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Element of a pluri-disciplinary project on karstic reservoir characterization: first results of cave sediments paleomagnetic dating in Dévoluy Massif, France.

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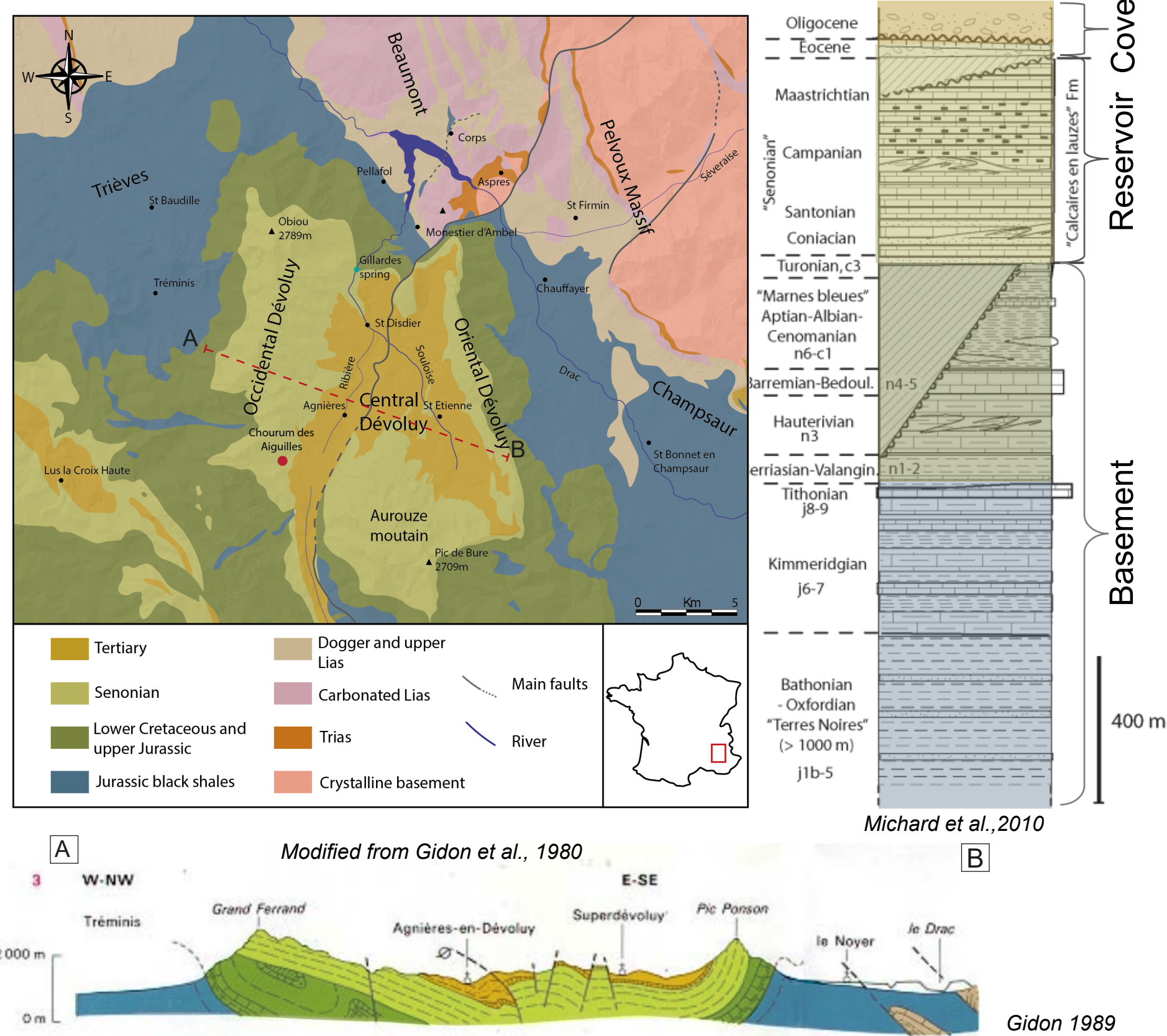


Objectives : this work aims to explore the karstic evolution of the Dévoluy Massif by studying cave sediments. These karstic fillings provide evidence of the evolution of the massif and allow the recording of events not preserved at the surface. This will improve the geological calendar for the area and provide information about the evolution of the Dévoluy karstic reservoir.

Case study : Rama-Aiguille cave

Dévoluy Massif

- Southern French Alps massif.
- Folded fractured and karstified Upper Cretaceous reservoir.
- Unique outlet (Gillardes spring) average Q= 5m³/s
- > major challenge for water management in contexte of climate change (T°C, P).



Typical senonian limestone in Rama Aiguille cave (top) and entrance of Aiguille cave (right).

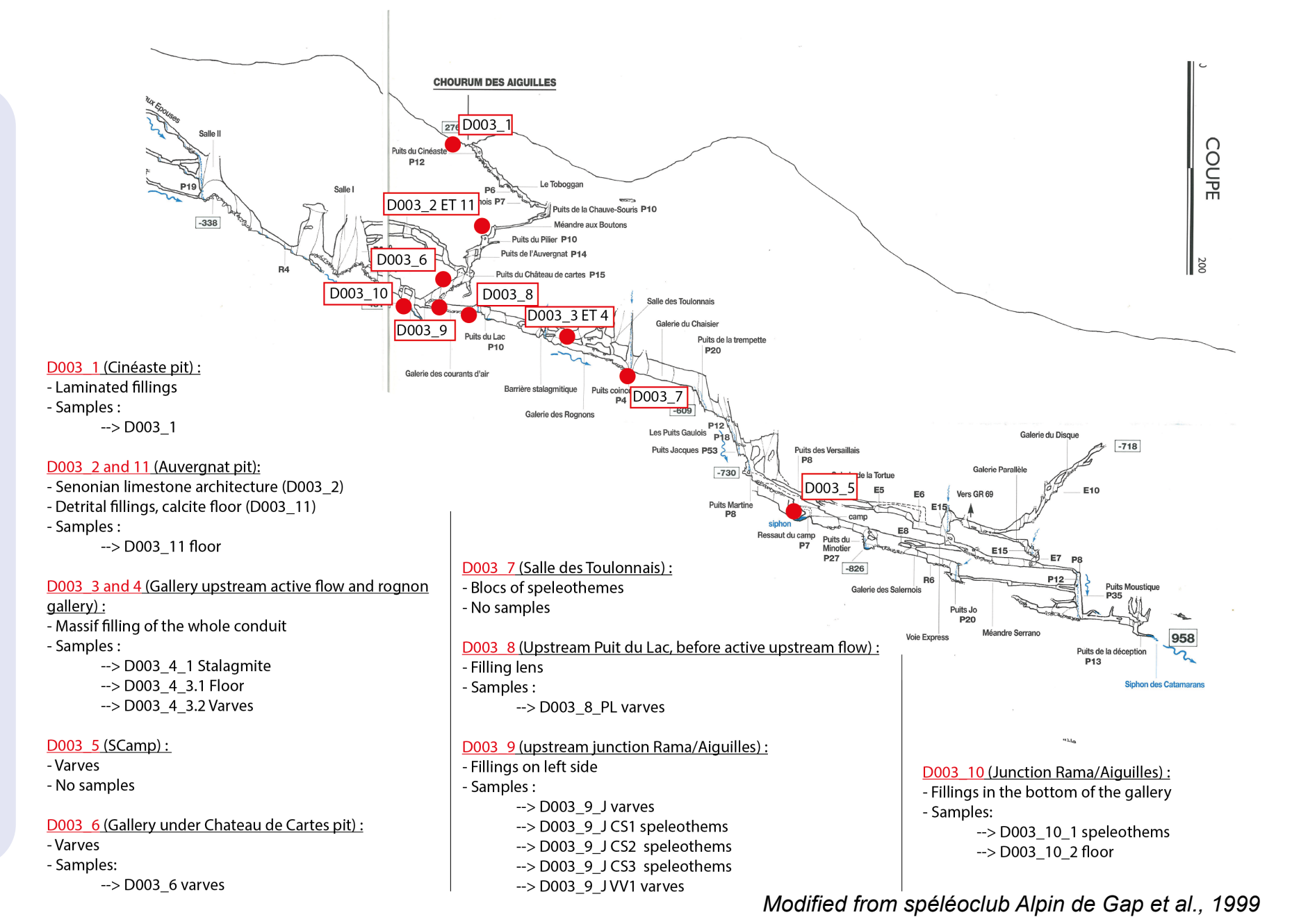


Rama Aiguilles cave
 - Deepest cave of the area (depth 980m, length 6km).
 - Presence of extended sequences of sediment in several places on the cave.

Material and method

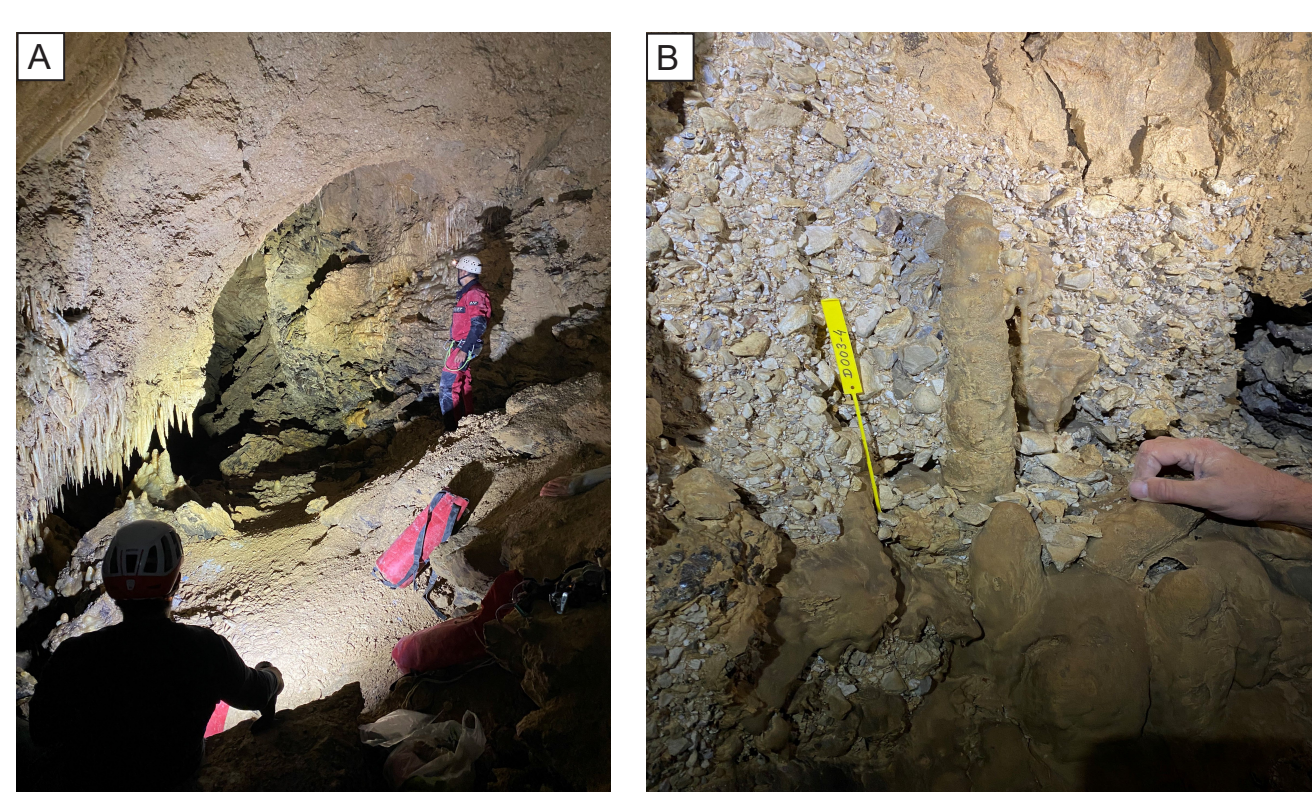
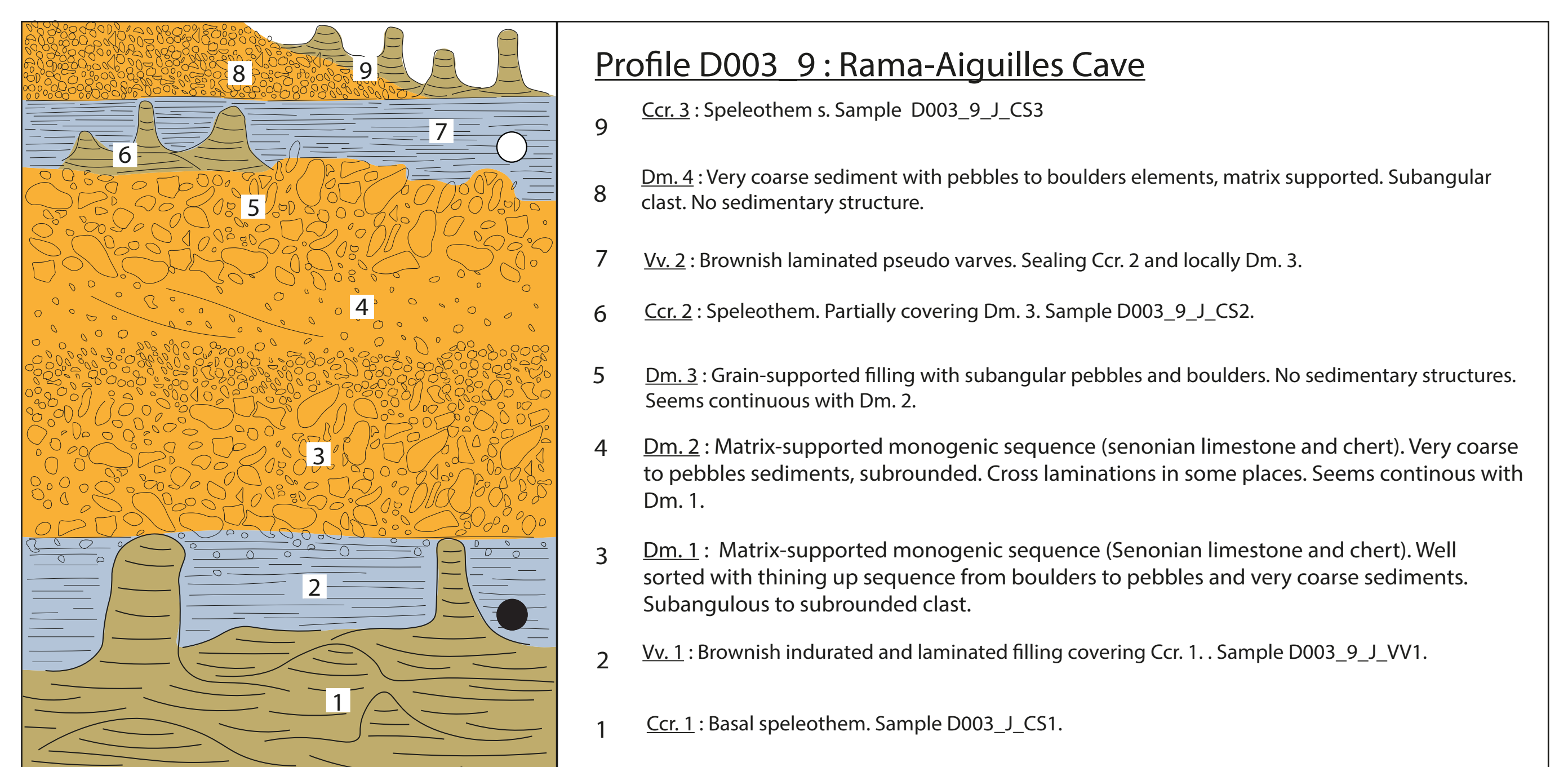
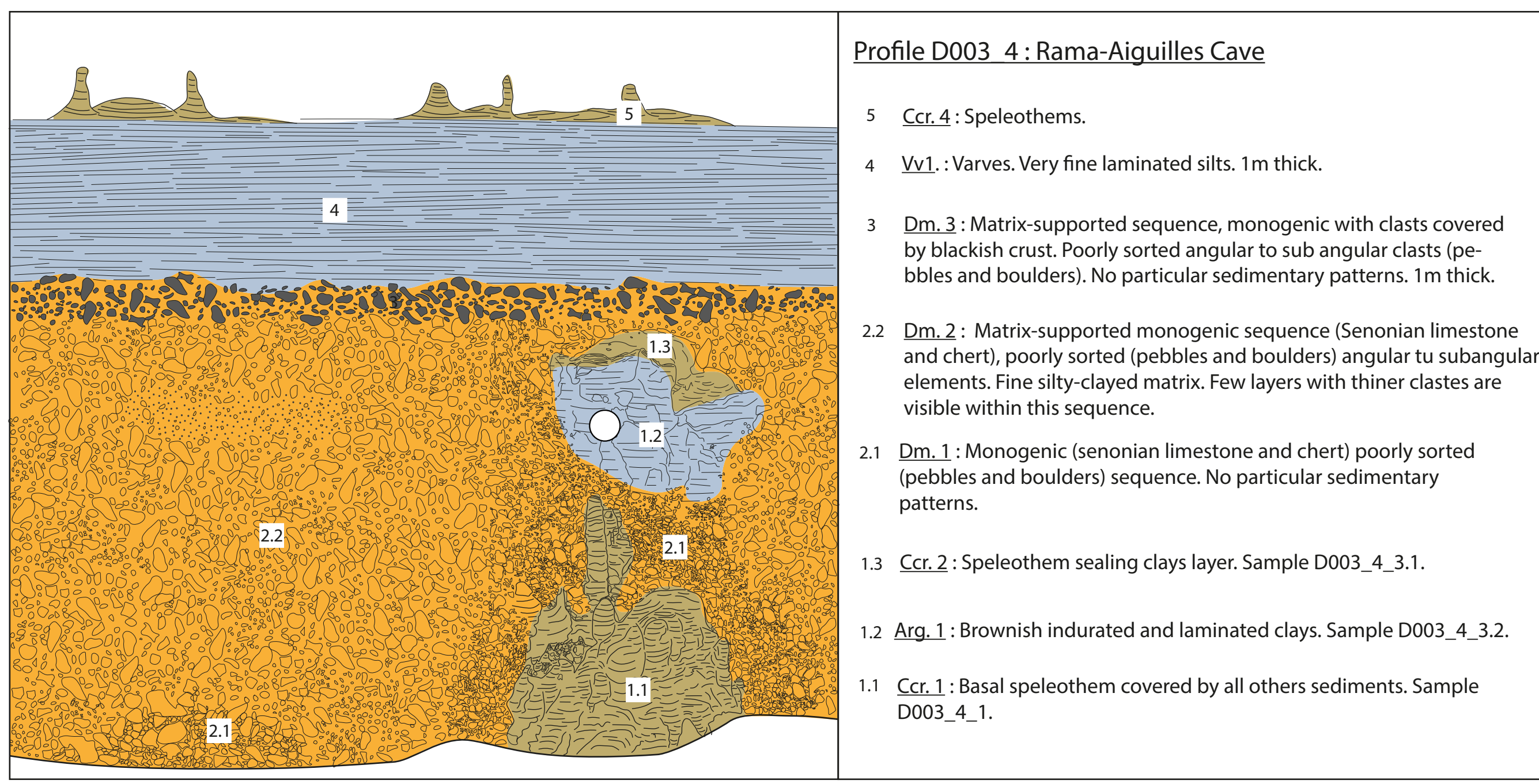
Dévoluy Massif

- Study of sedimentary profile, best preserved in D003_4 and D003_9.
- Precise logging for sedimentology, architecture and relationships between sequences.
- Sampling for dating (U/Pb, U/Th, paleomagnetism).
- Sampling for pollens analysis.
- Sampling for heavy minerals analysis and XRD.



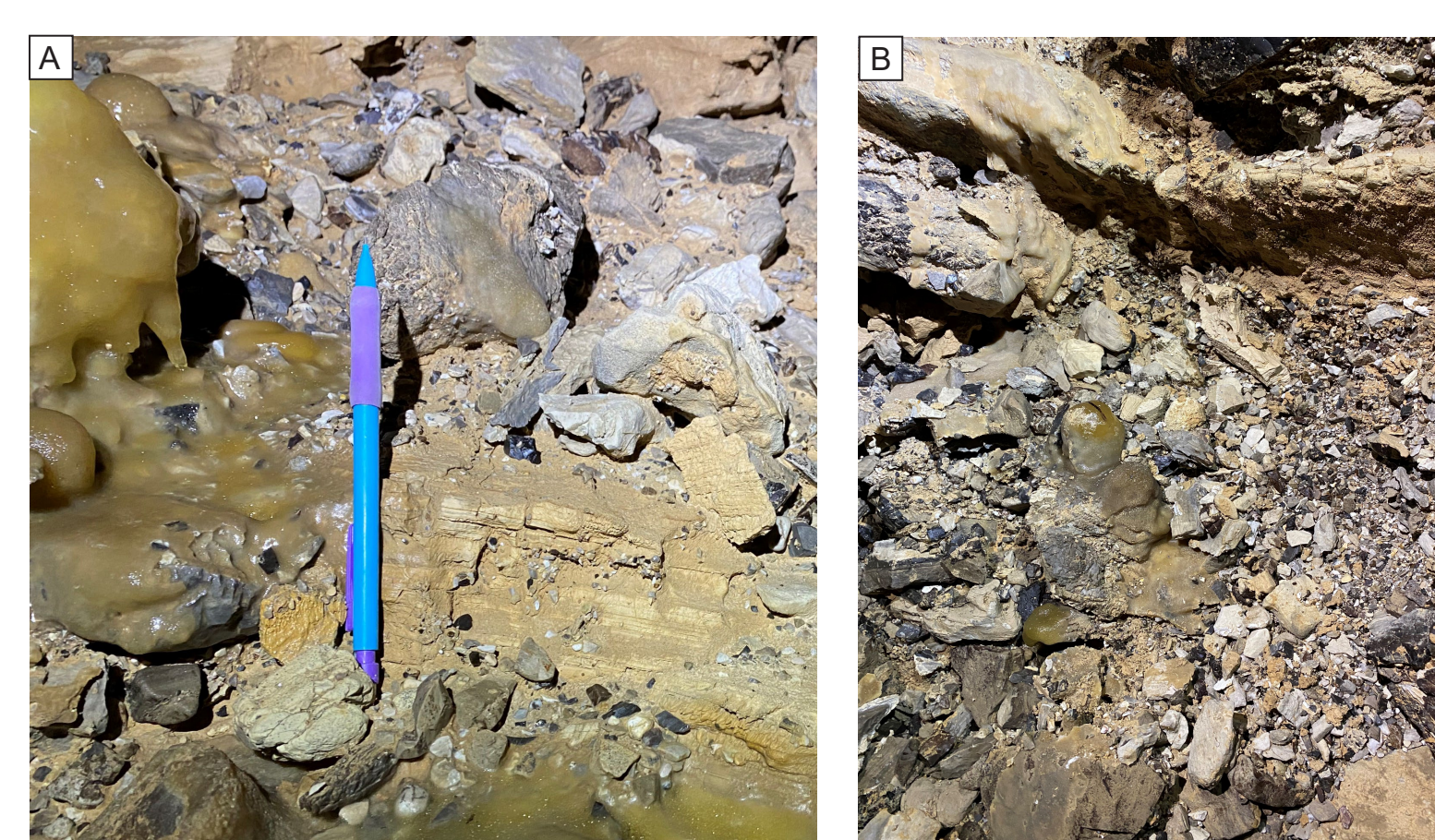
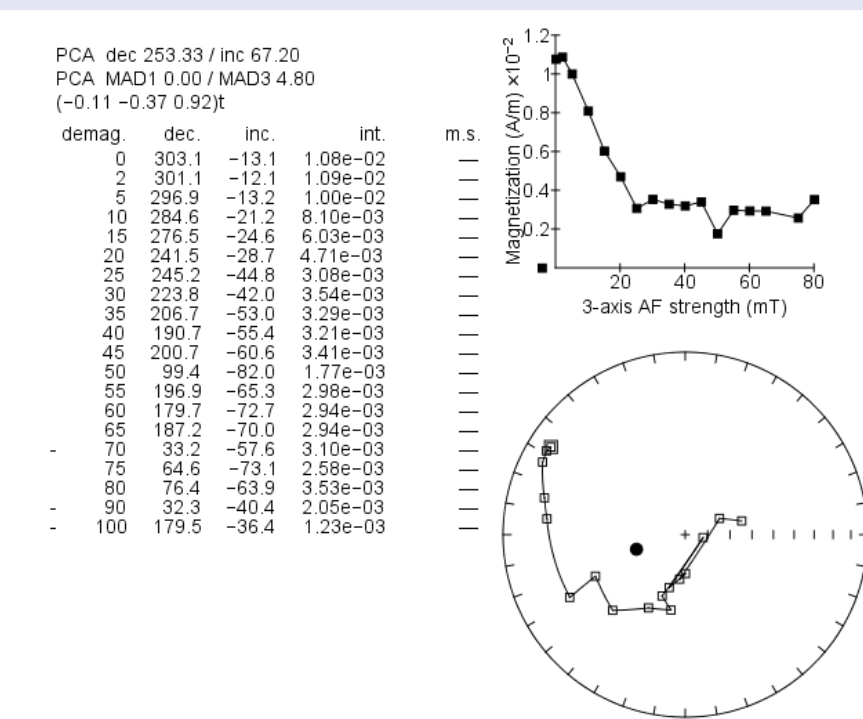
Samples taken from the cave : (A) speleothem D003_4_1, (B) and (C) paleomagnetism cubes.

Sedimentary profiles description and paleomagnetism dating

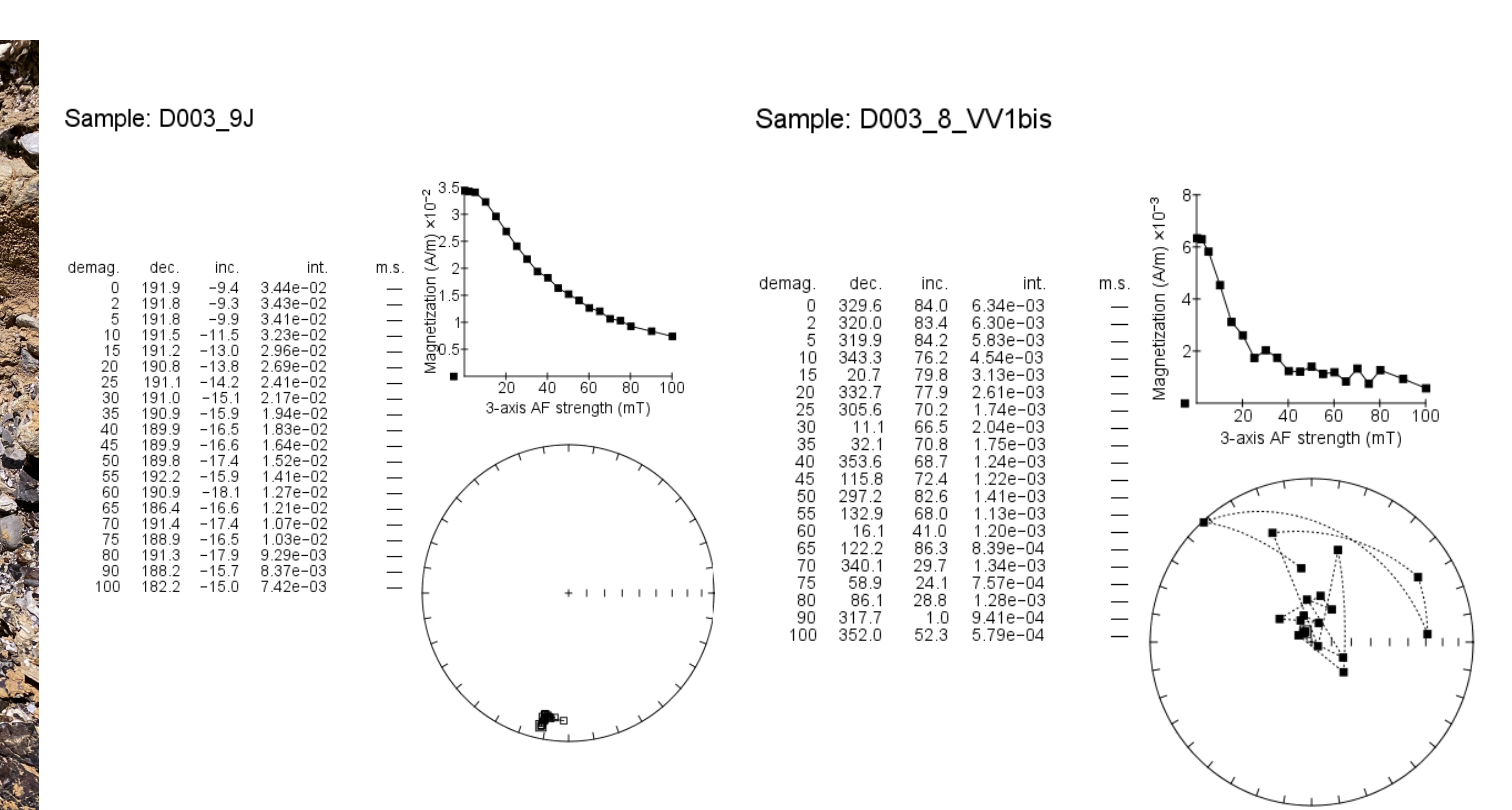


lithological poles :
 - Coarse detrital material : period of heavy loading favorable to sediment remobilization.
 - pseudo varves : period of calmer sedimentation with flooding of the cave and deposition by decantation of fine glacial sediments (no pollens found).
 - Speleothems : temperate period favorable for calcite to settle and growth.

Paleomagnetism on fine sediments
 Reverse polarity : dated from at least 780kyr.
 -> Part of the fillings are older than 780kyr.



Sedimentology
 - Same three lithological poles as in D003_4.
 - Similar sequence of events but one more detrital one at the top.



Paleomagnetism on fine sediments
 - Reverse polarity on top.
 - Normal polarity at the bottom.
 -> Parts of the fillings are older than 780kyr and an older normal period has even been recorded in the sediments.

Conclusion and way-forward

- Presence of karstic sediments reflecting various climatic phases (glacial vs. temperate).
- Phases of backfilling and clearing of conduits playing a role in the dynamics of underground flows in the massif.
- New markers on the geological calendar showing that cave sediments and by extension Rama-Aiguille cave system is older than 780kyr.
- Further dating using U/Pb and U/Th on calcite will enable us to refine the ages of the fillings.
- Extending analysis in other caves would help to decipher if those sediments are a record of large scale events in the Dévoluy.

References

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 Approaches and conceptual models
 June 2024, Postojna, Slovenia