

# INSTRUCTIONS FOR THE WRITTEN TEST

## WRITTEN TEST 1 : 3 HOURS

The test is divided in sections. They can be partially linked. So it may be interesting to try to answer the questions of one section before beginning to the next one.

**PLEASE ANSWER ON THE ANSWER SHEET**

### MARKING THE QUESTIONS :

If only one answer is required (only one answer) :

- Correct answer chosen : +1 point
- Wrong answer or several answers chosen : 0 point

If several possible answers :

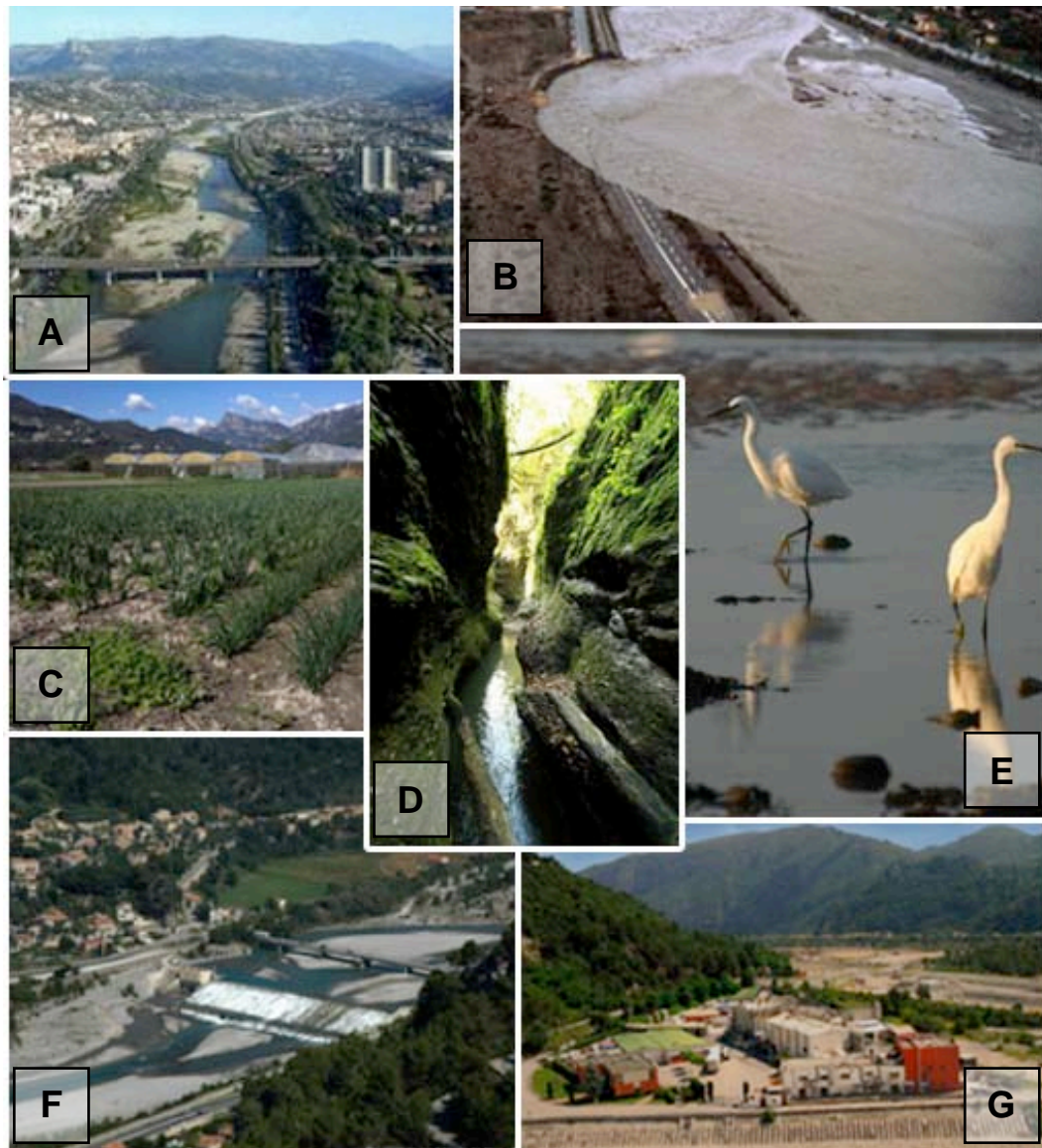
- For each correct answer : + 1 point
- For each wrong answer : -0,5 point

No question can be marked under 0 (zero). If number of negative points exceeds the positive points, the question will be marked zero :  $+1-1,5 = 0$

## IESO 2017 - WRITTEN TEST NUMBER 1

### 50 YEARS OF DEVELOPMENT IN THE VAR VALLEY

The Var alluvial plain is an estuary associated with the longest river in the French Southern Alps. Between the mountains and sea, over a distance of 110 km, the Var is a vast depression (average width = 1.2 km), which reaches the Mediterranean coast. Such an environment presents many challenges, including conservation of the unique biodiversity associated with the estuary, and the sustainable economic development of the area. Indeed, the Côte d'Azur is experiencing a period of growth in the pristine and utilizable areas of the lower valley. With the help of figures and your knowledge, we will take several approaches to understand the complexity of this vibrant environment.

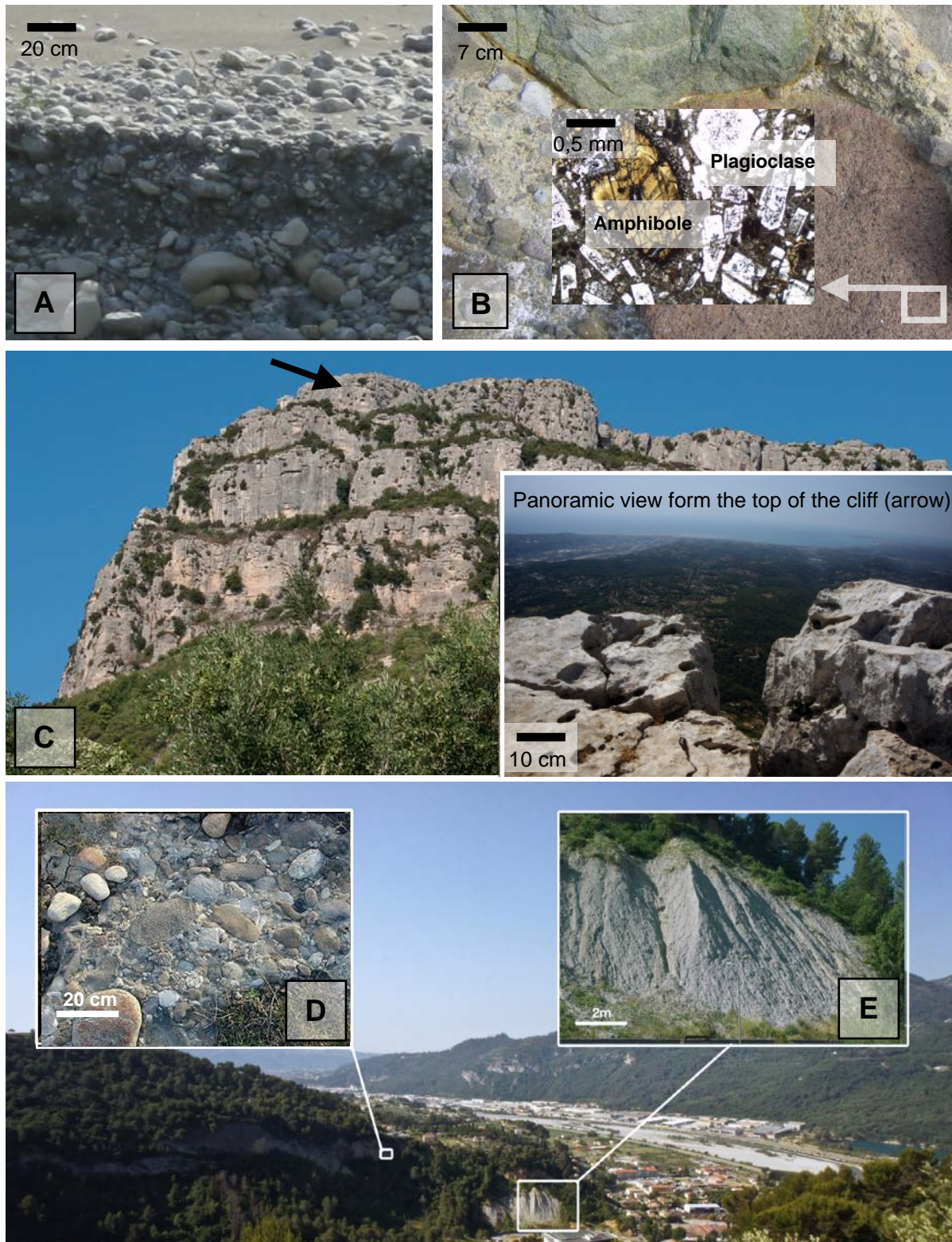


**FIGURE 1 :** (A) A view of the Var plain looking north; (B) Illustration of the major flood of 1994; (C) Agricultural activity in the valley of the Var; (D) and (E) Illustration of the preserved environments in the plain; (F) containment and dam to control the flow of the river; (G) Industrial activity in the plain.



**SECTION 1 : OVERVIEW OF THE PETROLOGICAL DIVERSITY OF THE VAR VALLEY, STUDY TRACKS**

The lower valley of the Var is a geographical area, which initially presents a landscape with relatively homogenous rock types. However, on closer inspection, one can observe very diverse rocks, reflecting a complex geological history. The photographs below illustrate this diversity.



**FIGURE 2** : Photographs of the large-scale geological formations that make up the landscape of the Var Plain.

**Question 1: Refer to figure 2. On your answer sheet, match the picture letter with the number of the corresponding description: (some descriptions do not correspond to any photograph)**

- 1- an alluvial deposit indicating transported, deposited and poorly consolidated sediments.
- 2- a metamorphic rock showing substantial deformation.
- 3- a turbidite indicating a graded sequence.
- 4- a sedimentary breccia at the bottom of a slope characterized by unsorted angular particles.
- 5- a volcanic breccia composed of a fine matrix, showing load-casts around blocks of microlitic rocks.
- 6- a homogeneous and poorly consolidated clay deposit.
- 7- a conglomerate of well-consolidated pebbles.
- 8- a crystalline rock of granitic type because of its homogeneous massive appearance.
- 9- a well-consolidated, sedimentary rock.

**Question 2: Refer to figure 2. The following statements describe geological processes favorable to the formation of different rock types. On your answer sheet, match the picture letter with the number of the corresponding description: (some descriptions do not correspond to any photograph)**

- 1- Continental sedimentation with little or no transport
- 2- Aeolian sedimentation.
- 3- Deposition of volcanic material.
- 4- Continental deposition and consolidation after a long transport
- 5- Continental deposition after a long transport
- 6- Shallow oceanic sedimentation (less than 2,000 meters)
7. Sedimentation of fine particles in a calm environment.

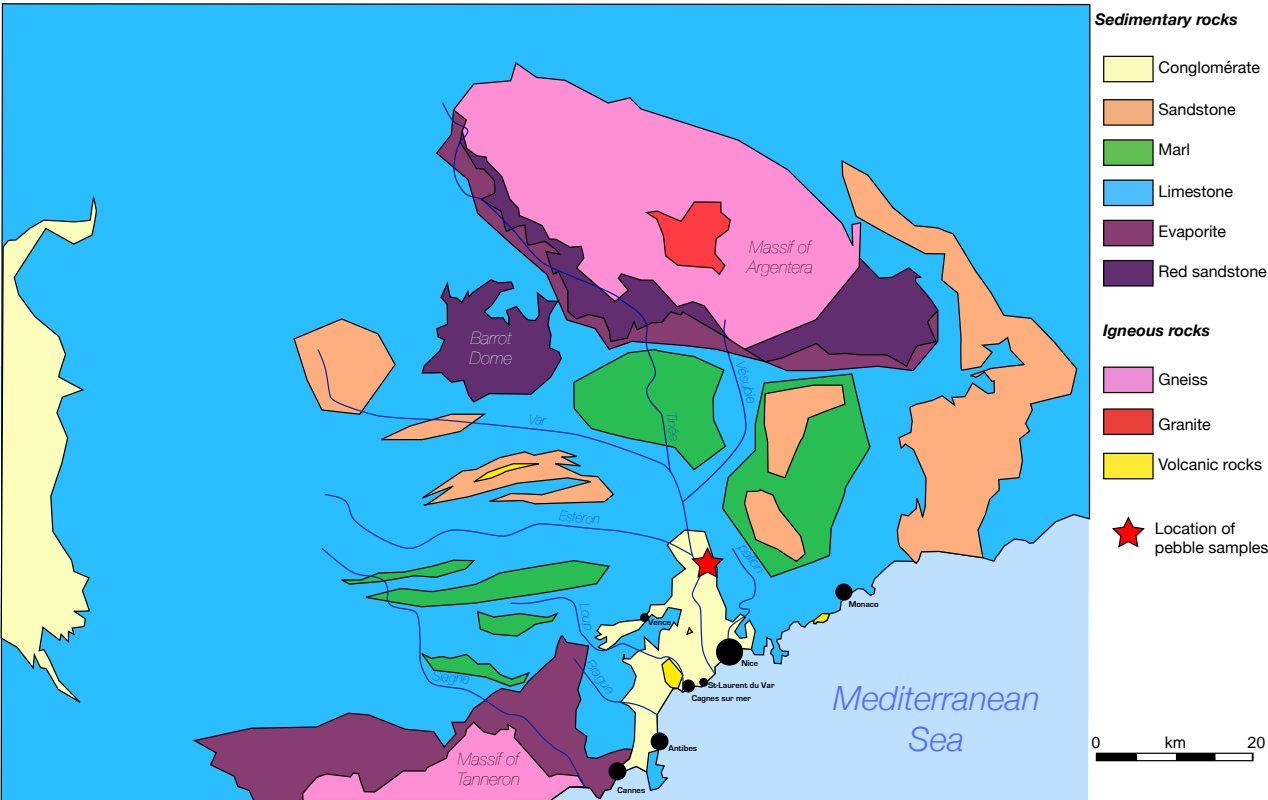


*FIGURE 3 : Photograph of pebbles that constitute the conglomerates of the Var valley.*

**Question 3 : Refer to figure 3. Beside the rock descriptions, correlate the pebbles photographs and one of the description (some descriptions do not correspond to any photograph) :**

- 1- An andesite-type of volcanic rock.
- 2- A granitic-type of rock composed of minerals visible to the naked eye.
- 3- A metamorphic rock like gneiss with bands of minerals with contrasting colors that highlight important deformations.
- 4- A well consolidated rock composed of particles about one millimeter size. This is called a red sandstone because of its color.
- 5- A very homogeneous rock that does not reveal any minerals to the naked eye.
- 6- A metamorphic rock displaying schistosity.





**FIGURE 4 :** Simplified lithological map of the region crossed by the Var and its tributaries. Pebbles photographs are from the location marked by the red star.

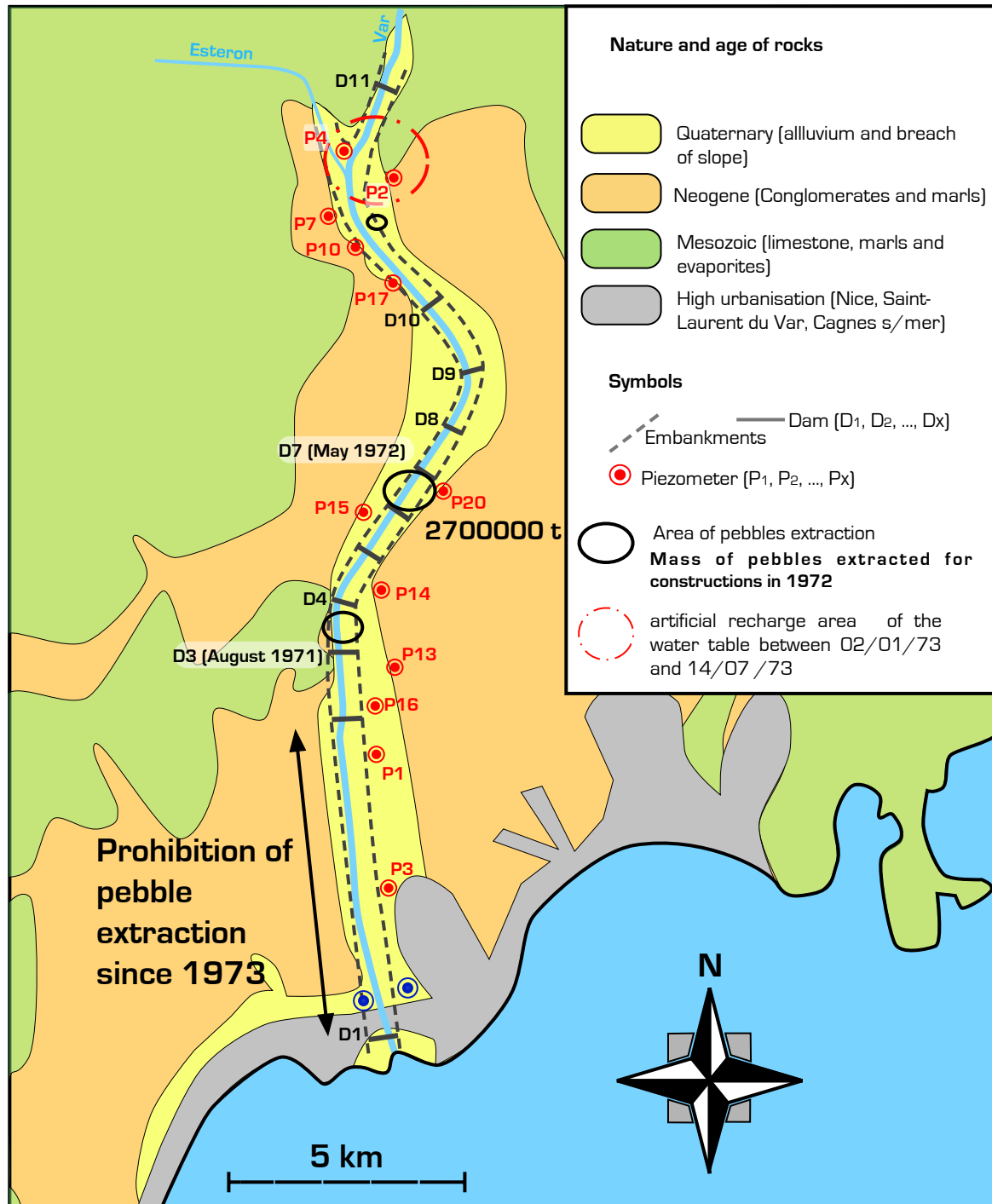
**Question 4 :** From the map (Figure 4), we can estimate the minimum distance traveled by the rock fragments which have become the pebbles observed in figure 3 : (only one answer)

	pebble A	pebble B
1-	80 km	200 km
2-	35 km	35 km
3-	30 km	15 km
4-	80 km	80 km

To understand this region, it is necessary to consider all aspects of the recent and older history of this territory, for which rocks are the evidence. We will check later, in order to understand the management issues of the lower Var valley.

## SECTION 2 : HYDROLOGY OF THE VALLEY, EVOLUTION OF AN IMPORTANT AQUIFER

The city of Nice and the neighboring communes draw a significant amount of water from the aquifer of the Var plain for domestic use. Also, It is a local resource for the agricultural activity that historically took place on the valley land.



**FIGURE 5** : General location map of the Var plain. The background map shows the major geological features (reviewed in more detail later), indicating the measuring equipment and devices along the course of the Var. Specific activities are located in zones : areas of pebble extraction in the river bed, and an artificial supply area of groundwater by lateral irrigation from the Var. In 1973, the groundwater in the conglomerates around the Var was re-supplied by major irrigation works (canals dug and spread over the entire area).

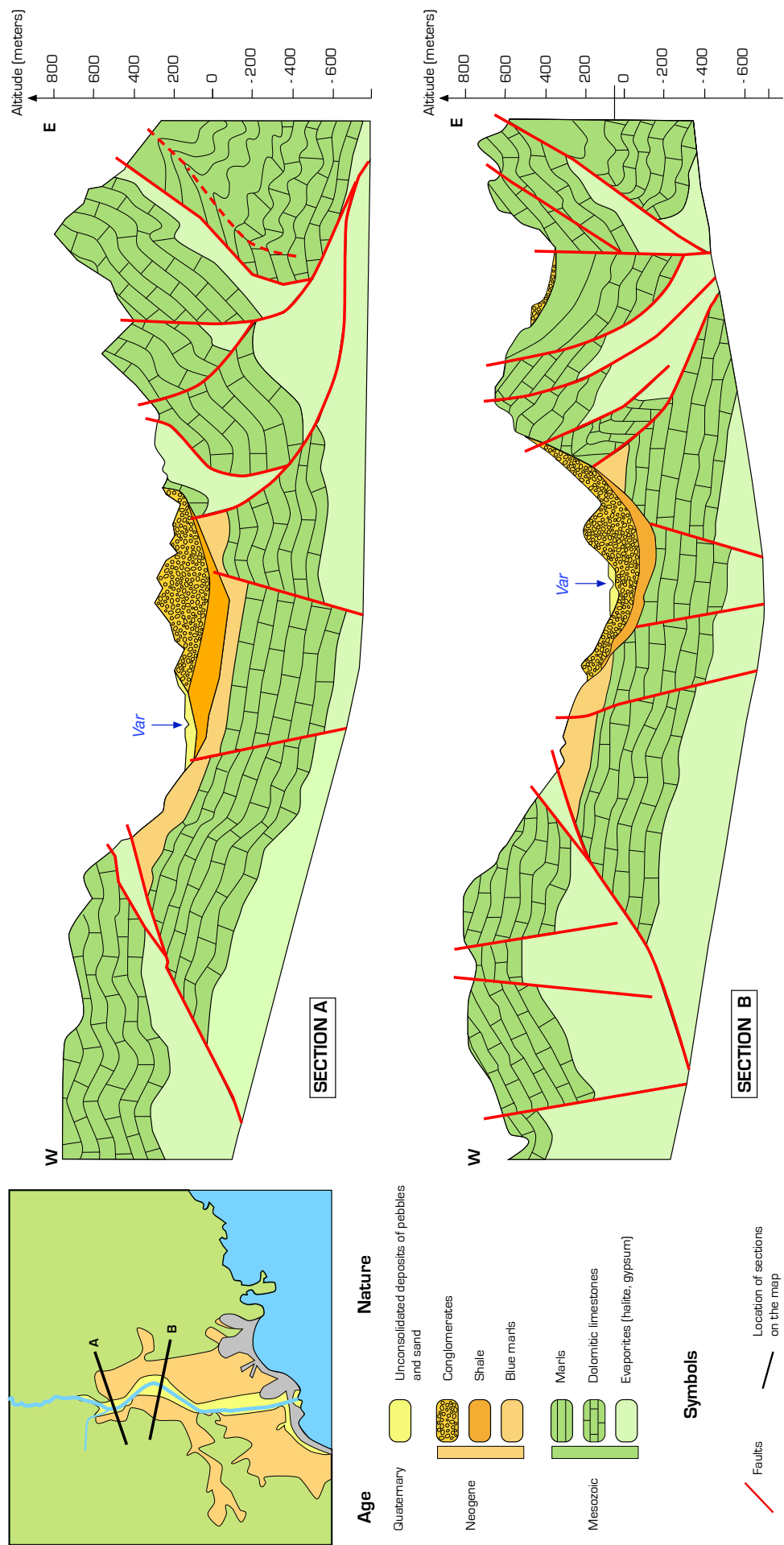
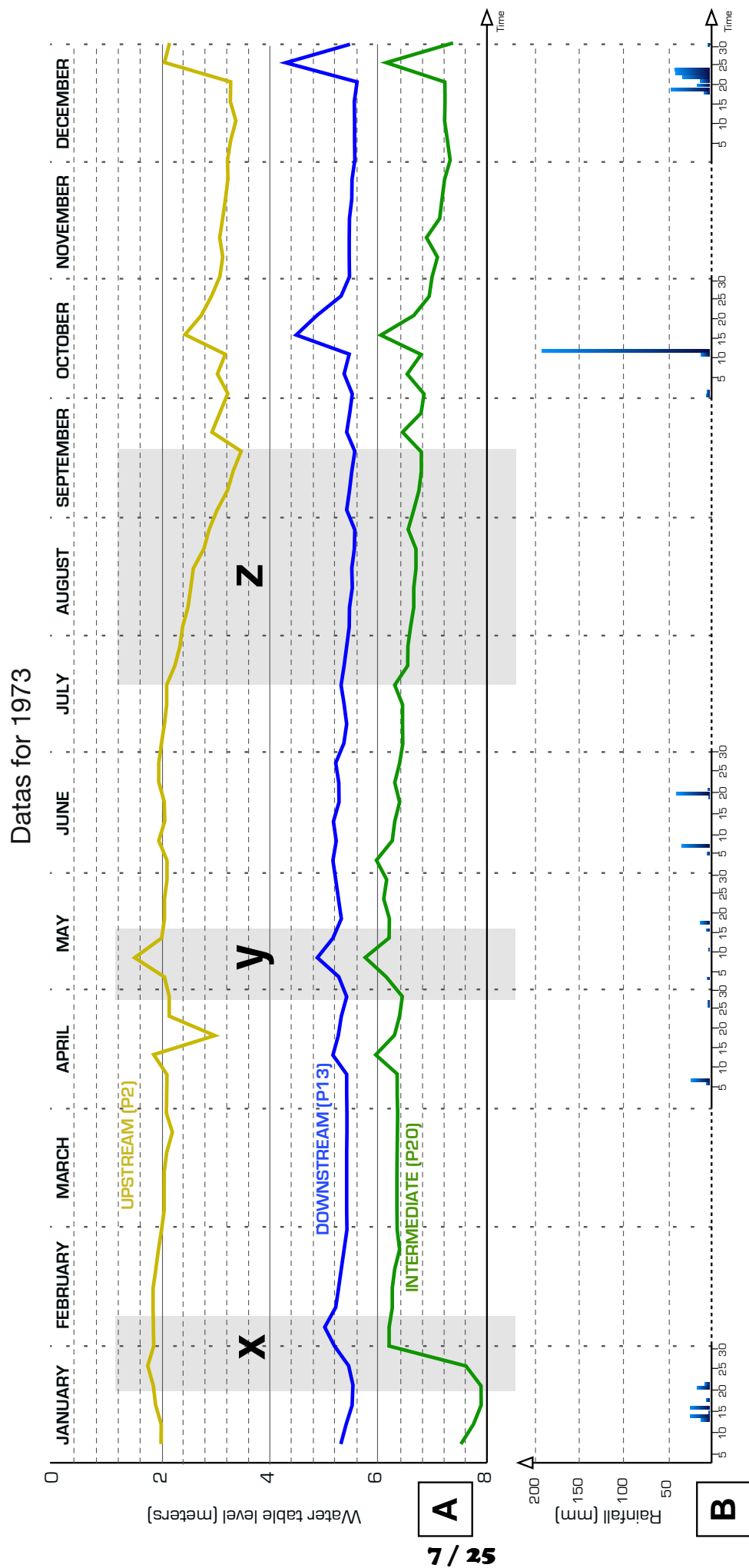


FIGURE 6 : Geological cross sections (section lines A-A' and B-B' shown in the map) along the Var valley.



Test code : WT-1

FIGURE 7 : Datas of the water table level (A) and rainfall (B) in the Var valley Each bar in figure B refers to piezometer



**Question 5 : On a large-scale, identify the rocks that can constitute a good groundwater reservoir. Aquifer is a medium that contains and transmits water: (several possible answers)**

- 1- Clay and limestone because they are impermeable.
- 2- Conglomerate and limestone because they are permeable.
- 3- Conglomerate and clay because they are impermeable.
- 4- Sandstone and limestone because they are permeable.
- 5- Clay and limestone because they are permeable.
- 6 - Clay and conglomerate because they are permeable.

**Question 6 : On a large-scale, identify the rocks that can prevent the passage of water from one aquifer to another: (Only one answer)**

- 1- Clay because It is permeable.
- 2- Conglomerate because It is permeable.
- 3- Limestone because It is permeable.
- 4- Clay because It is impermeable.
- 5- Limestone because It is impermeable.
- 6- Conglomerate because It is impermeable.

**Question 7 : The data given in figure 7 (piezometers P2, P13 and P20) are related to the groundwater contained in aquifers. Those aquifers are essentially composed of (only one answer) :**

- 1- Evaporites.
- 2- Limestones.
- 3- Conglomerates.
- 4- Alluvial deposits.

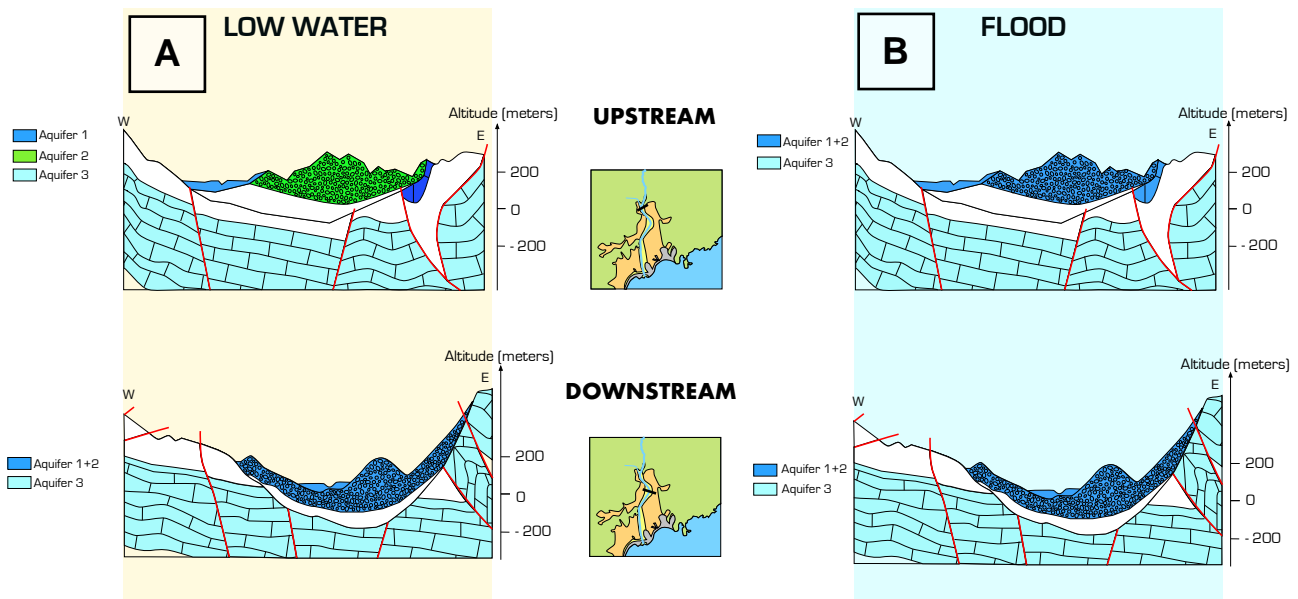
**Question 8 : Refer to figure 7, choose all correct statements pertaining to zone x (several answers possible) :**

- 1- The water table rises.
- 2- The water table rises at the same speed along the watercourse.
- 3- The water table goes down.
- 4- The water table rises less upstream than in the downstream segment.
- 5- The water table drops less upstream than in the downstream segment.
- 6- The water table level changes following precipitation of 100 mm over a period of 3 hours.
- 7- The water table level changes following precipitation of 100 mm over a period of 10 days.
- 8- The water table level changes following precipitation of 30 mm over a period of 10 days.
- 9- The water table level changes following precipitation of 30 mm over a period of 3 hours.

**Question 9 : Refer to figure 7, choose the correct statement pertaining to zone y. The water table : (Only one answer)**

- 1- increases due to the May rainfalls.
- 2- goes down due to the May rainfalls.
- 3- goes down due to snowfall.
- 4- increases due to snow melt.
- 5- increases due to snowfall.

The contacts between the different aquifers along the Var valley aren't continuous. As It is visible on the transects upstream and downstream (see figure 6), the Neogene shale layer separate or not two aquifers, depending on the river level. In period of low water (figure 8A), the conglomerate aquifer is isolated from the river and loses its source of recharge. In period of flood (figure 8B), river supplies the groundwater into the conglomerate aquifer.



**FIGURE 8** : Transect along the Var Valley during a low water period (A) and a flood period (B).

**Question 10** : Refer to figure 7 and 8. Choose all correct statements pertaining to zone z (several possible answers) :

- 1- The level of the upstream groundwater is lowered more than elsewhere due to local drought.
- 2- The level of the upstream groundwater is lowered more than elsewhere because the Var no longer supplies groundwater, its level being too low.
- 3- The level of the upstream groundwater is lowered more than elsewhere because the Var no longer supplies groundwater, its bed being isolated from the conglomerate by clay.
- 4- The level of the upstream groundwater is lowered because water is no longer supplied artificially.
- 5- The level of the upstream groundwater is only lowered due to the seasonal drought.

**Question 11** : In 1973, between the piezometers P15 and P20, 2,700,000 tons (tons = 1000 kg) of pebbles were extracted. Which volume corresponds to this mass ? (density of pebbles =  $2000 \text{ kg.m}^{-3}$ )

- |                                   |                                   |                                       |
|-----------------------------------|-----------------------------------|---------------------------------------|
| 1- $1.35 \times 10^9 \text{ m}^3$ | 5- $0.74 \times 10^9 \text{ m}^3$ | 9- $0.74 \times 10^{-9} \text{ m}^3$  |
| 2- $1.35 \times 10^9 \text{ kg}$  | 6- $0.74 \times 10^9 \text{ kg}$  | 10- $0.74 \times 10^{-9} \text{ kg}$  |
| 3- $1.35 \times 10^6 \text{ m}^3$ | 7- $0.74 \times 10^6 \text{ m}^3$ | 11- $0.74 \times 10^{-6} \text{ m}^3$ |
| 4- $1.35 \times 10^6 \text{ kg}$  | 8- $0.74 \times 10^6 \text{ kg}$  | 12- $0.74 \times 10^{-6} \text{ kg}$  |

**Question 12** : Over a year, the water table in piezometer P2 and P13 : (only one answer)

- 1- increased by one meter
- 2- remained unchanged
- 3- decreased by one meter
- 4- increased by 0.1 meter
- 5- decreased by 0.1 meter

**Question 13 : Over the next five years, the change in groundwater level has continued the global trend (see question 12). The accepted explanation is extraction of the pebbles from the river-bed. What is the logical explanation to account for these two facts? Removing the pebbles would : (only one answer)**

- 1- reduce the size of the reservoir.
- 2- modify the slope of the river-bed; hence, the water would flow faster, leaving less water in the reservoir.
- 3- modify the slope of the river-bed, which would then erode the upstream segment of the river-bed.
- 4- destroy the aquifer, and the groundwater contained escapes to the surrounding land.

Date of datas	1970	1971	1972	1973
January 30 <sup>th</sup>	4	3.95	5.8	5.3
March 28 <sup>th</sup>	3.78	3.7	5.8	5.55
May 21 <sup>st</sup>	3.8	3.7	3.52	5.56
August 20 <sup>th</sup>	4.3	4.87	4.98	6
September 17 <sup>th</sup>	4.03	5.51	5.1	6.24

**TABLE I :** Water table level (meters) data collected at the P20 piezometer station from the period January 1970 to September 1973. During this period, dams were constructed (see previous figures).

**Question 14 : Refer to table 1. Which problems are linked to changes in water table level (Figure 7) ? (several possible answers)**

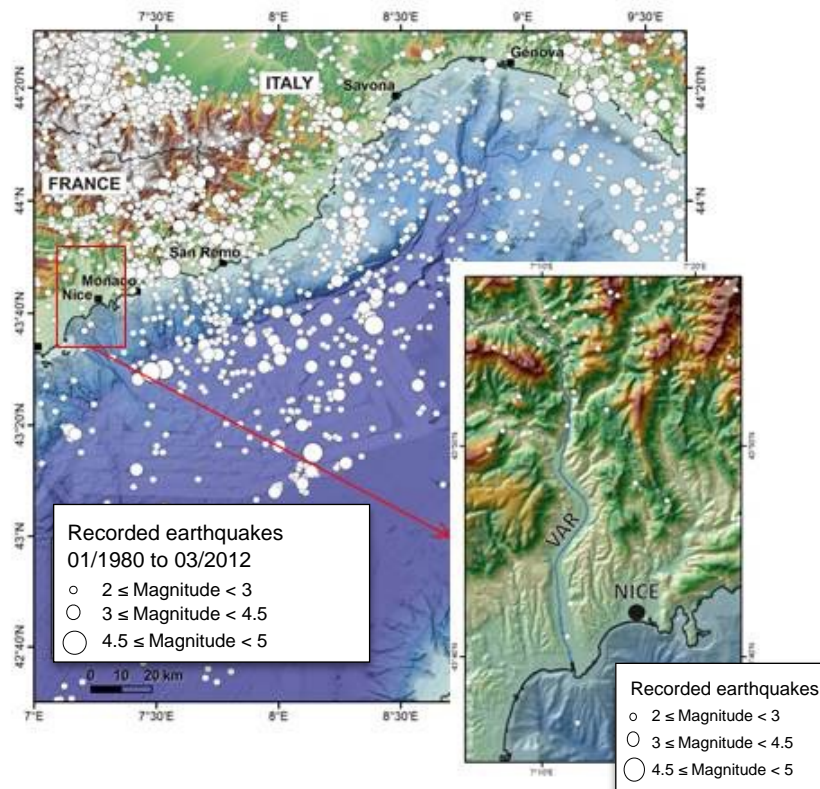
- 1- Water becomes more polluted because it is deeper but its volume remains constant.
- 2- Water needed for domestic use and agriculture is more difficult to extract.
- 3- The total volume of water contained in this groundwater system decreases.
- 4- Water flows faster at depth; therefore, its extraction is more difficult.

**Question 15 : Among the solutions meant to improve water supply, which ones would have limited the observed trend of the water table level ? (several answers possible)**

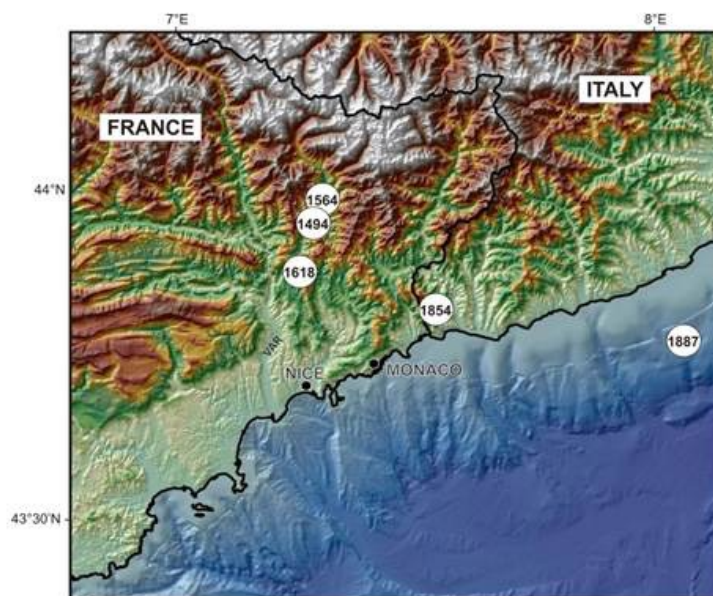
- 1- Two embankments were placed on either side of the riverbed.
- 2- The groundwater was artificially recharge upstream.
- 3- The extraction of the pebbles was totally forbidden.
- 4- Dams were constructed across the watercourse.
- 5- Deeper wells were dug.

In conclusion, utilization of resources at the mouth of the Var can be managed over the long term only if interactions between the hydrosphere and the geosphere are understood. It is, therefore, necessary to better understand the interactions. Presently, we intend to collect valuable recordable data.

### SECTION 3 : SEISMIC CONTEXT OF THE VAR VALLEY AND SURROUNDING AREA

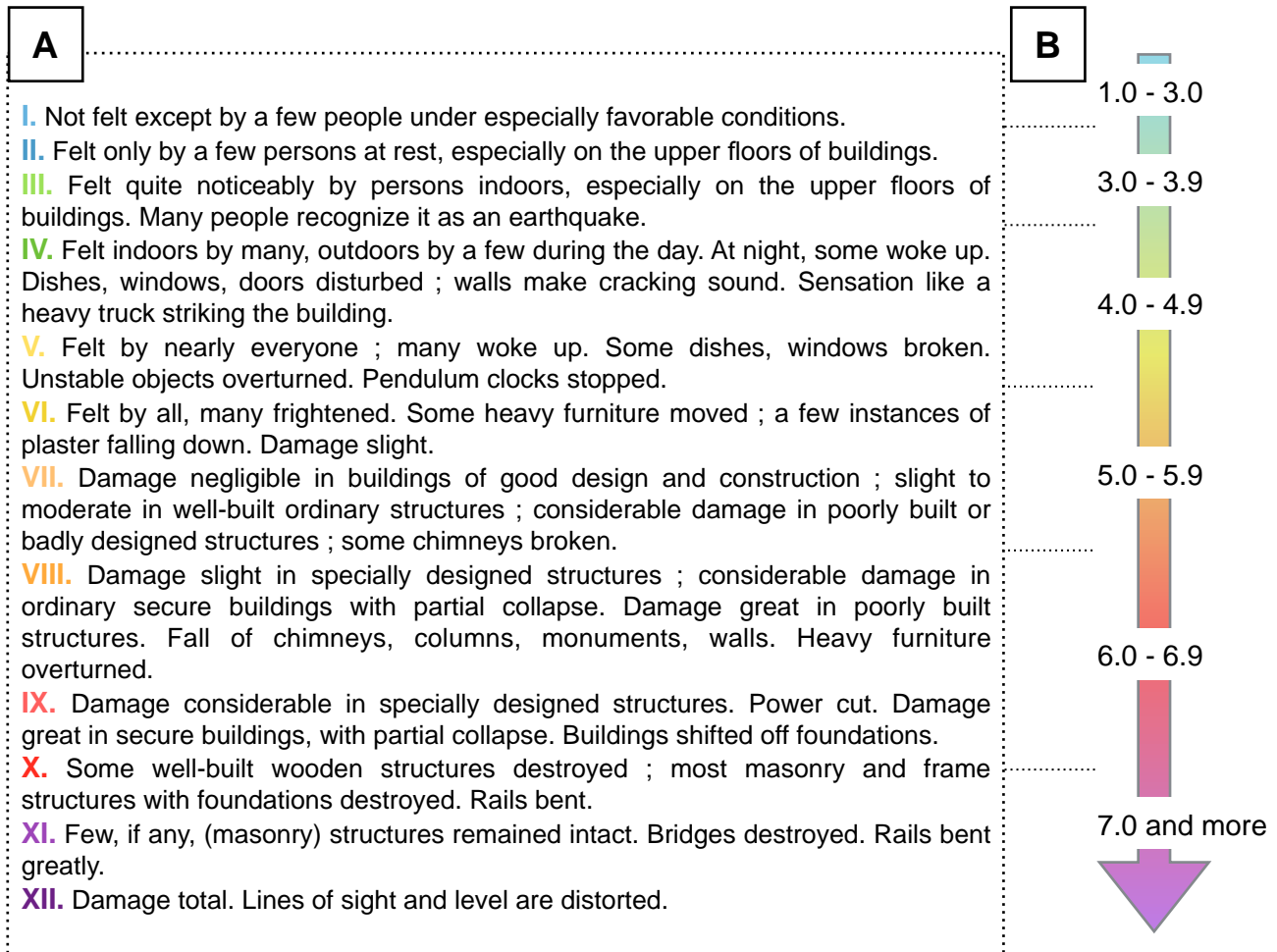


**FIGURE 9** : Seismic map (location of earthquake epicenters detected by the seismometers) of the area and a zoom on the lower valley of the Var (area of interest). Earthquake foci never exceeded 30 km depth.

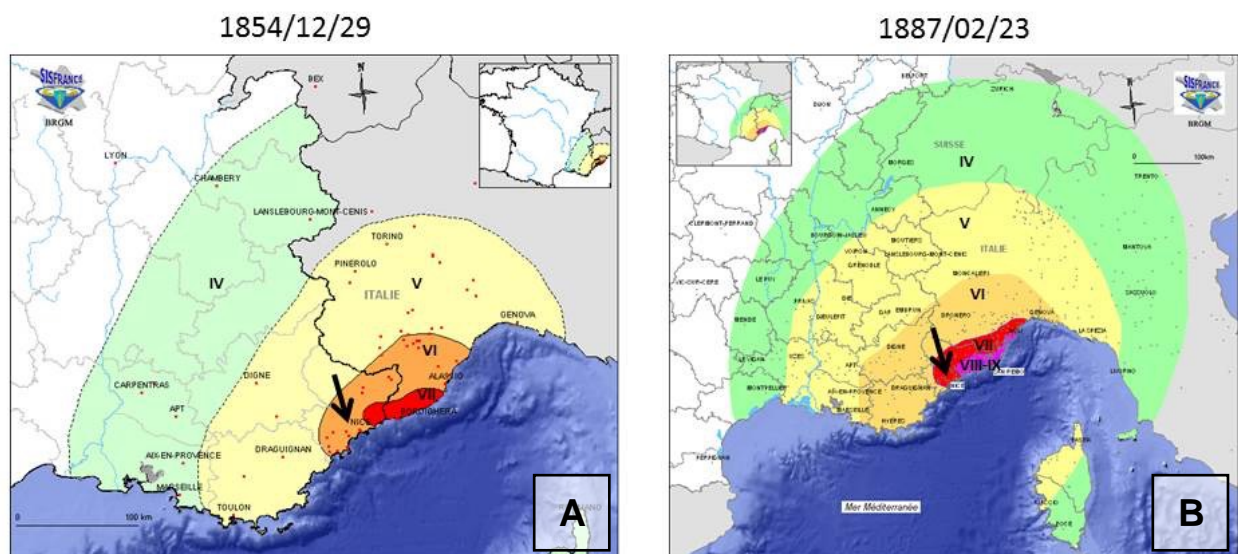


**FIGURE 10** : Historical seismicity map (location of earthquake epicenters (before seismometer were used), based on the assessment of ground motion during an earthquake based on witness accounts and observation of destruction): macroseismic epicenters of A.D.1494 (maximum intensity VIII), A.D.1564 (maximum intensity VIII), A.D.1618 (maximum intensity VII-VIII), A.D.1854 (maximum intensity IX) and A.D. 1887 (maximum intensity VIII).

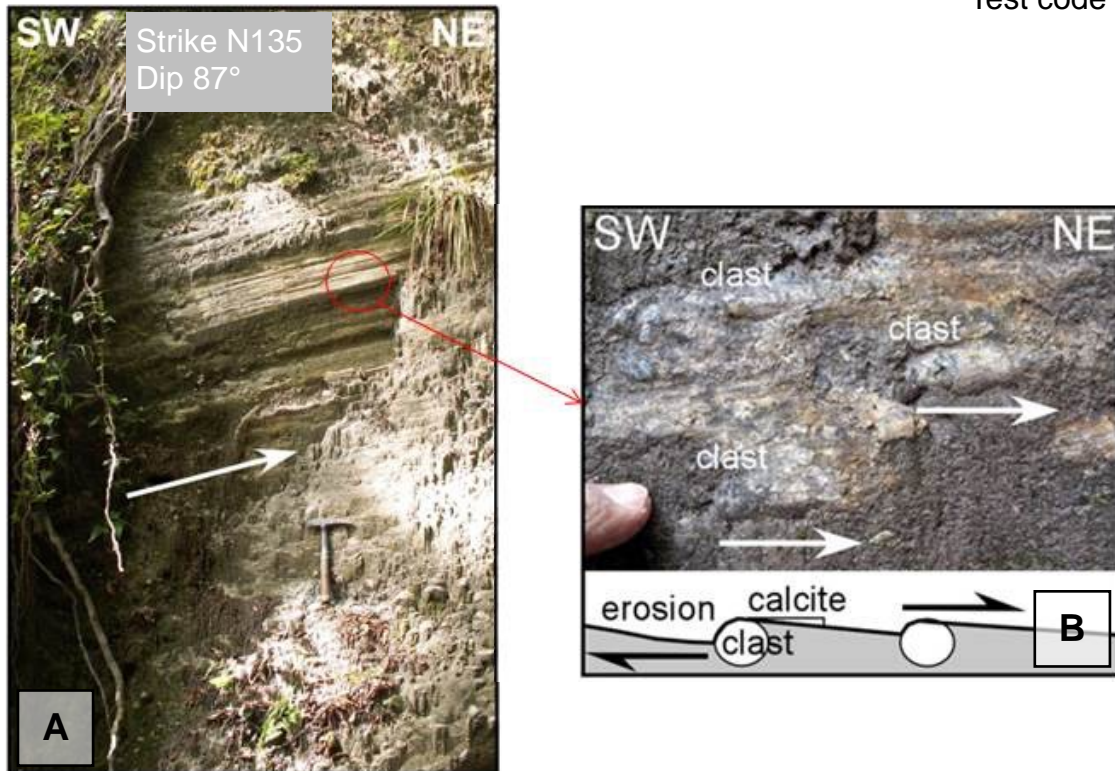




**FIGURE 11:** (A) Macroseismic Intensity Scale (assessment of the ground motion based on witness accounts and observation of destructions). (B) Approximate correspondence between macroseismic intensity and magnitude for a crustal earthquake (hypocenter between 0 and 30km).



**FIGURE 12:** Isoseismal maps prepared after the earthquakes of A.D.1854 (A) and A.D.1887 (B). The colored zones indicate the fields of equal ground motion intensity. The Var valley is indicated by the black arrow.



**FIGURE 13 :** (A) A recent fault plane that has not been displaced since its formation. The photograph was taken near the epicenter drawn on figure 14. (B) Explanatory diagram of the kinematic evidence observable at the outcrop.

**Question 16 :** The seismicity recorded by seismometers on the figure 9 shows :  
(several answers possible)

- 1- earthquakes of magnitude greater than 7.
2. Only a few earthquakes per year.
- 3- earthquakes of magnitude less than 5.
- 4- high seismic frequency (more than 10 earthquakes of magnitude 3 or more per year).

**Question 17 :** Refer to figure 9. The spatial distribution of seismicity is : (several answers possible)

- 1- diffuse.
- 2- aligned along one or more faults.
- 3- mainly concentrated offshore.
- 4- mainly located onshore.
- 5- characterized by shallow foci.

**Question 18 :** Over the period from 1980 to 2012 (figure 9), the Var valley had a seismicity rate ——— the regional seismic average

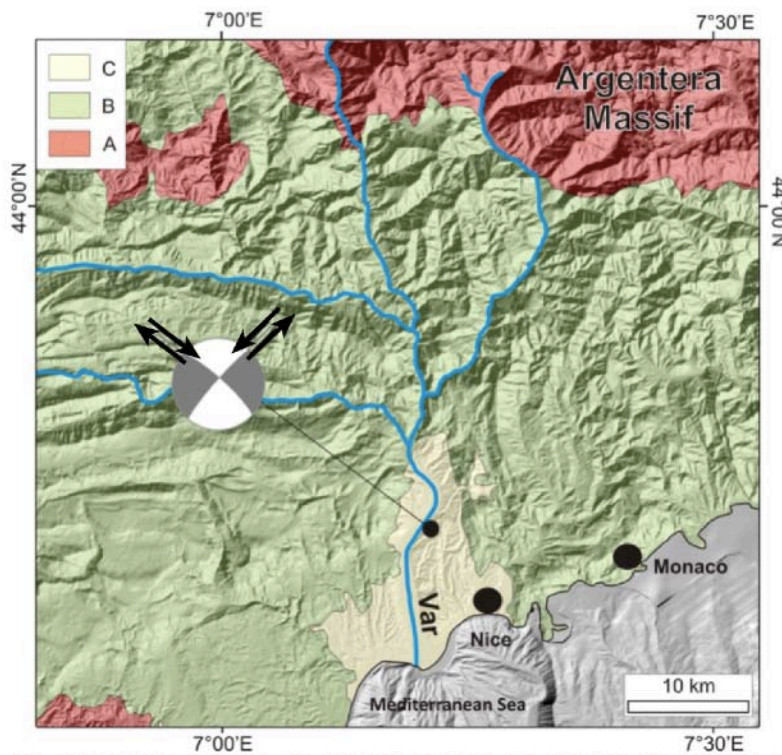
- 1- greater than
- 2- similar to
- 3- lower than

**Question 19 : Searching for traces of ancient earthquakes in historical witness accounts and historical records : (several possible answers)**

- 1- Some historic earthquakes have led to the destruction of buildings.
- 2- No earthquake caused human injury or physical damage in the region.
- 3- The maximum magnitude of historical earthquakes is the same as the magnitude of the instrumental earthquakes for the 1980-2012 period.
- 4- The maximum magnitude of historical earthquakes is greater than 6.
- 5- There are no historical earthquakes affecting the Var valley.
- 6- All historically recorded earthquakes have a magnitude higher than the instrumental earthquakes of the period 1980-2012.

**Question 20 : Based on these data, indicate the most responsible decision for the situation you have described :**

- 1- The seismic risk in the Var valley is not high enough to warrant the use of seismic building standards.
- 2- There is a real seismic risk in the Var valley. Seismic standards must be adopted.
- 3- There is a real seismic risk. Seismic standards enabling buildings to withstand ground motion of intensity around XII must be adopted.



**FIGURE 14 :** Structural map of the Var valley showing the relative motion (circle with colored zones. The two lines inside represent possible motion directions on a non-observed fault - arrows symbolize relative motion linked to each possible fault) ; along a fault during a recent earthquake. Legend : A—crystalline bedrock, B—Mesozoic sedimentary cover, C—Plio-Quaternary sedimentary deposits. Near the location of the epicenter plotted on the map, the fault plane of figure 13 have been observed.

Considering data recorded on the seismic event described in figure 14, some uncertainty still remains on the original fault. 2 possibilities : a dextral displacement along a fault oriented NW-SE or a sinistral displacement along a fault oriented NE-SW.

**Question 21 : Considering all the figures, choose the options from the list below which would lead you to infer the presence of a fault in the Var valley (several answers possible) :**

- 1- Historical data before the use of seismometer.
- 2- Instrumentally recorded seismicity.
- 3- Observational data of the ground (the fault plane previously described).
- 4- The terrain around the Var valley (mountains, gorges, small valleys).
- 5- The path of the river.

**Question 22 : Considering all the figures, choose the options from the list below which enable you to suspect the presence of an fault with a recent activity in the Var valley (one possible answer) :**

- 1- Historical seismicity.
- 2- Instrumentally recorded seismicity.
- 3- Observational data of the ground (the fault plane previously described).
- 4- The terrain around the Var valley (mountains, gorges, small valleys).
- 5- The path of the river.

**Question 23 : Considering all the figures, choose the options from the list below which enable you to suspect the presence of a fault whose trajectory would run approximately SW-NE (several answers possible) :**

- 1- Historical seismicity.
- 2- Instrumentally recorded seismicity.
- 3- Observational data of the ground (the fault plane previously described).
- 4- The terrain around the Var valley (mountains, gorges, small valleys).
- 5- The path of the river.

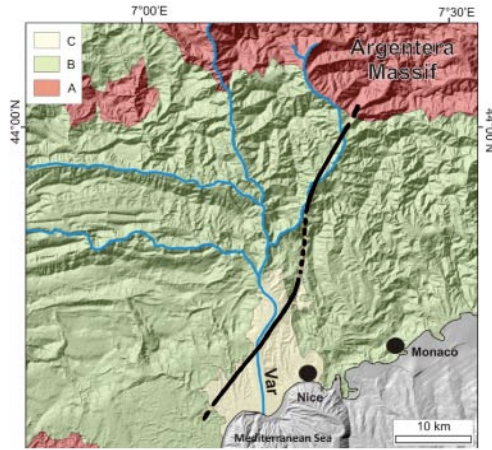
**Question 24 : Considering all the figures, choose the options from the list below which enable you to suspect the presence of a fault whose trajectory would run approximately SE-NW (several answers possible) :**

- 1- Historical seismicity.
- 2- Instrumentally recorded seismicity.
- 3- Observational data of the ground (the fault plane previously described).
- 4- The terrain around the Var valley (mountains, gorges, small valleys).
- 5- The path of the river.



**Question 25 : Choose the most probable fault trace from the four given in figure below.**

1-



3-



2-



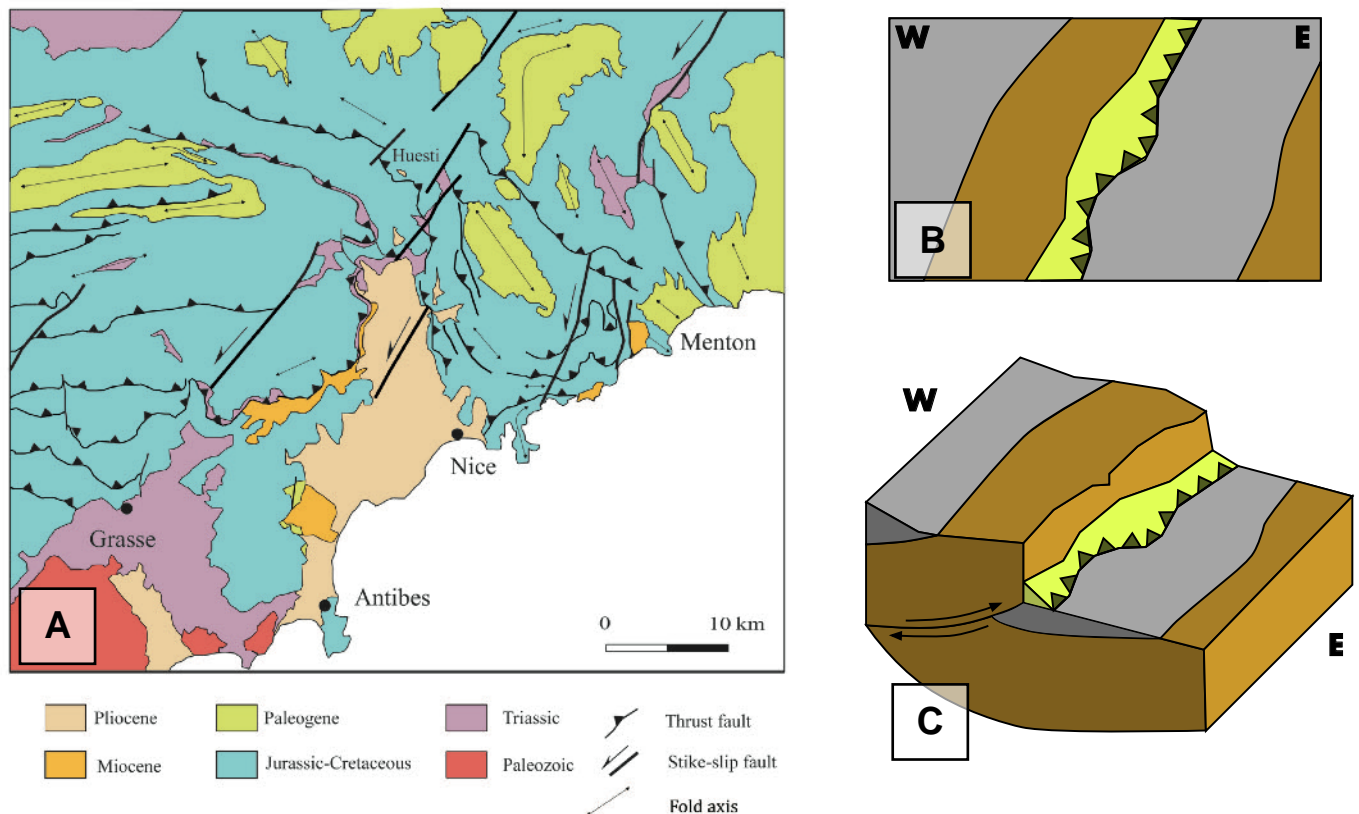
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Understanding the origin of seismic events should enable one to better characterize seismic hazard. We are interested in the geodynamic situation affecting the Var valley.

## SECTION 4 : RECENT AND THE PRESENT GEODYNAMIC SITUATION OF THE REGION

The figure below shows the simplified tectonic structure of the region around the Var plain. Some of the topics can be related to some of the previous sections :



**FIGURE 15 :** (A) Schematic sketch of the southern Alps in the area of Nice; (B) and (C) Corresponding sketch between a thrust fault in 3D and its representation on a geological map.

**Question 26 : A fold with its axis oriented NE-SW indicates a shortening direction oriented : (one answer possible)**

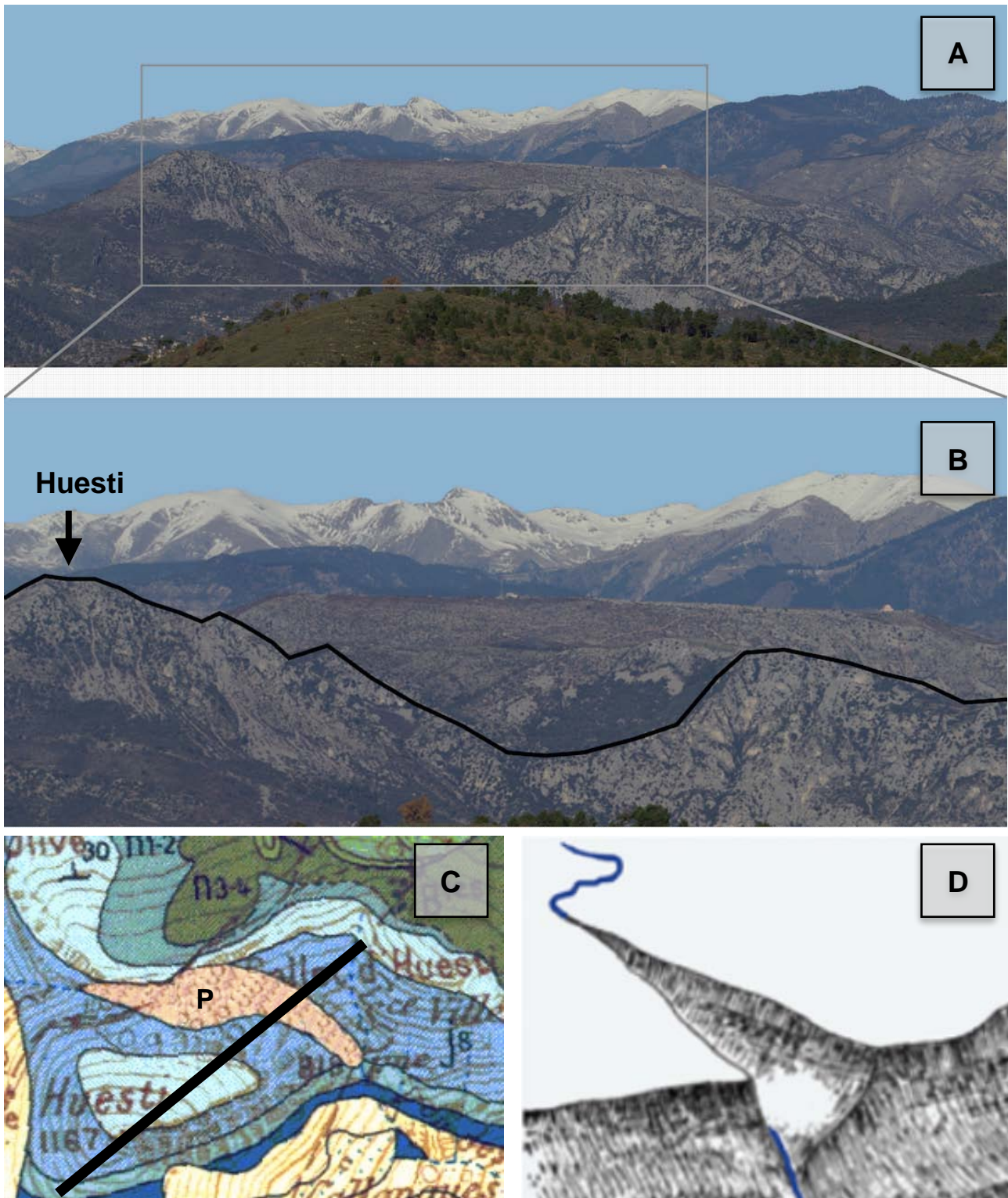
- 1- NE-SW.
- 2- SSE-NNW.
- 3- NW-SE.
- 4- ESE-WNW.

**Question 27 : Refer to figure 15. The observed tectonic structures indicate : (several answers possible)**

- 1- A zone that is subjected to extension.
- 2- A zone that is subjected to shortening.
- 3- A main shortening direction oriented along the principal N-S axis.
- 4- Two main shortening directions oriented along the N-S and NE-SW axes.



The local tectonics has moved characteristic structures to surprising places. We focus on Mount Huesti.



**FIGURE 16 :** (A) A panoramic view of the southern Alps north of the Var valley; (B) A panoramic view of Mount Huesti (1167 meters elevation); (C) Geological map of Mount Huesti. The thick black line shows the orientation of the photograph in B. Colors indicate the age of the rocks: all blues-Jurassic, green-Cretaceous, orange (p on the map)-Pliocene, yellow-Quaternary (superficial landslide); (D) Sketch of a canyon.

**Question 28 :** For each of the geological formation designated by the letters x, y, and z, indicate the corresponding ages by using the following letters: J for Jurassic, C for Cretaceous, P for Pliocene, and Q for Quaternary.



**Question 29 :** The Pliocene pebble conglomerate, like most conglomerates, was probably deposited and consolidated... (only one answer)

- 1- In abyssal plain environment.
- 2- In a fluvial environment, near the mouth.
- 3- In a high mountain far from any river.
- 4- on the seashore, far from a river mouth.

**Question 30 :** Using the cartographic data, the tectonic event that gave rise to Mount Huesti, having an elevation of 1167 meters, could be dated to : (several answers possible)

- 1- Mio-Pliocene.
- 2- Jurassic-Cretaceous boundary.
- 3- Cretaceous to Pliocene.
- 4- Post-Pliocene.

This type of tectonic structure is called a thrust fault. It involves the displacement of one block over another, aided by a lubricating layer, normally an evaporite (Triassic rocks in the region).



**Question 31 :** After examining the map below, choose the correct course of the thrust fault (numbered 1-4) that brought Mount Huesti into existence.

2

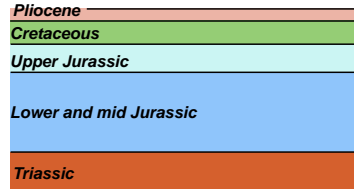
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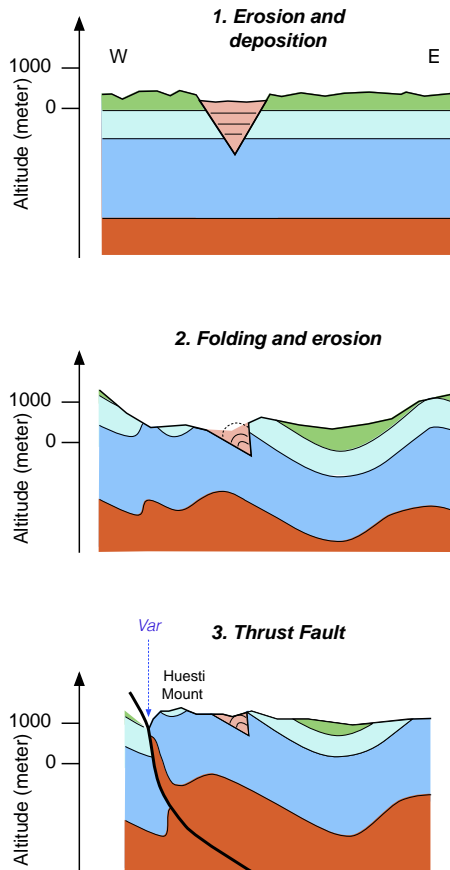
Caption :  $t_3$  are Triassic rocks (evaporites) ;  $j_1-2-6-7-8-9$  are Jurassic rocks (limestones) ;  $n_1-3-4-6$  and  $c_1$  are Cretaceous rocks (marl and limestones) ;  $p_2$  are Pliocene rocks (conglomerate) ; B, E and  $F_{x-z}$  are Quaternary rocks (unconsolidated deposits).

**Question 32:** After considering all the previous information, choose the scenario whose sequence of deposition and deformation best explains the formation of Mount Huesti (on map) .

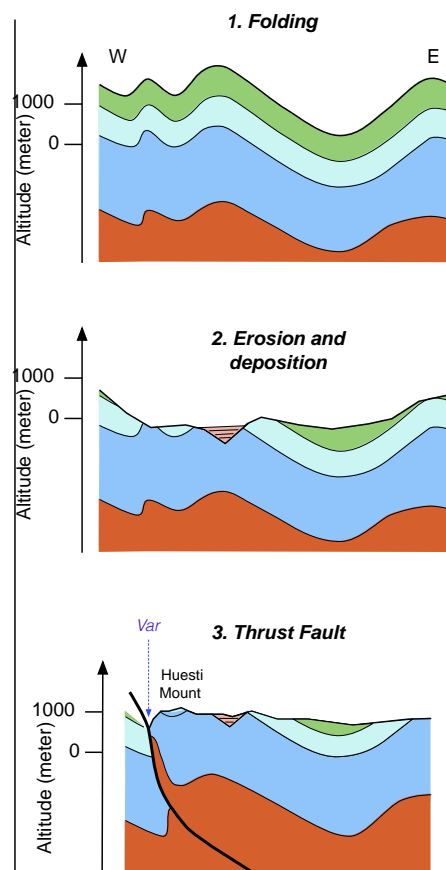


Stratigraphic position of sedimentary units observed on the map

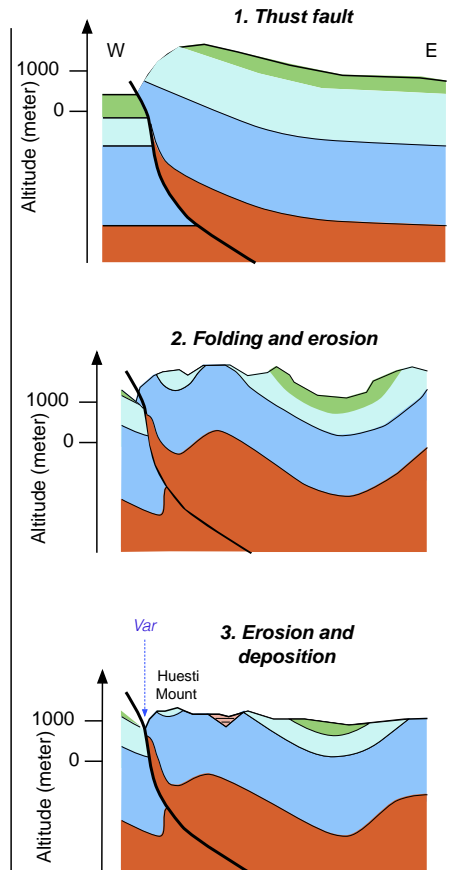
### SCENARIO 1



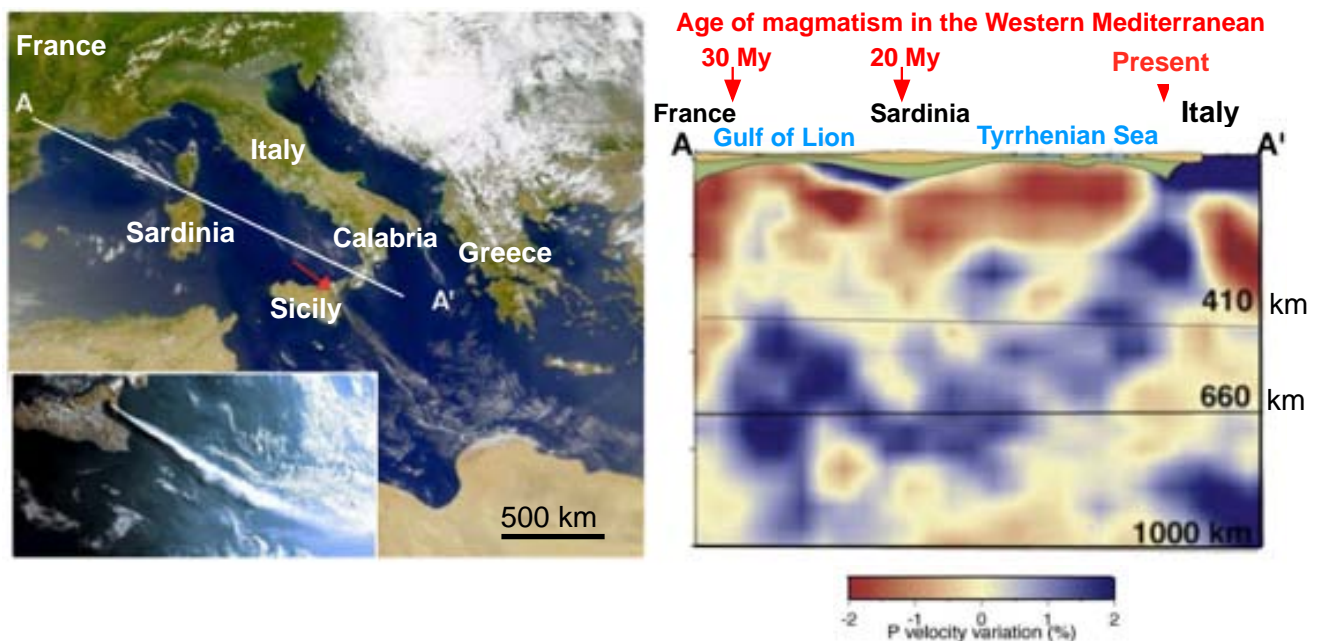
### SCENARIO 2



### SCENARIO 3



To better understand the geodynamical context, let us focus on the present situation in the western Mediterranean Sea.



**FIGURE 17 :** (A) Satellite imagery of the western Mediterranean Sea. Inset is a zoom showing Sicily marked by the red arrow, indicating a volcanic activity; (B) results of seismic tomography performed along A-A' in (A). Information about magmatism over time can be seen in the upper part of the tomogram.

**Question 33 : Tomography is a method, which enables color-coded representation of : (several answers possible)**

- 1- the motion of different chemical materials at depths below the earth's surface.
- 2- depth of mafic/felsic rock.
- 3- wave speed anomalies in the Earth.
- 4- depth of total melt of rock.
- 5- differences in temperature and/or density detected from variations in the speed of seismic waves.
- 6- differences in direction of crystal alignment in metamorphic rock.

**Question 34 : Refer to figure 17. The results of tomography suggest subduction in this area of the Mediterranean. The evidence provided by tomography is : (only one answer)**

- 1- a long, blue area beginning on the surface at Calabria (South of Italy) and towards the NW up to the core-mantle boundary.
- 2- not clear. There is no logic between the red and blue anomalies presented.
- 3- an oceanic lithosphere thrusts towards the NW up to the lithosphere-asthenosphere boundary.
- 4- a cold material (coming from superficial strata) diving towards the upper mantle-lower mantle boundary.

**Question 35 : Refer to figure 17. There are indications of (only one answer) :**



- 1- two subduction fronts, one of which is located between the Gulf of Lion and Sardinia.
- 2- a subduction zone whose front is located between the Gulf of Lion and Sardinia.
- 3- a subduction zone whose front is located between Sardinia and Calabria (South of Italy).
- 4- a subduction zone whose front is located to the east of Calabria (South of Italy).

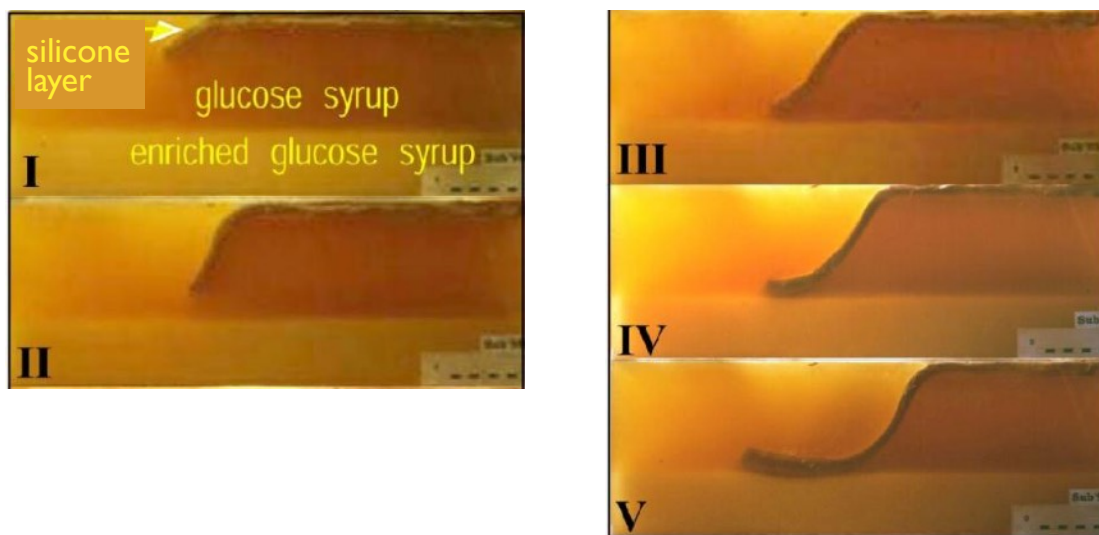
**Question 36 : With reference to the known subduction model, the results of tomography are compatible with localized, active volcanism: (only one response)**

- 1- in southeastern France.
- 2- from southeastern France to Sicily.
- 3- that could explain the collision between two continental plates which gave rise to the Alps.
- 4- in Sicily.

To test a slightly different hypothesis of subduction, Claudio Faccenna proposed an analog model, which is rather unique. With this model, he wanted to determine:

- if subduction could occur without convergence, and
- if such a phenomenon (subduction without convergence) could be compatible with the subduction of the western Mediterranean.

For this, he poured two liquids of different densities (as a function of their glucose concentration) and then placed a slab of silicone with elastic viscosity on the surface. He took successive photos (I to V in figure 18) of the behavior of the silicone layer.



**FIGURE 18** : Results of Claudio Faccenna's (University of Rome, 2003) experiments modeling subduction without convergence. I to V are sequential photographs taken during the experiments.



**Question 37 : Refer to figure 18. Considering silicone layer (x), glucose syrup (y) and enriched glucose syrup (z); match x, y, z with one of the following:**

- 1- The continental lithosphere.
- 2- The oceanic lithosphere.
- 3- The continental crust.
- 4- The asthenospheric mantle.
- 5- The lower mantle.
- 6- The core-mantle boundary
- 7- The lithospheric mantle.

**Question 38 : In modeling, one must control the essential parameters of the modeled process. Indicate the parameters below that the researcher can control: (several answers possible)**

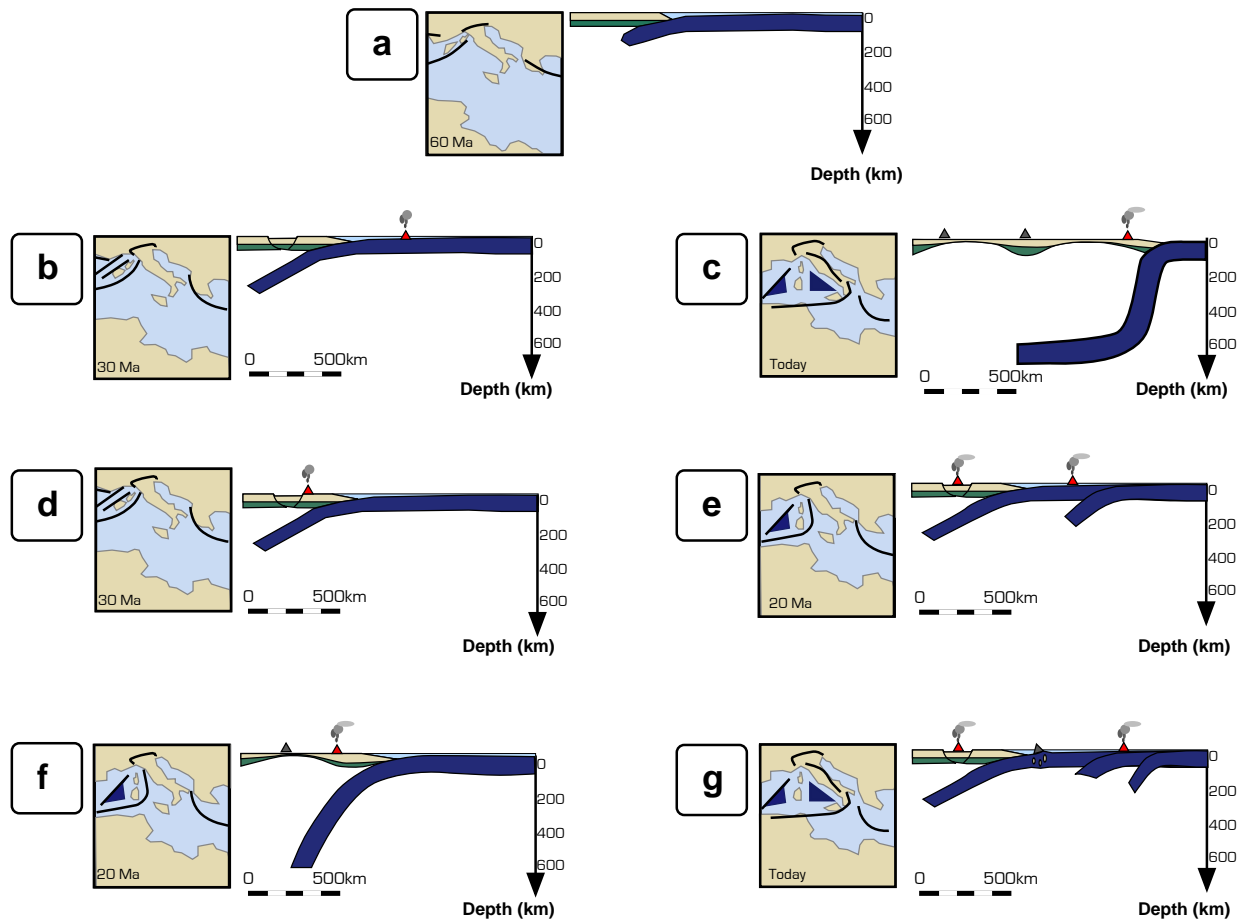
- 1- The density contrasts between the subducting plate and the underlying strata.
- 2- The viscosity of the strata.
- 3- The increasing temperature of successive strata.
- 4- The speed of convergence of the plates.
- 5- The convection currents in the upper mantle.

**Question 39 : Subduction in the Mediterranean Sea resembles that shown in the analog model (figure 18). Choose the observations that demonstrate the similarity : (only one answer)**

- 1- The slab (silicon layer) presses against an interface marked by a change in density, which is an observation specific to this subduction.
- 2- The front migrates in the model, which fits with the observed location of volcanism.
- 3- The slope of the subducting slab (silicon layer) is identical both in the model and the tomogram; such a slope is thus due to the absence of convergence.

**Question 40 : From the information available and your knowledge, choose the correct chronological order of the events leading to the formation of the western Mediterranean.**

- 1- a / d / e / g
- 2- a / b / e / c
- 3- a / d / f / c
- 4- a / b / e / g



**Question 41 : In conclusion, one may say that the regions of Nice and the Var plain are currently subject to (only one answer.) (Please answer the question although It carries no point.)**

- 1- A high volcanic risk.
- 2- A moderate volcanic risk.
- 3- A low volcanic risk.
- 4- No volcanic risk.