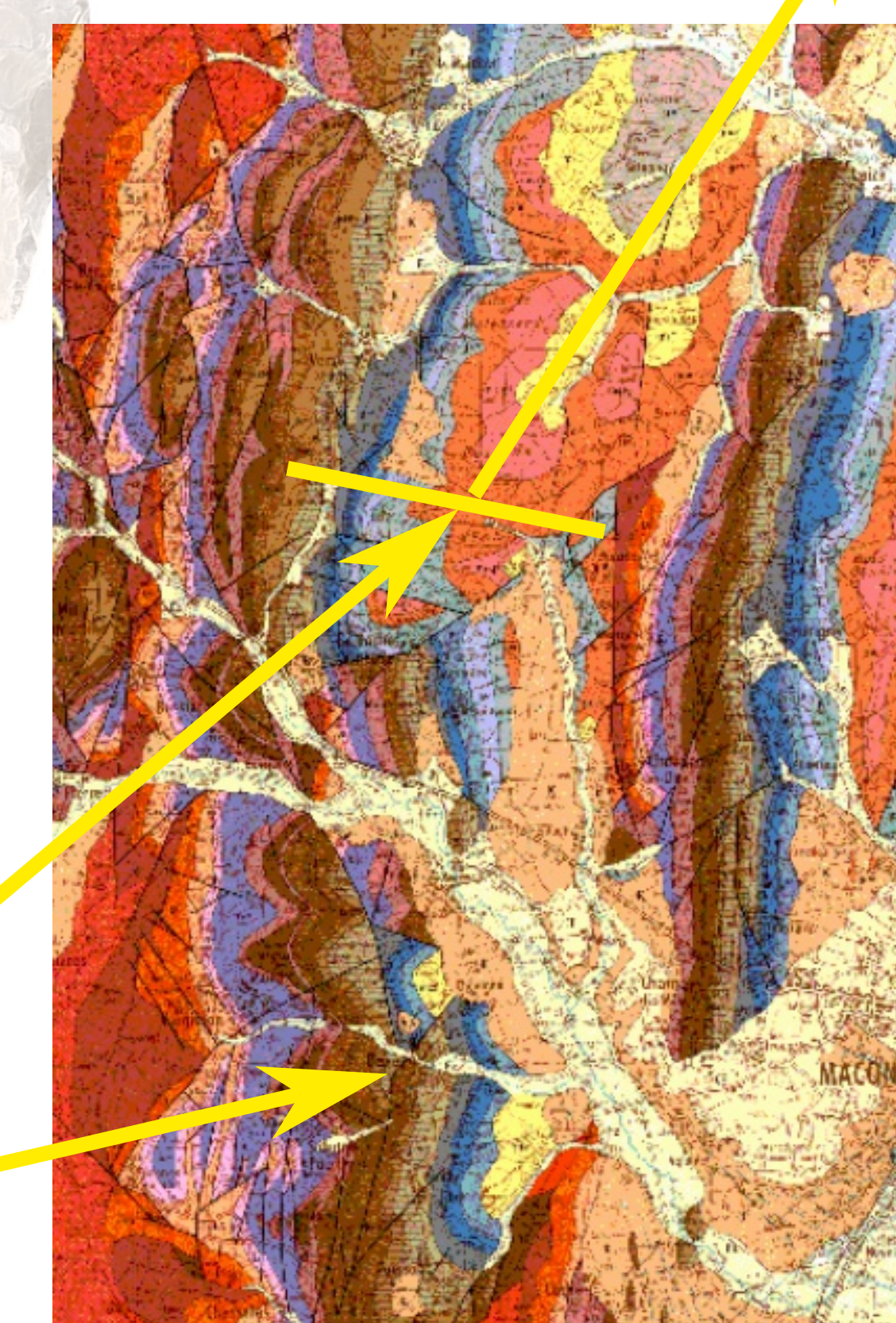
Position des argiles à silex aux environs de Mâcon ( distance au 1/80000<sup>ème</sup>, hauteurs triples)



- Alluvions du quaternaire
- Argile à silex
- Kimmeridgien
- Corallien
- Oxfordien

6. Callovien
7. Bathonien
8. Bajocien

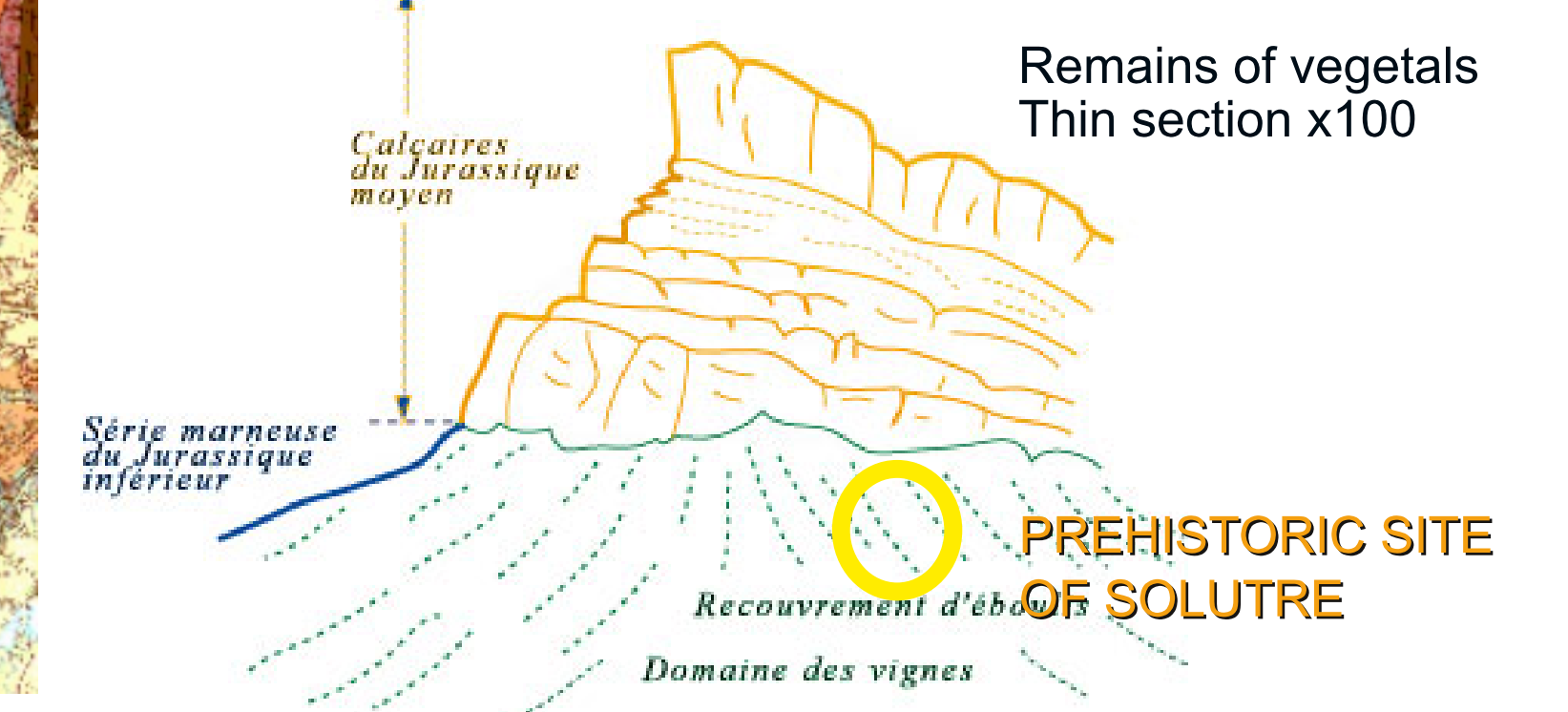
9. Lias
10. Trias
11. Porphyre



## Clay with present Flint in the region of Solutré

The grounds of Jurassic containing fossils with corals in it and crinoid stem fossils. Flints contain in Cénomannien, Turonian and Sénomannien. Flints in Solutré were formed in a deep sea.

The clay with present flint in the region of Solutré is the result of the erosion of grounds of the Cretaceous which were situated above the grounds of Jurassic.



Remains of vegetals  
Thin section x100

PREHISTORIC SITE OF SOLUTRE  
Recouvrement d'éboulis  
Domaine des vignes

Lycée Pontus de Tyard

