



Reconstruire le cadre chronoclimatique et paléoenvironnemental des occupations humaines paléolithiques : le cas d'école et d'équipe du Nord de la France

David Hérisson

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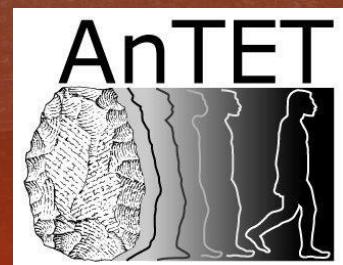


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Reconstruire le cadre chrono-climatique et paléo-environnemental des occupations humaines paléolithiques : le cas d'école et d'équipe du Nord de la France

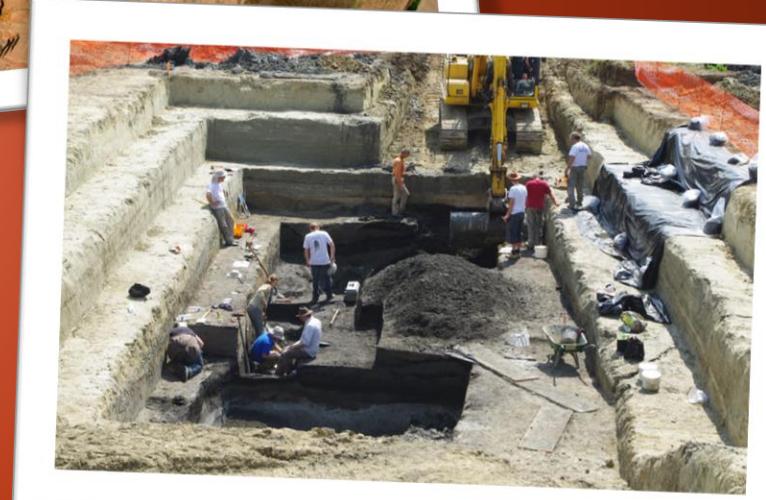
David Hérisson

[@david_herisson](https://twitter.com/david_herisson)



Séminaire de Master 2
Préhistoire & Anthropologie
9 novembre 2023

Qui suis-je ?

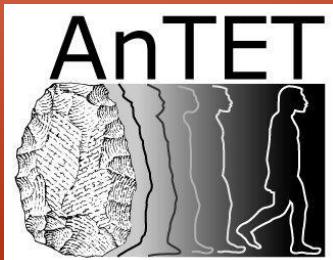


David Hérisson

@david_herisson



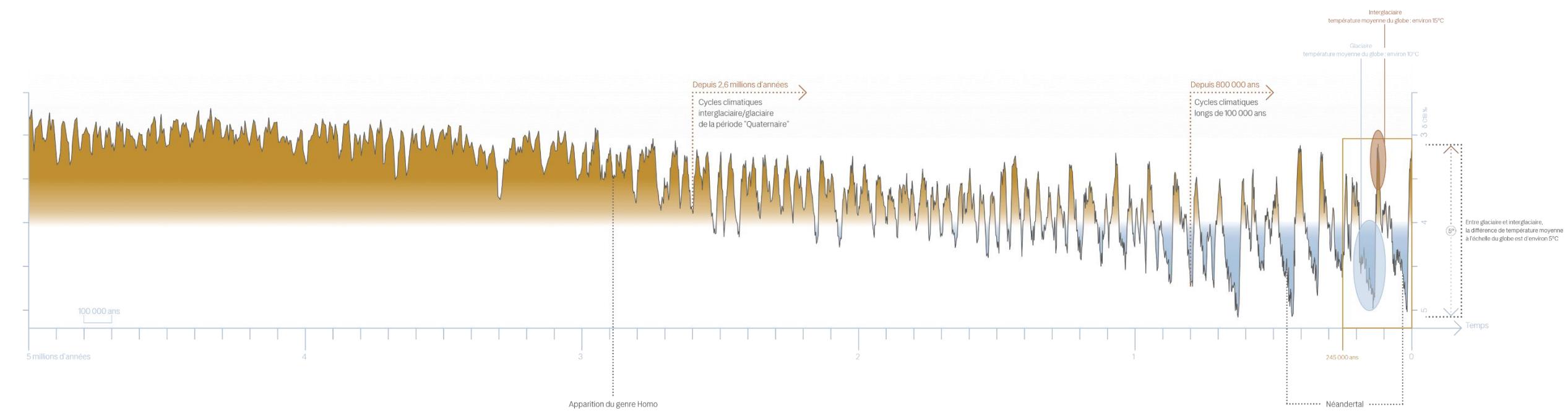
Archéologie et Sciences de l'Antiquité
CNRS - Université Paris-Sorbonne - Université Paris Nanterre - Inrap
Ministère de la Culture et de la Communication - Direction des Affaires Culturelles de la Ville de Paris - Ville de Paris



**Université
Paris Nanterre**

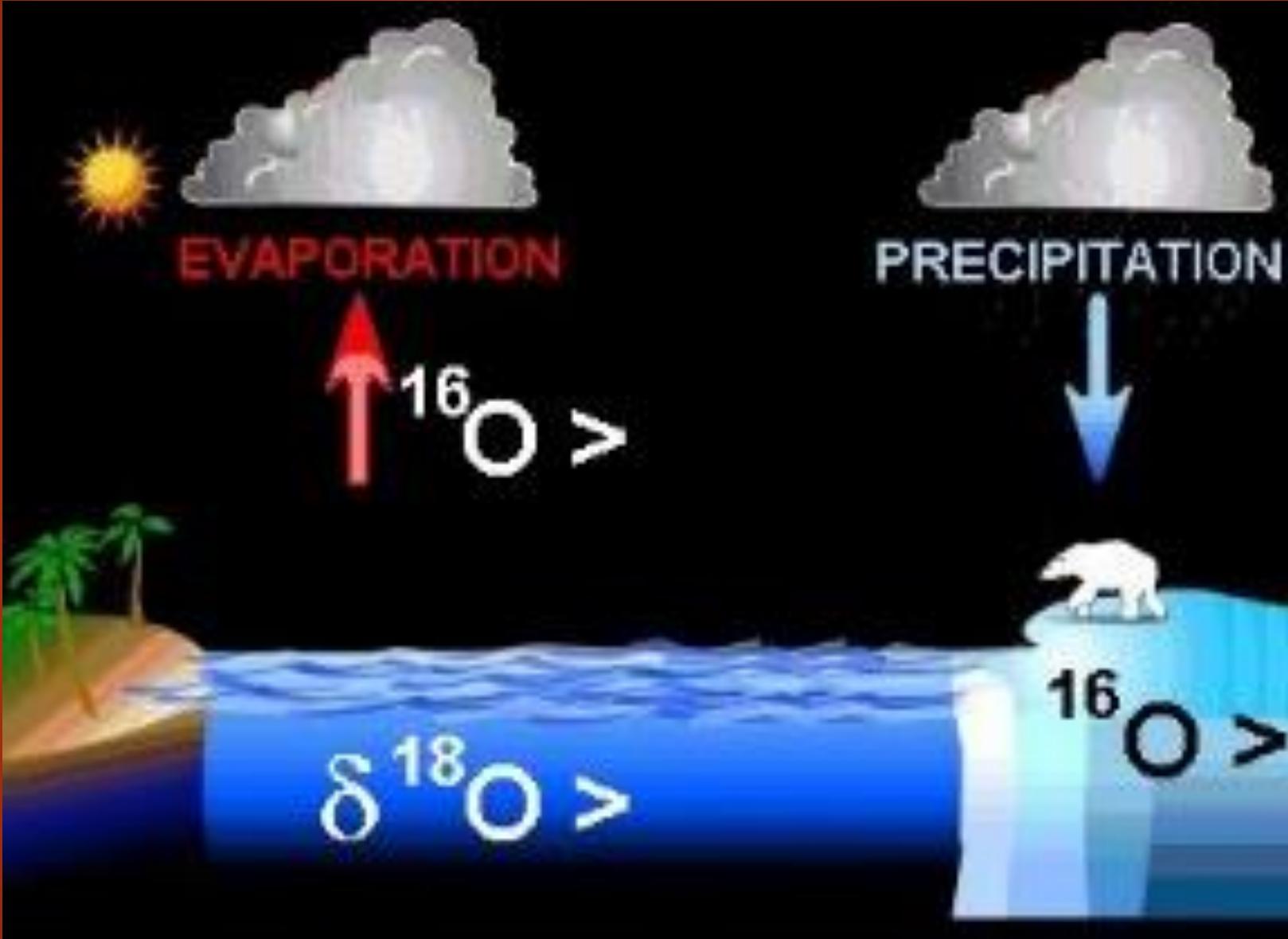
Les changements climatiques du Quaternaire

The LR04 stack spans **5.3 Myr** and is an average of **57** globally distributed benthic $\delta^{18}\text{O}$ records (which **measure global ice volume and deep ocean temperature**) collected from the scientific literature.

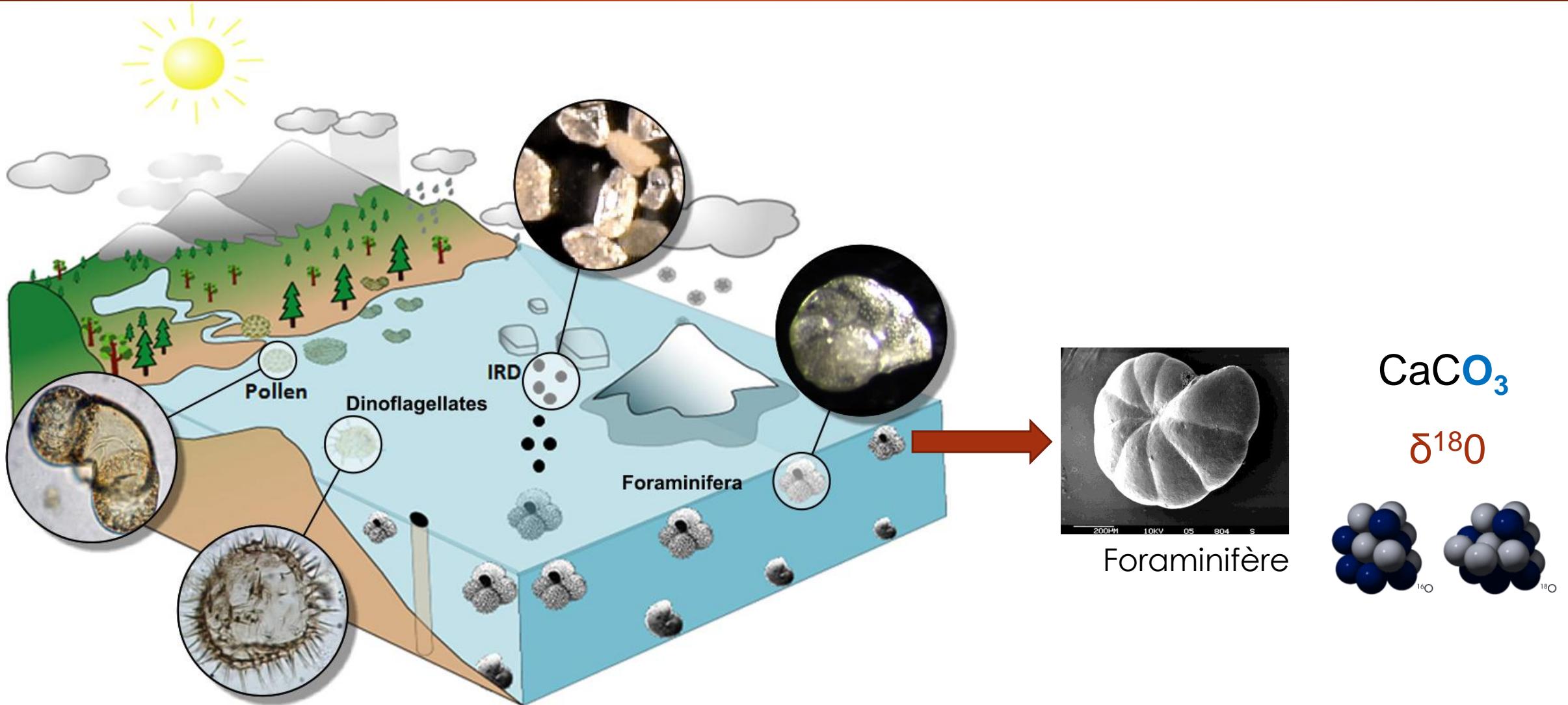


LISIECKI L.E. & RAYMO M.E., 2005 - A Pliocene-Pleistocene stack of 57 globally distributed benthic $\delta^{18}\text{O}$ records. *Paleoceanography*, 20, (1), 10.1029/2004PA001071.

Les changements climatiques du Quaternaire



Les changements climatiques du Quaternaire



Les changements climatiques du Quaternaire

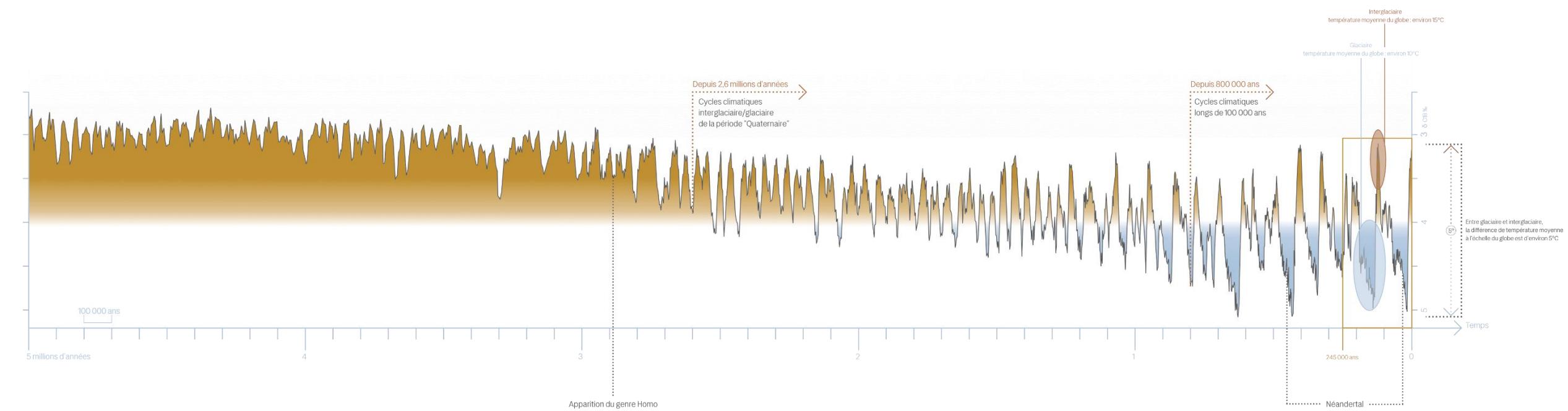


IFREMER

<https://www.flotteoceanographique.fr/Nous-connaitre/Decouvrir/Comprendre/Le-carottage>

Les changements climatiques du Quaternaire

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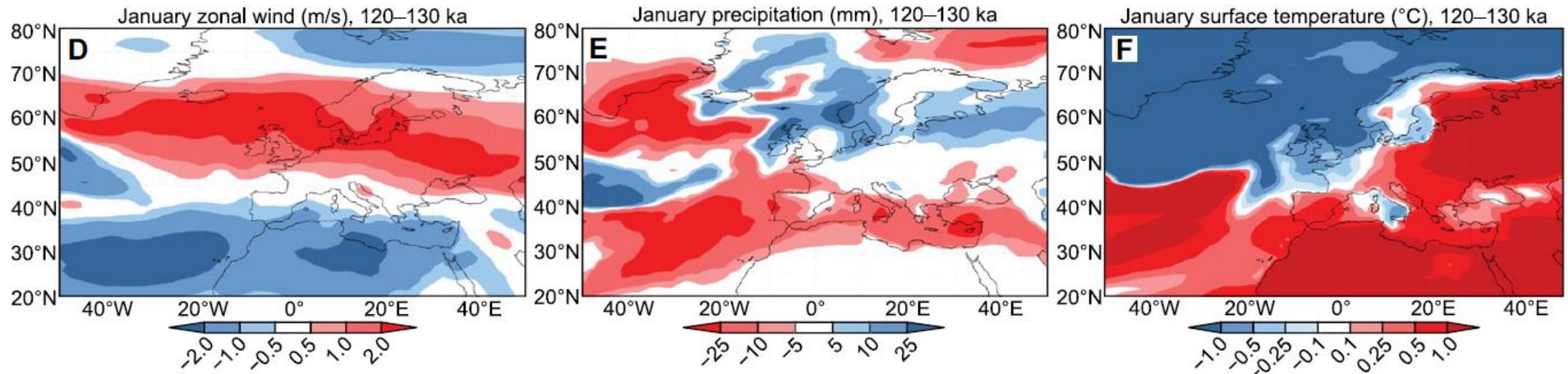
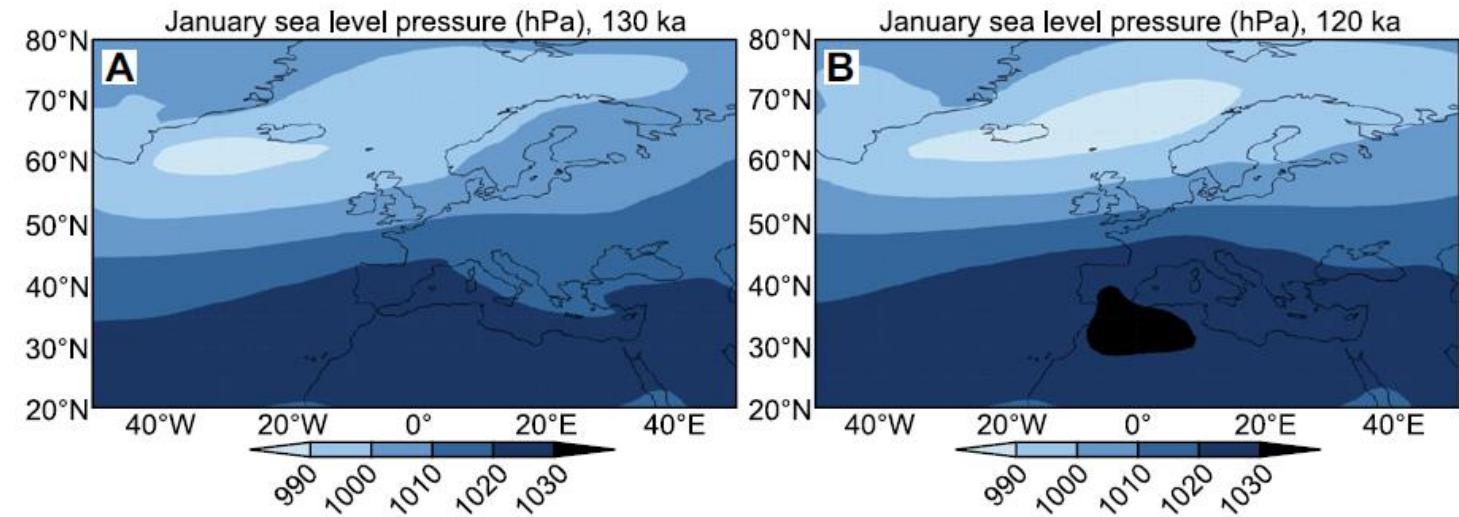
LISIECKI L.E. & RAYMO M.E., 2005 - A Pliocene-Pleistocene stack of 57 globally distributed benthic $\delta^{18}\text{O}$ records. Paleoceanography, 20, (1), 10.1029/2004PA001071.

Les changements climatiques du Quaternaire

Two simulations at 130 ka and 120 ka
forced by changes in orbital
parameters : Community Climate
System Model, v. 3 (CCSM3)

fully coupled,
global atmosphere–land surface–
ocean–sea-ice,
general circulation model

Salonen et al., 2021



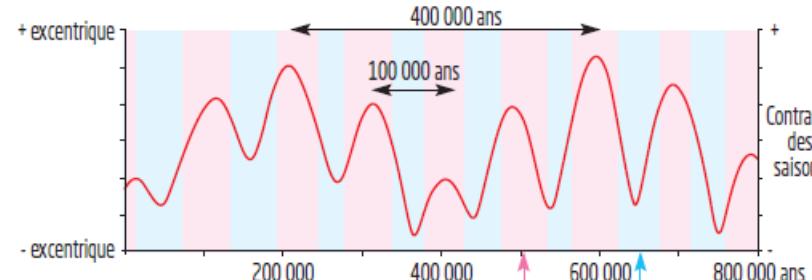
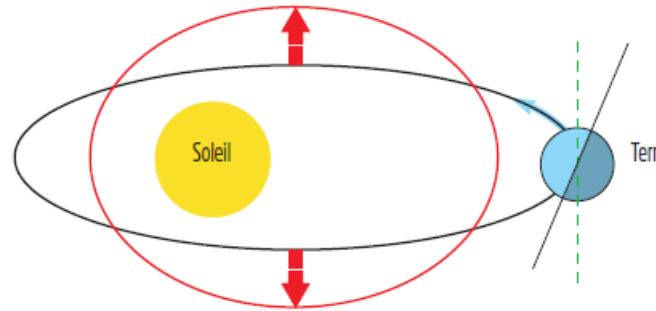
Les changements climatiques du Quaternaire

La quantité de chaleur reçue sur Terre est à l'origine des variations du climat.

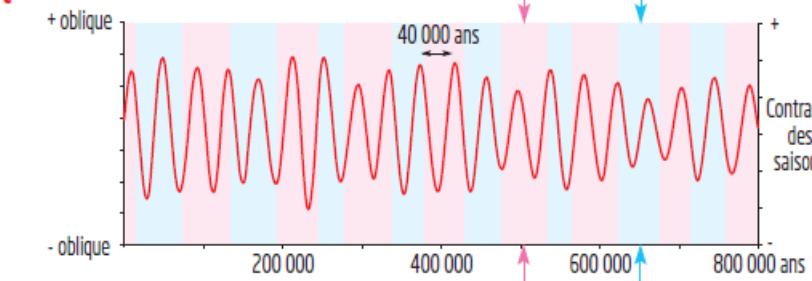
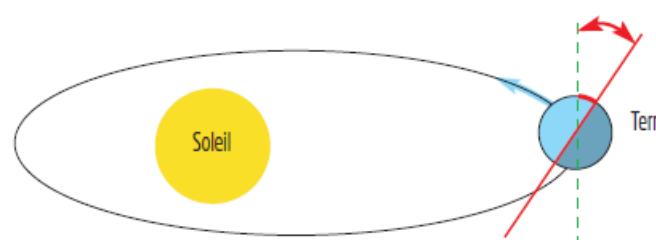
Elle contrôle le volume de glace sur Terre et le niveau marin.

La quantité de chaleur reçue sur Terre dépend de 3 cycles principaux, dits de "Milankovic"

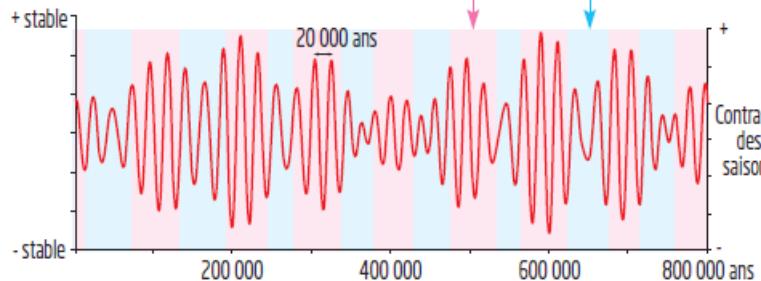
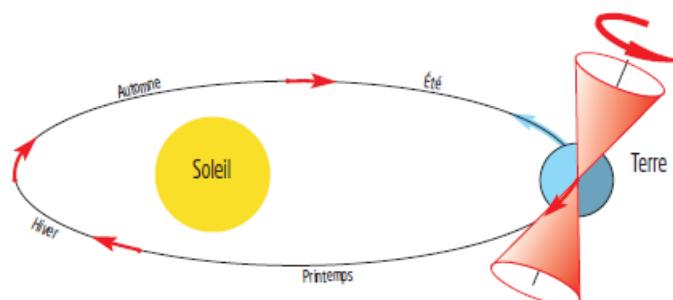
Variation de l'**EXCENTRICITÉ** de l'orbite terrestre



Variation de l'**OBLIQUITÉ** de l'axe de rotation



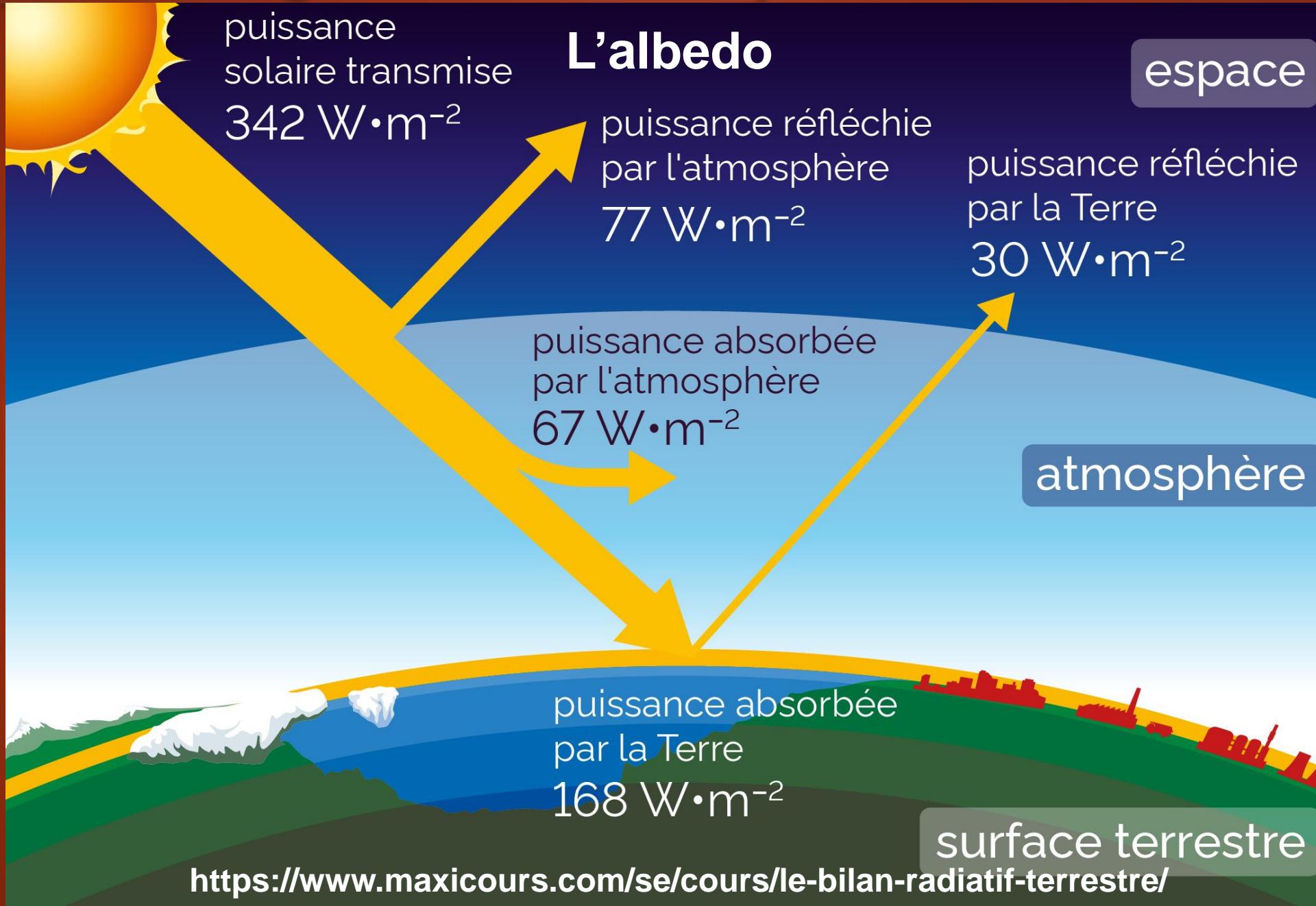
PRÉCESSION de l'axe de rotation et **ROTATION** de l'orbite terrestre



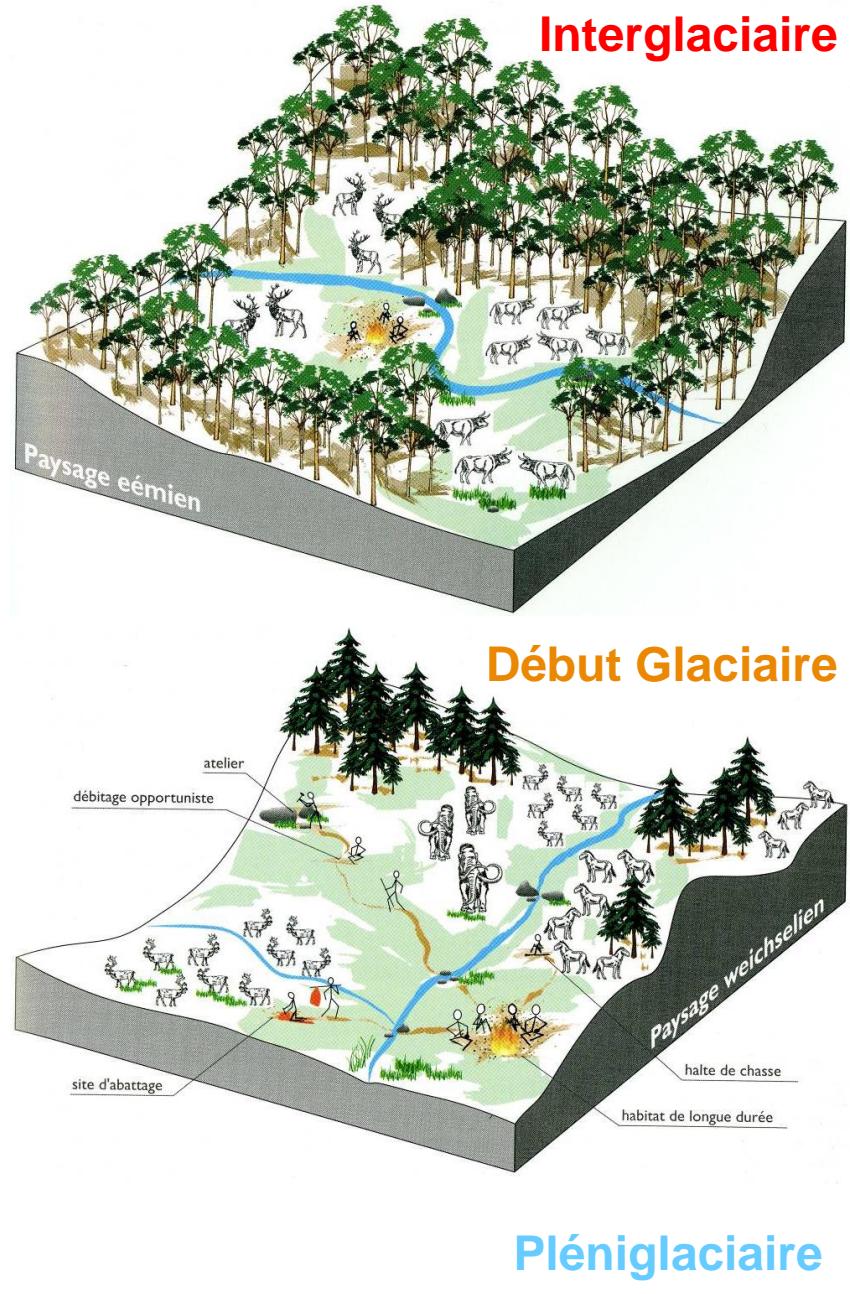
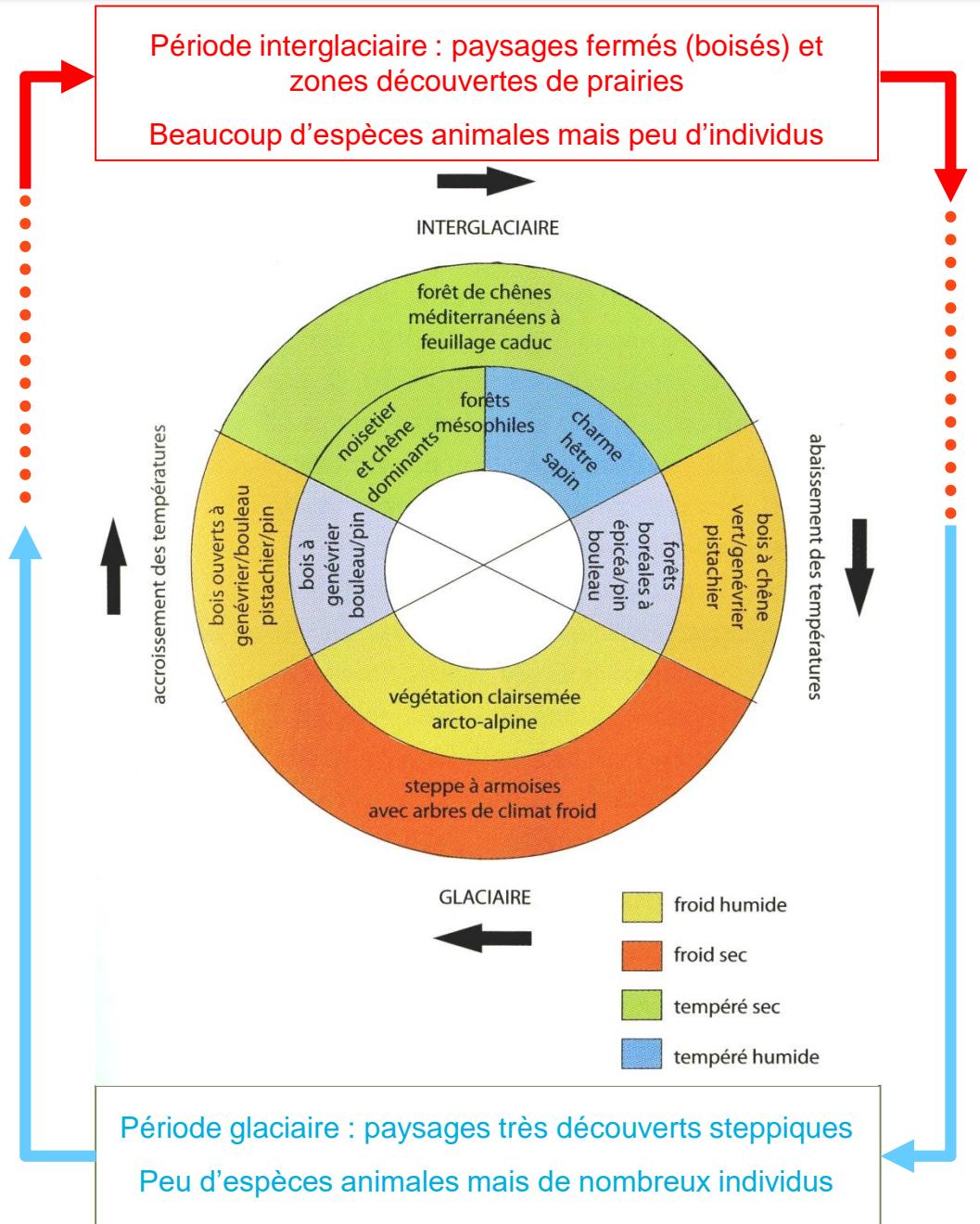
IFREMER

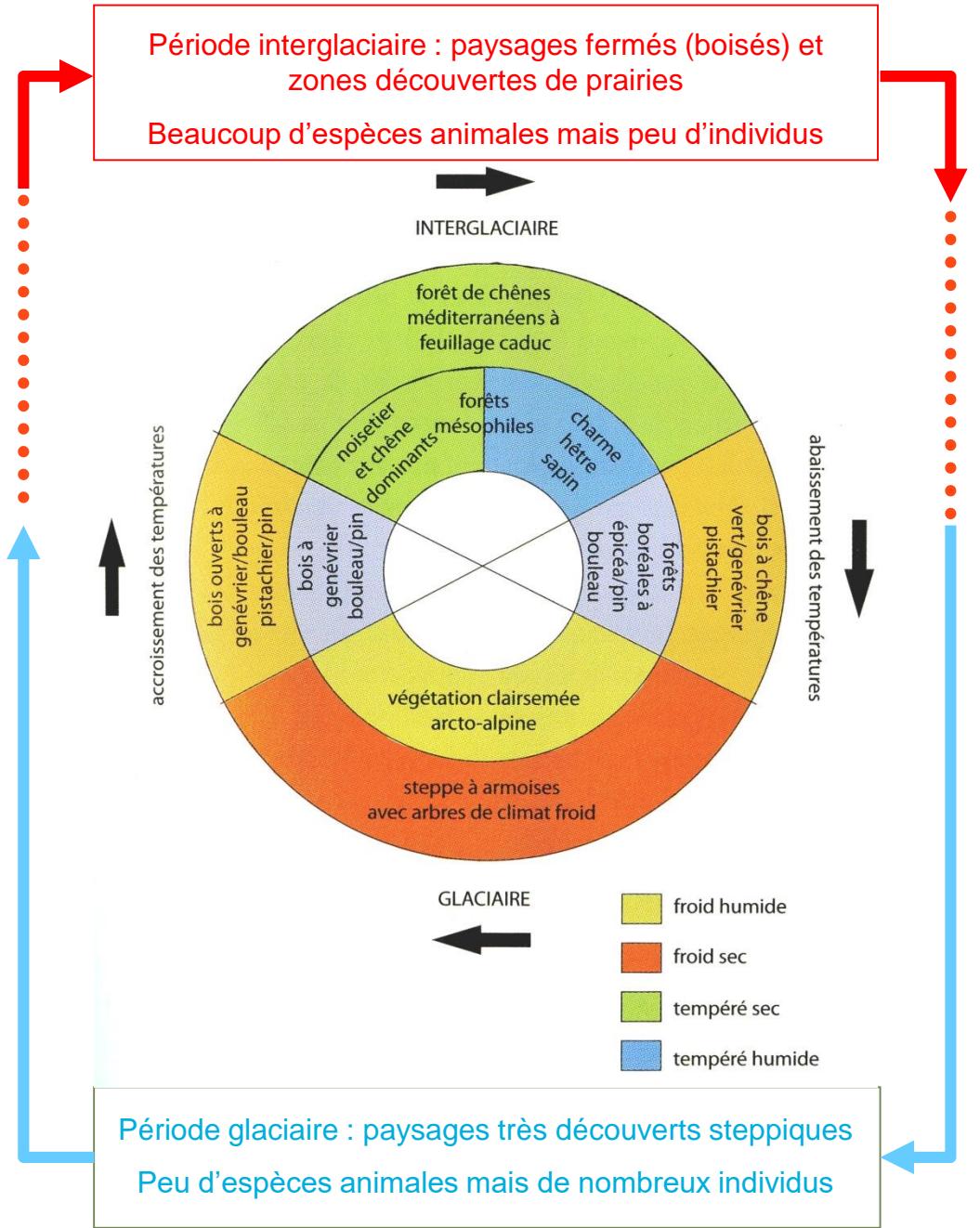
<https://www.geo-ocean.fr/Science-pour-tous/Nos-salles-d-etudes/Environnements-sedimentaires-et-paleoclimat/Variation-du-niveau-de-la-mer-4-posters>

Les changements climatiques du Quaternaire



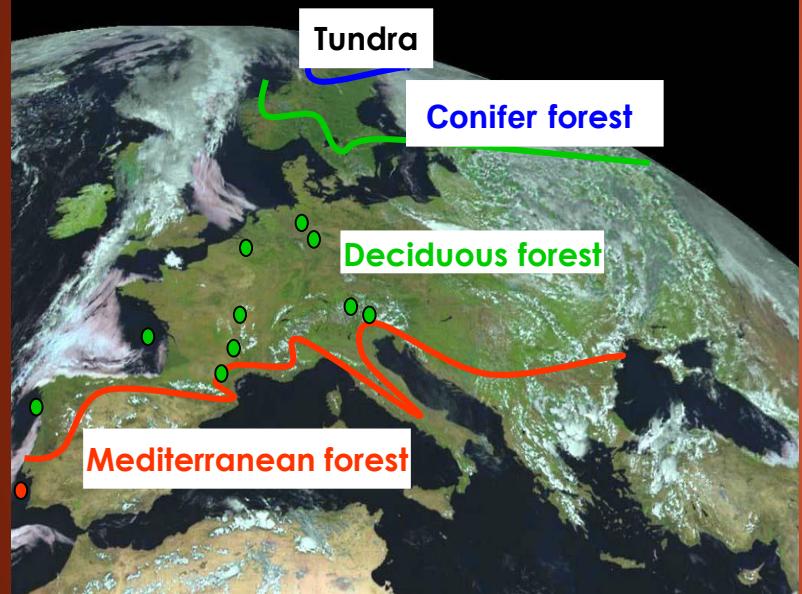
Des changements climatiques et environnementaux cycliques



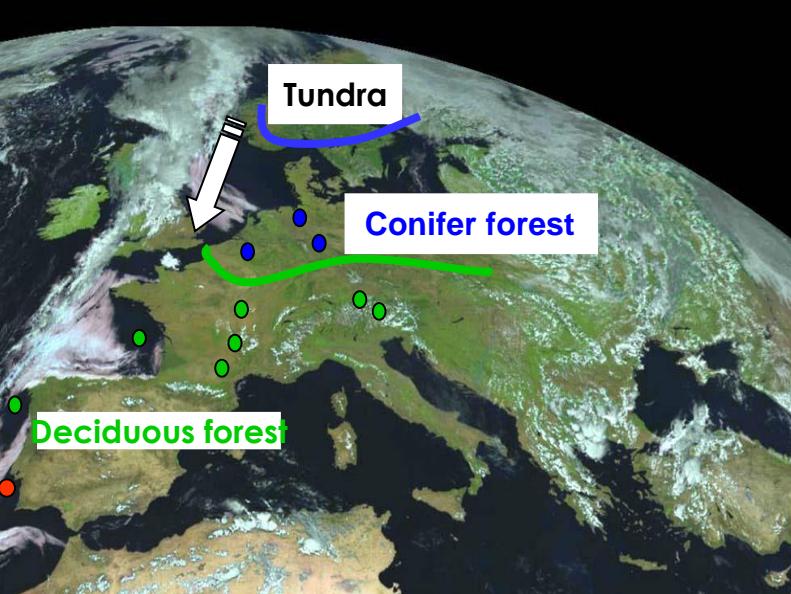


Des changements climatiques et environnementaux cycliques

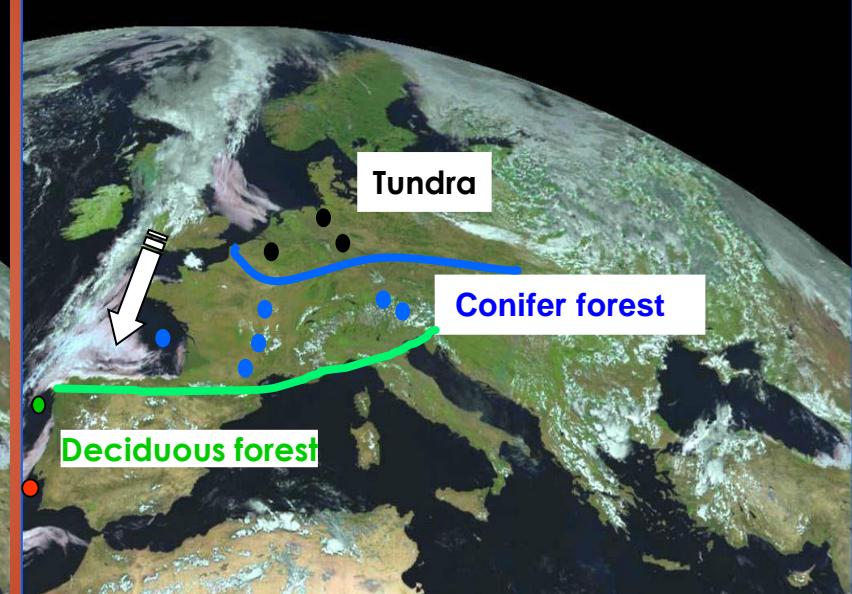
Vegetation distribution during the first part of the Eemian (126-122 ka)



Tundra southward migration at the Last Glacial Inception (121-115 ka)



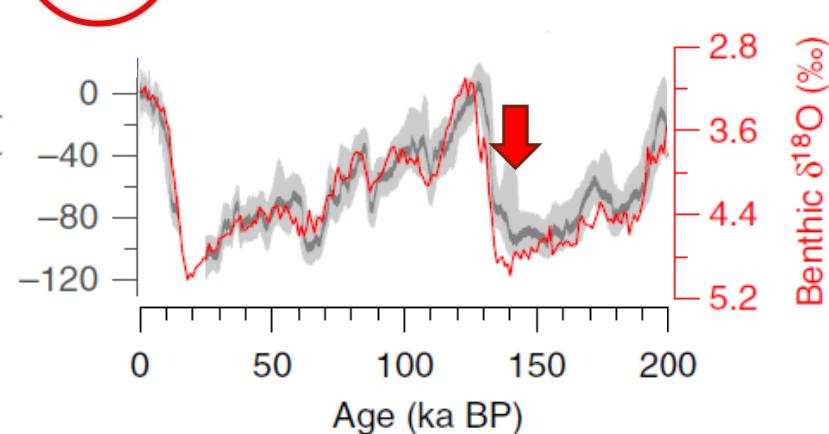
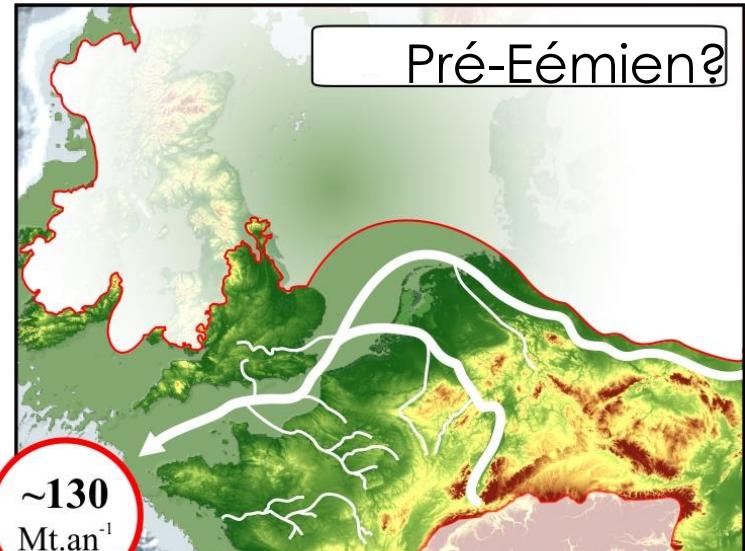
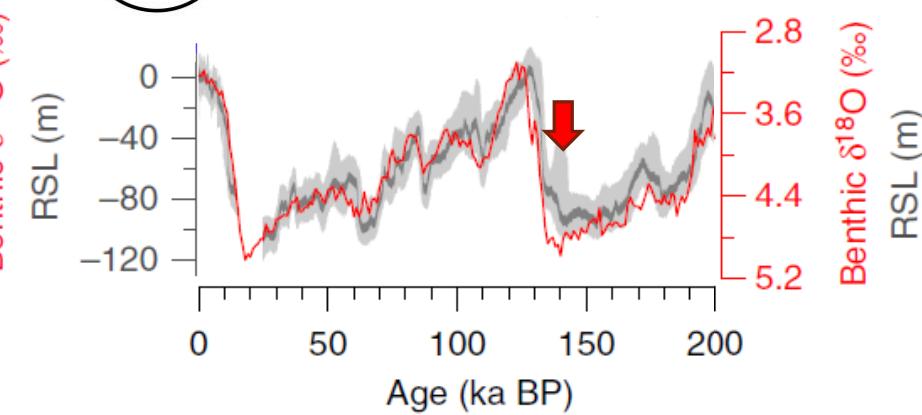
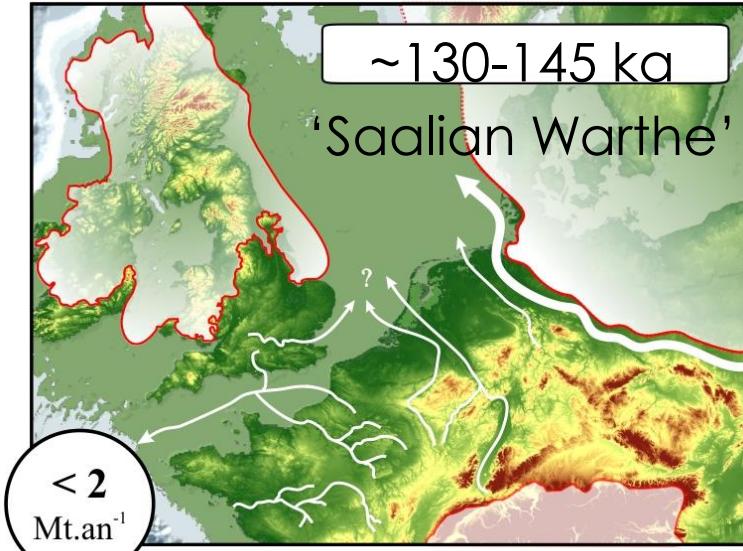
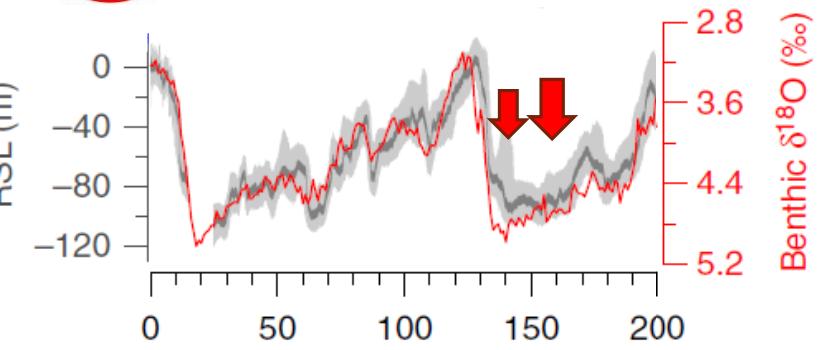
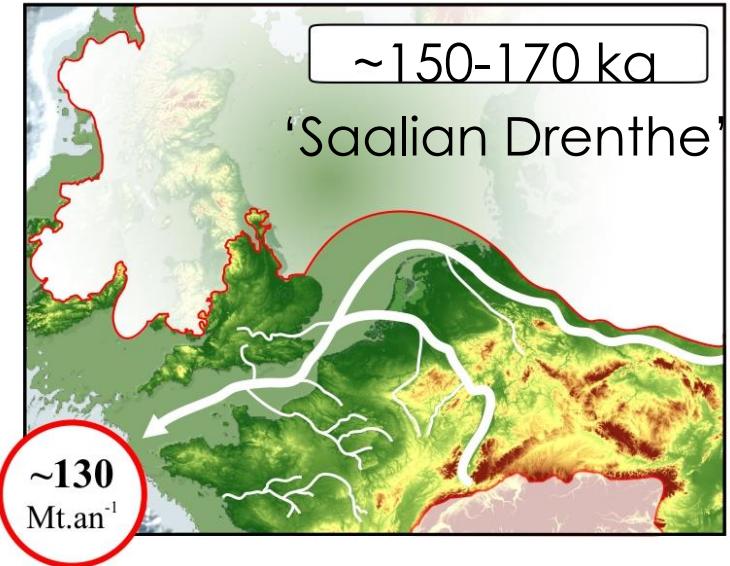
Tundra southward migration at the end of the Eemian (115-110 ka)



Increasing vegetation and climate gradient in western Europe
Eemian >50°N: ~11 kyr
Eemian <50°N: ~16 kyr

Sanchez Goñi et al, 2005

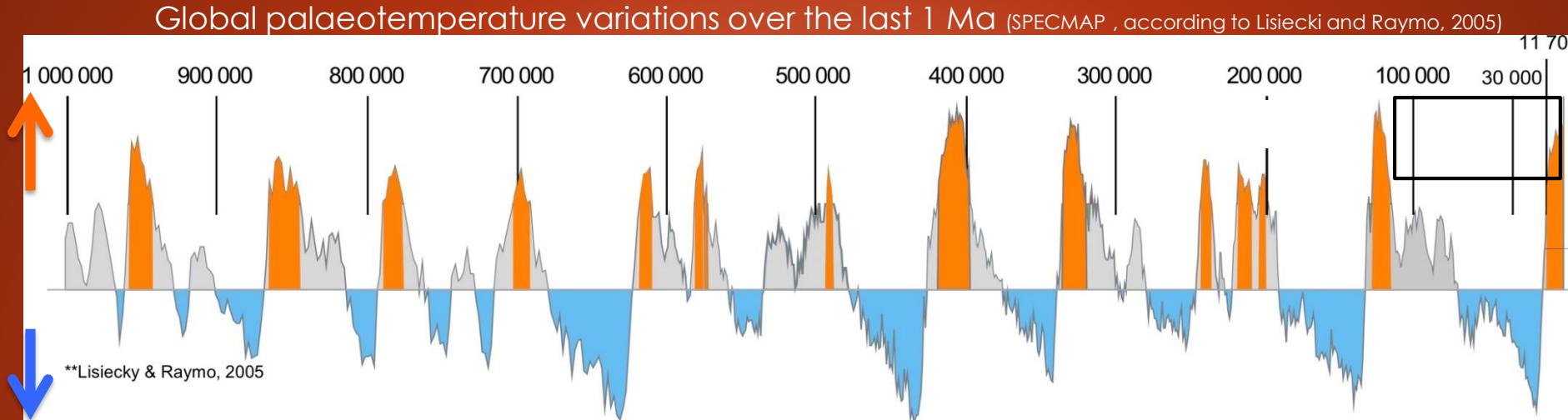
Des changements climatiques et paléogéographiques



Toucanne et al., 2009

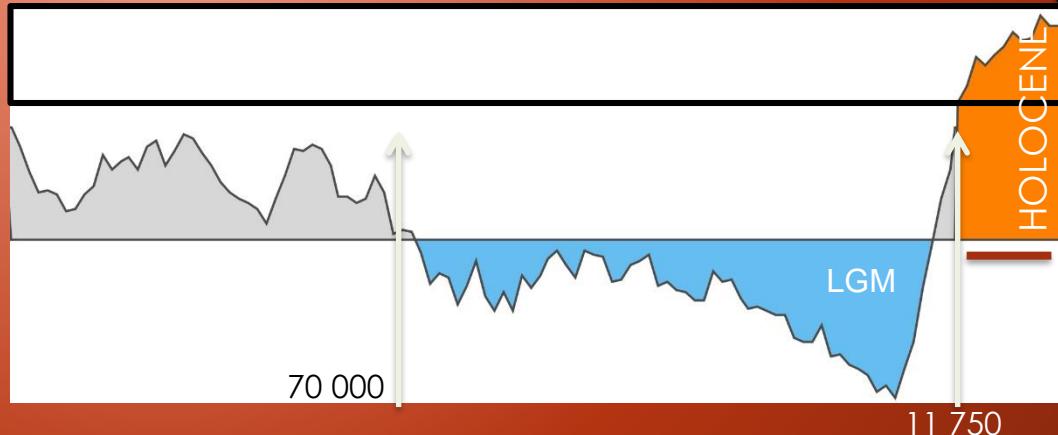
Boswell et al., 2019

Des changements climatiques et paléogéographiques



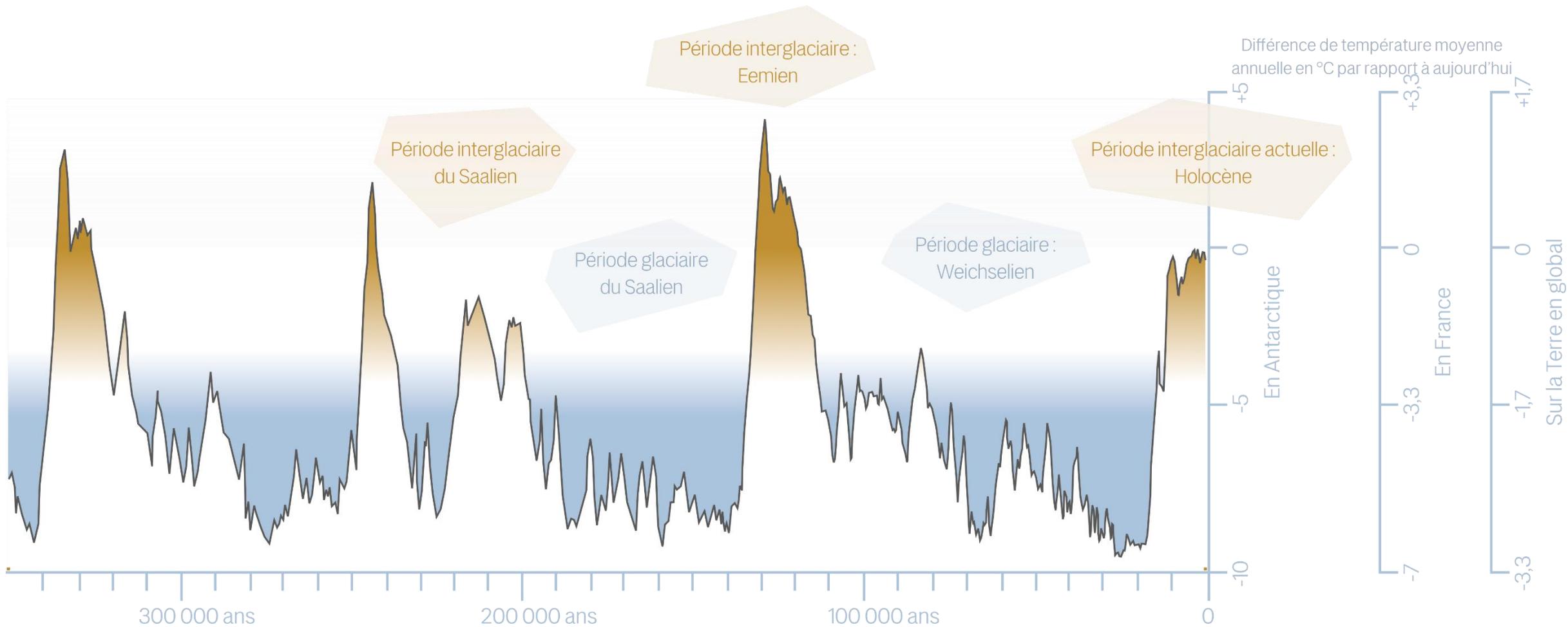
Incision of the Somme River and formation of the stepped terraces system (according to Antoine et al., 2019, modified)

1 MA
10 Glacial-Interglacial cycles
First major glacial period :
MIS 16 (about 650 ka)



Geological history of the Somme River Valley : long time / strong climatic and environmental changes / affecting both fluvial sedimentation and morpho-dynamics + slope processes, soil development / aeolian sedimentation ...

Des changements climatiques et paléogéographiques

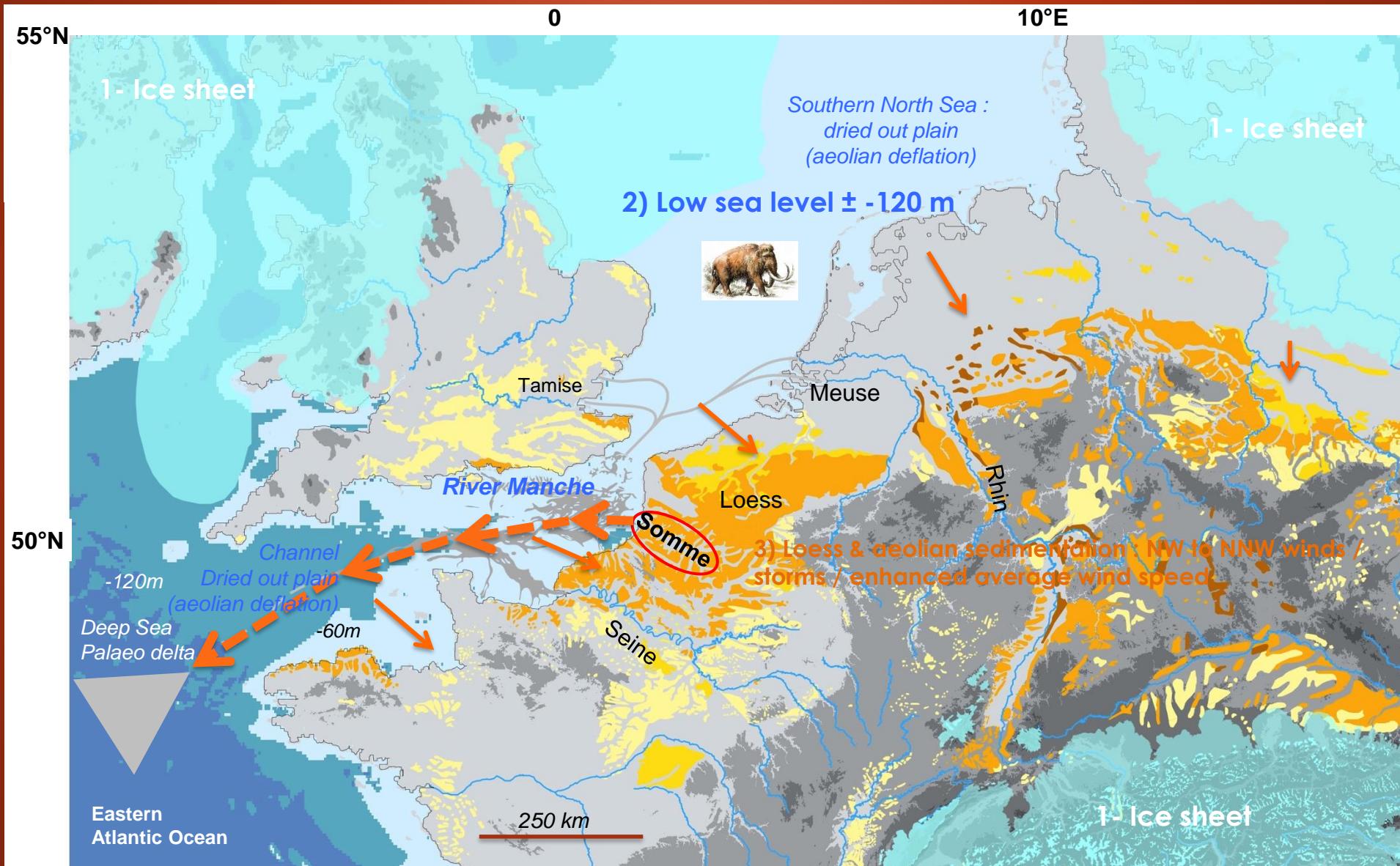


Petit, J. R. et al. Climate and atmospheric history of the past 420,000 years from the Vostok ice core, Antarctica. *Nature* 399, 429–436 (1999).

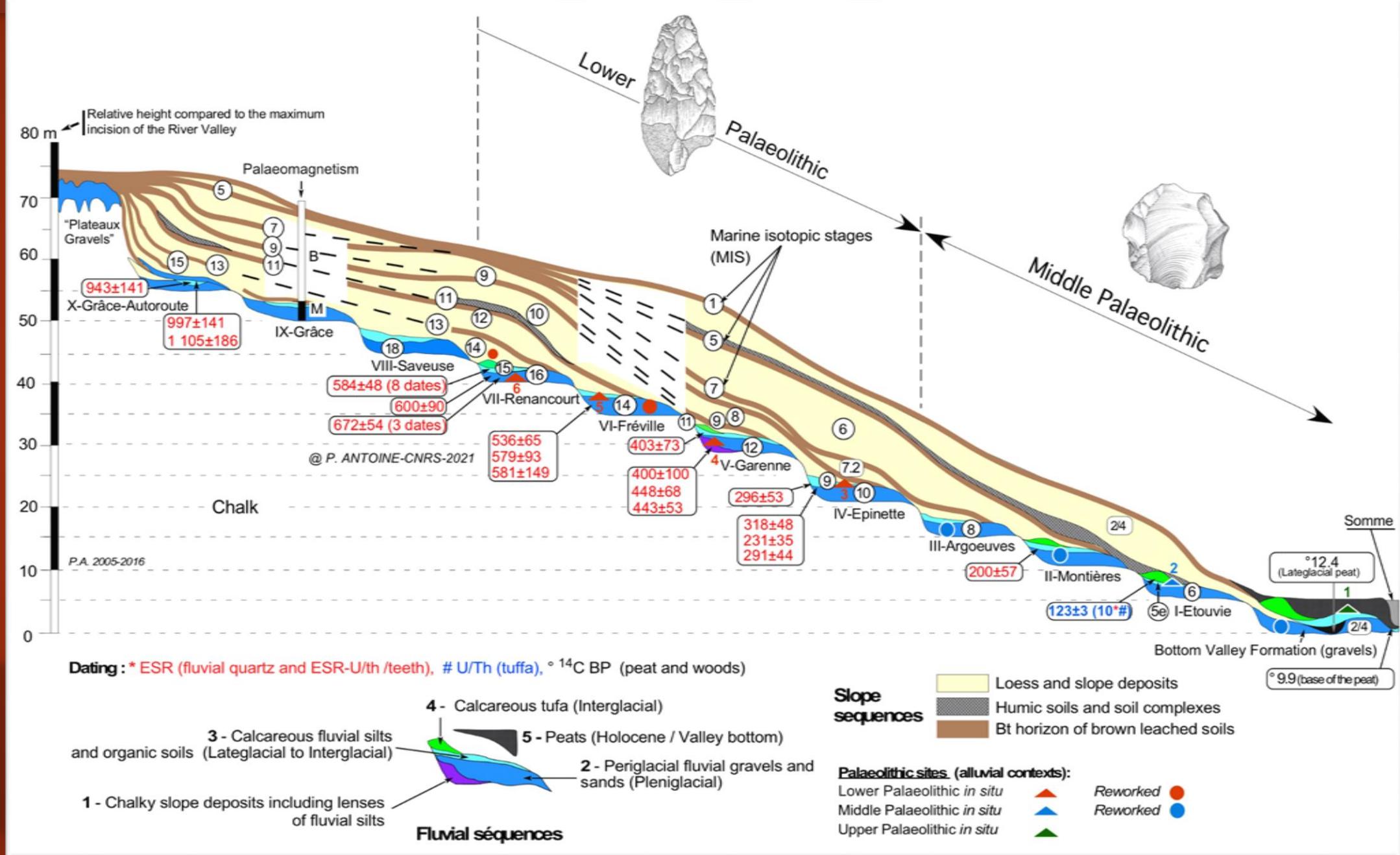
Des changements climatiques et paléogéographiques

Glacial times :

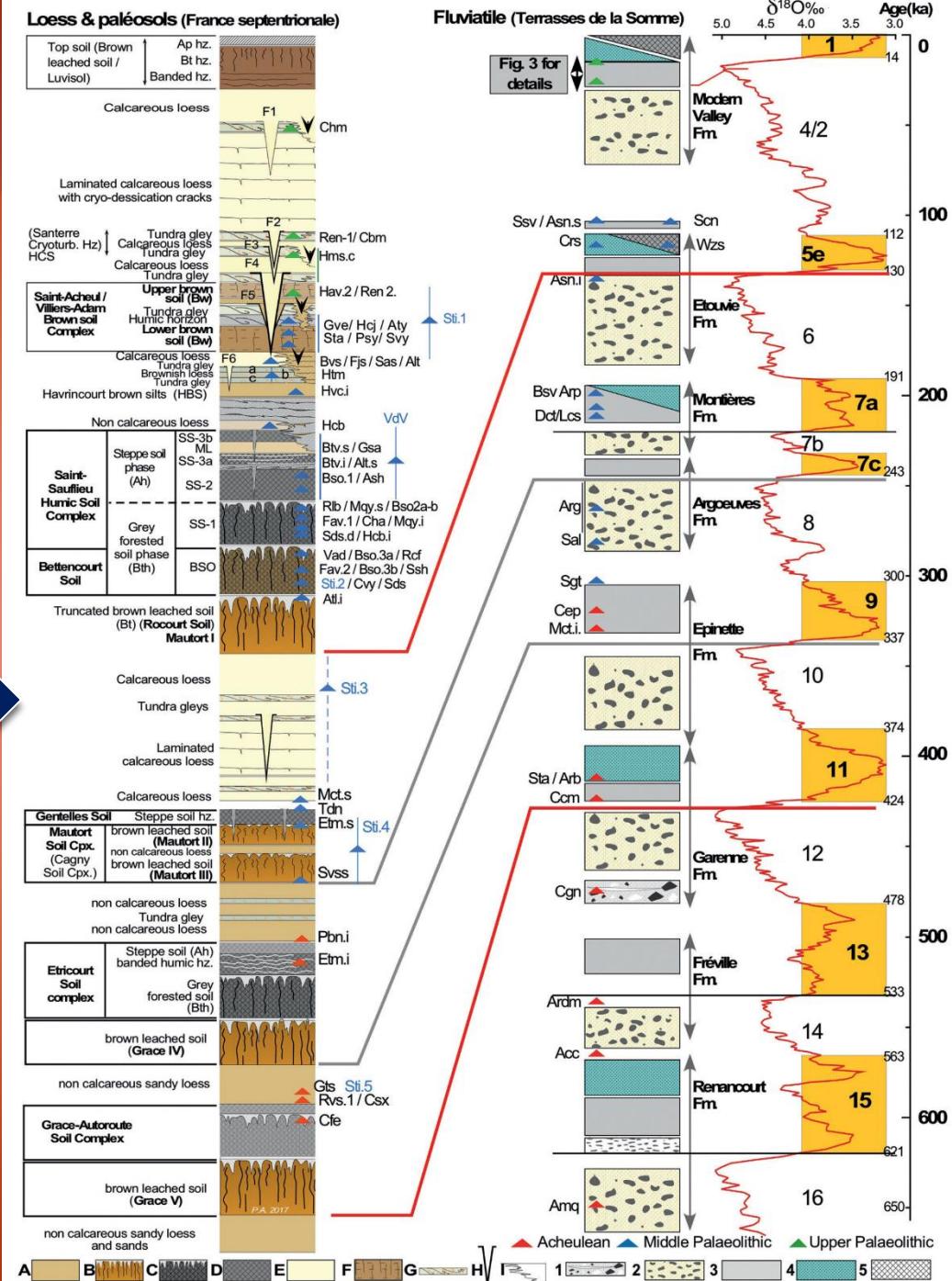
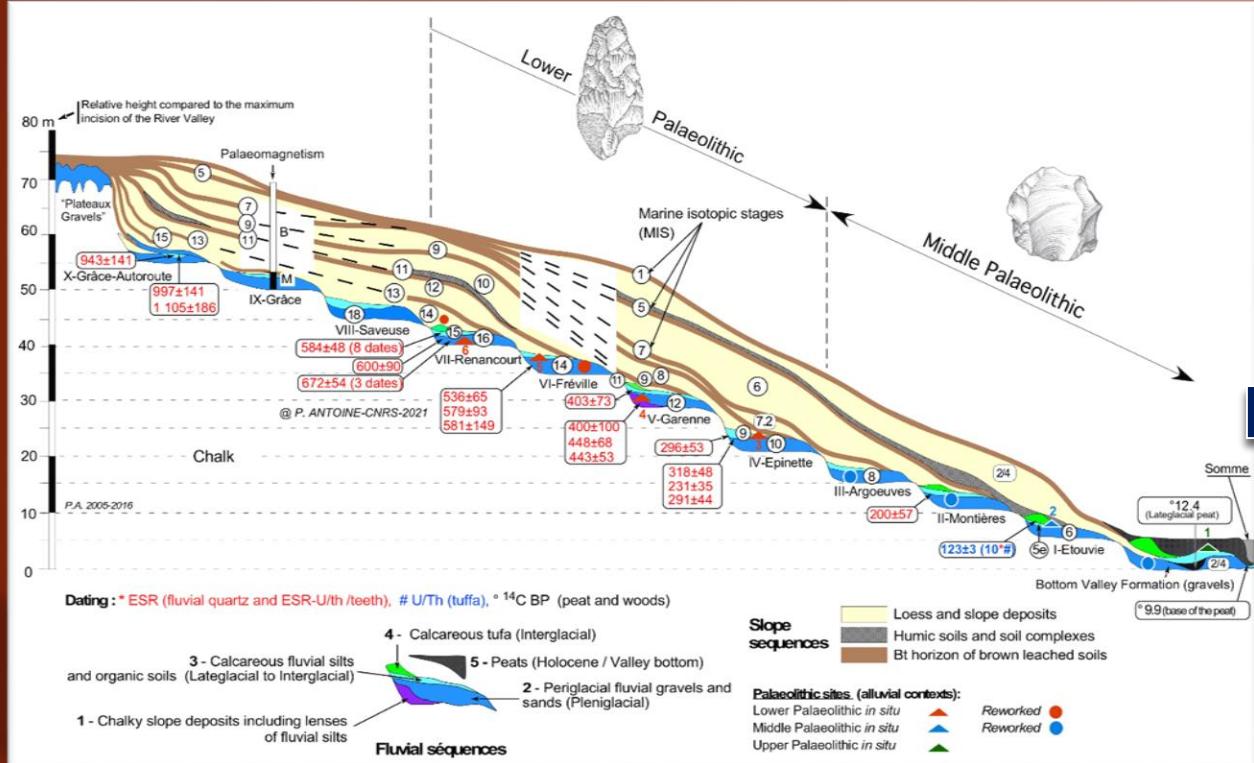
Ice sheets / low sea level / braider systems / aridity / stronger winds / aeolian deflation-deposition (loess)



Un escalier à remonter le temps en Somme

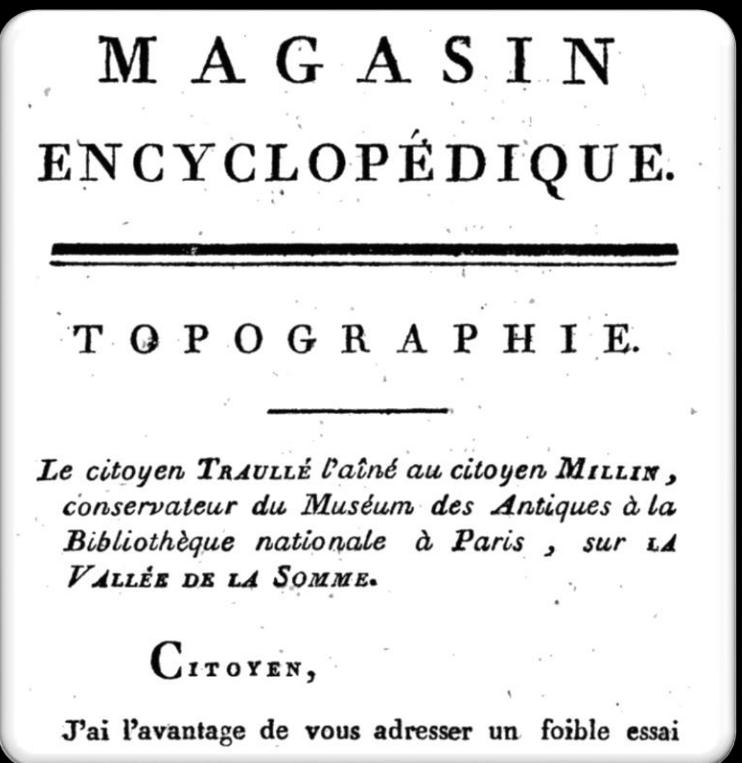


Un escalier à remonter le temps en Somme



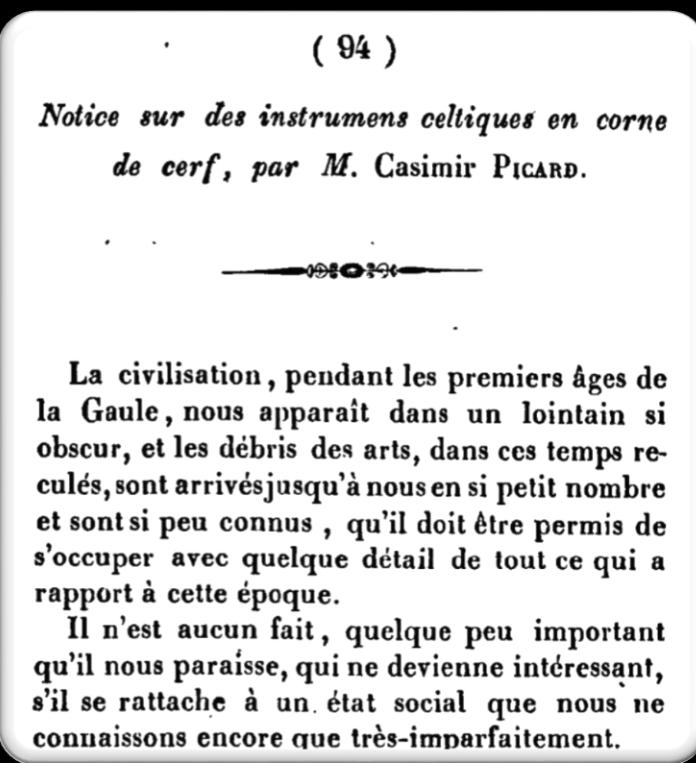
Une Somme de recherches : les pionniers

Laurent Traullé (1758-1829)



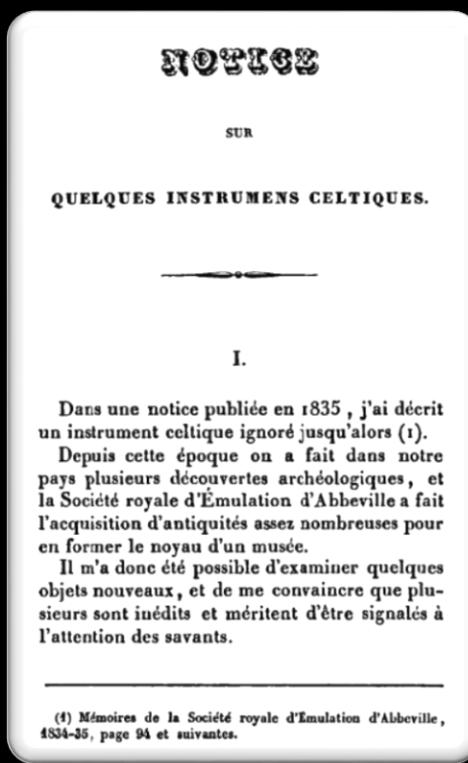
Traullé (Laurent), « Le citoyen Traullé l'aîné au citoyen Millin, Conservateur du Muséum des Antiques à la Bibliothèque nationale à Paris, sur la vallée de la Somme », Magasin encyclopédique ou Journal des Sciences, 2e année, T. 5, n°17, 1797, pp 4-46

Casimir Picard (1806-1841)



institutions have been established, and the first social uplift movement has been started by the people themselves.

Picard (Casimir), « Notice sur des instrumens celtiques en corne de cerf », Mémoires de la Société d'Émulation d'Abbeville, 1834-1835, T. 2 pp. 94-113



Picard (Casimir), « Notice sur quelques instruments celtiques », Mémoires de la Société d'Émulation d'Abbeville, T. 3, 1836-1837, pp. 221-271.

Une Somme de recherches : Jacques Boucher de Perthes (1788-1868)

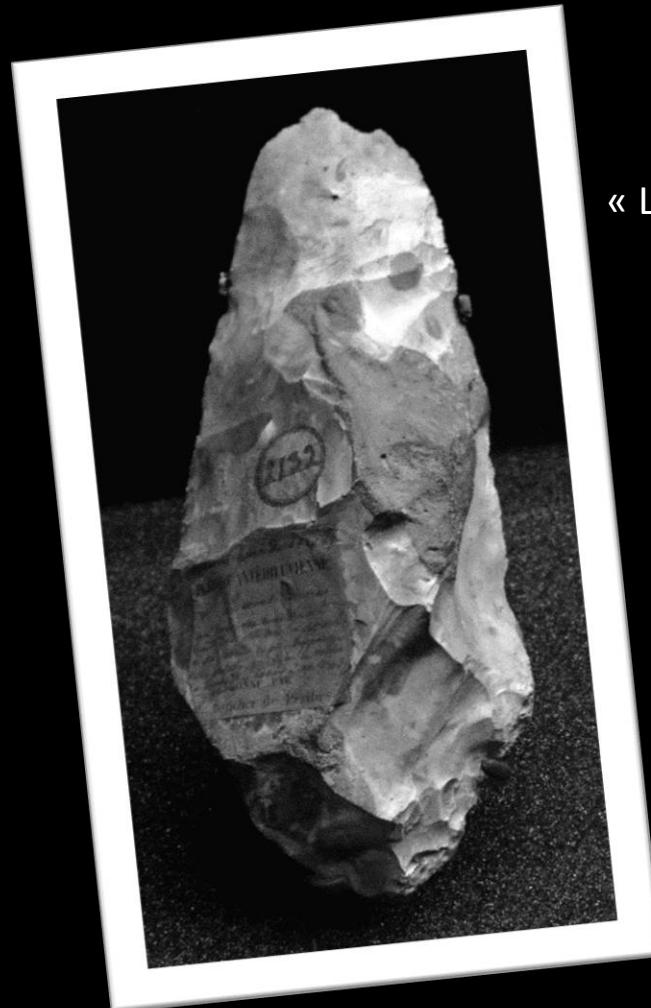
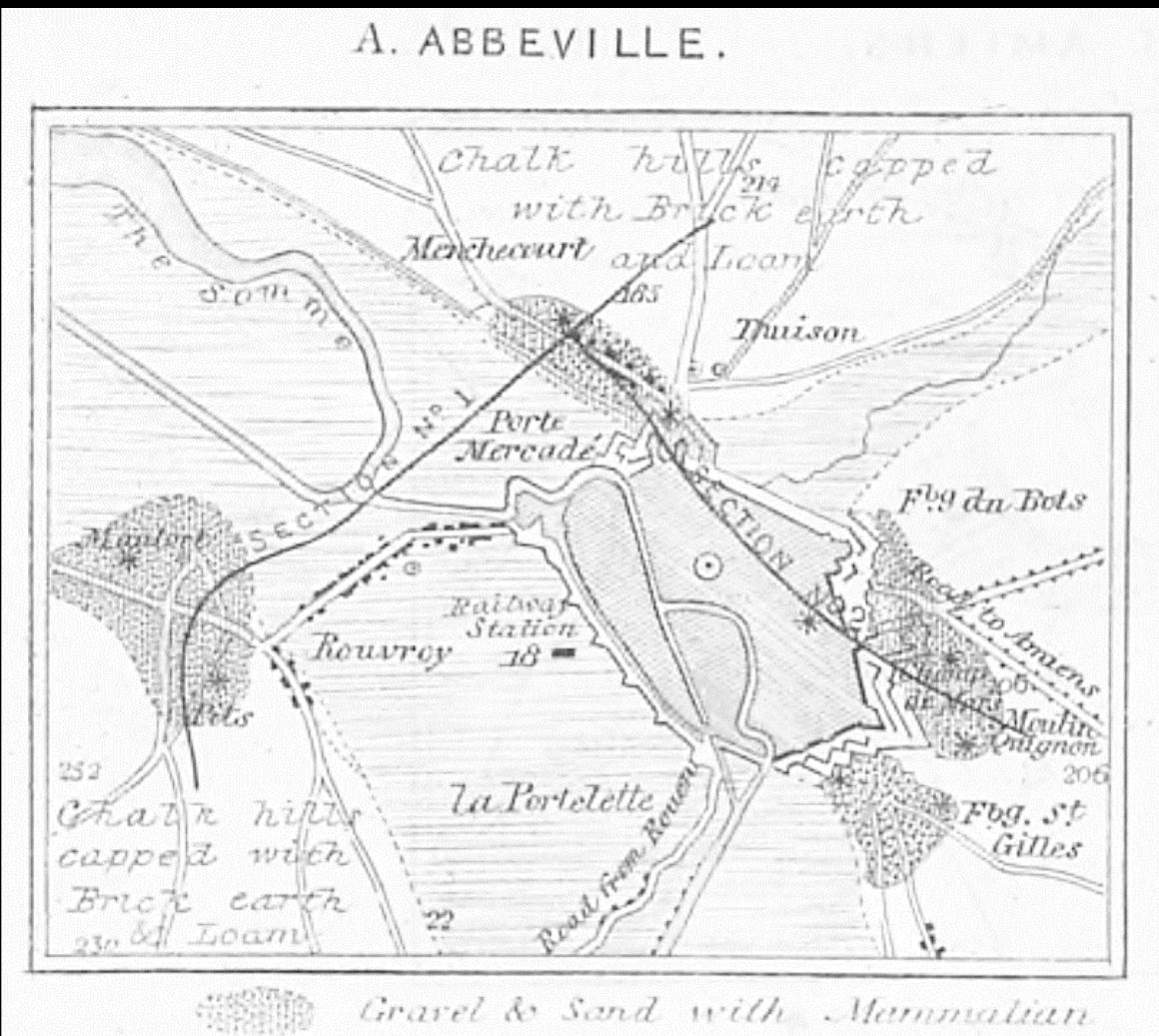


© MAN - V. Go

Jacques Boucher de Perthes, *Antiquités celtiques et antédiluviennes : mémoire sur l'industrie primitive et les arts à leur origine*. Paris : Treuttel et Wurtz, 1847, 1857, 1864 (3 volumes)

Une Somme de recherches : Jacques Boucher de Perthes (1788-1868)

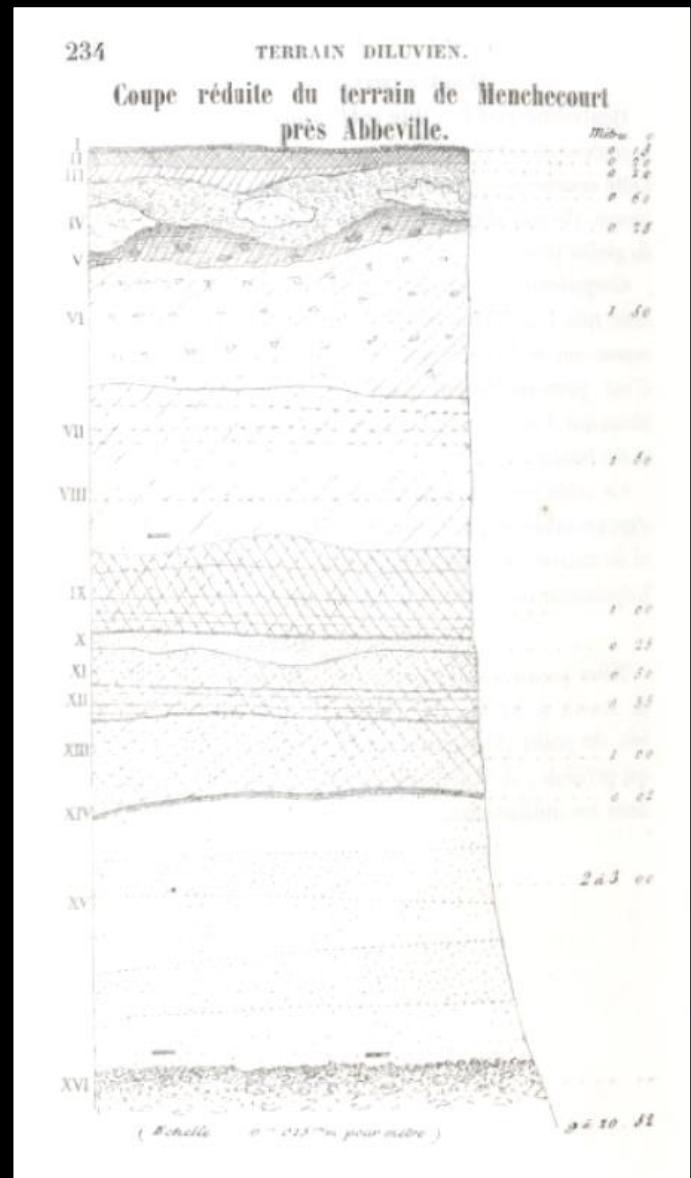
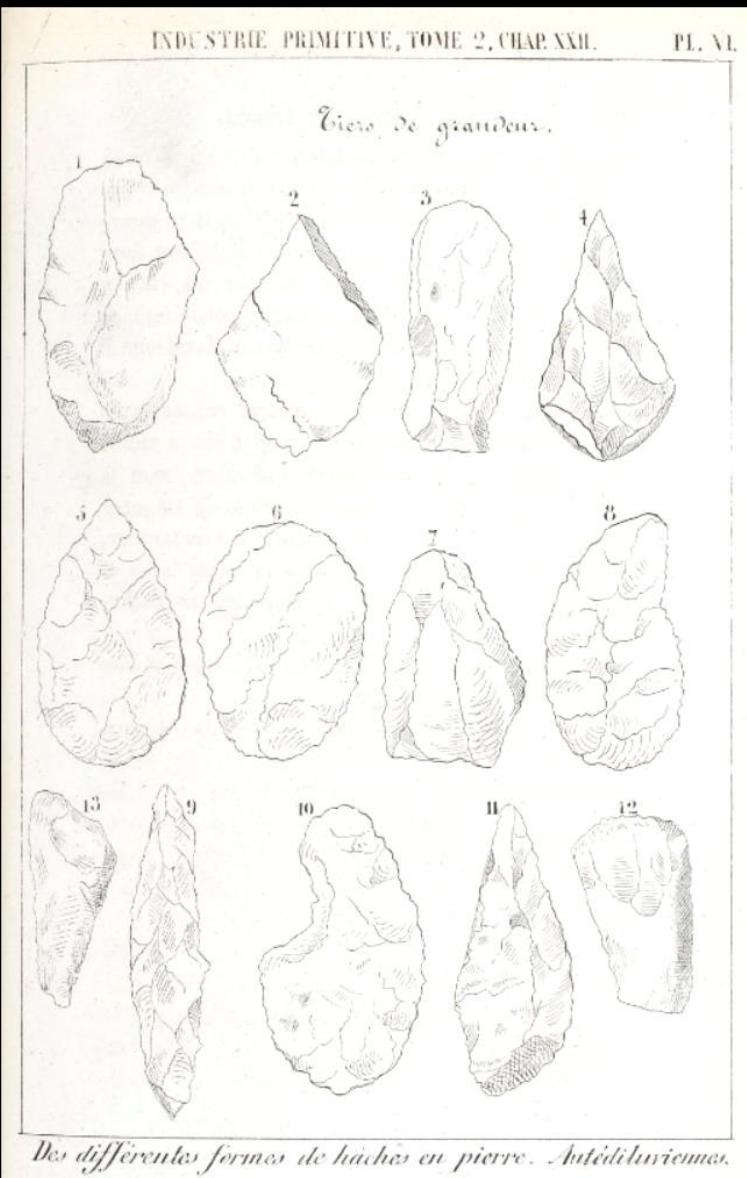
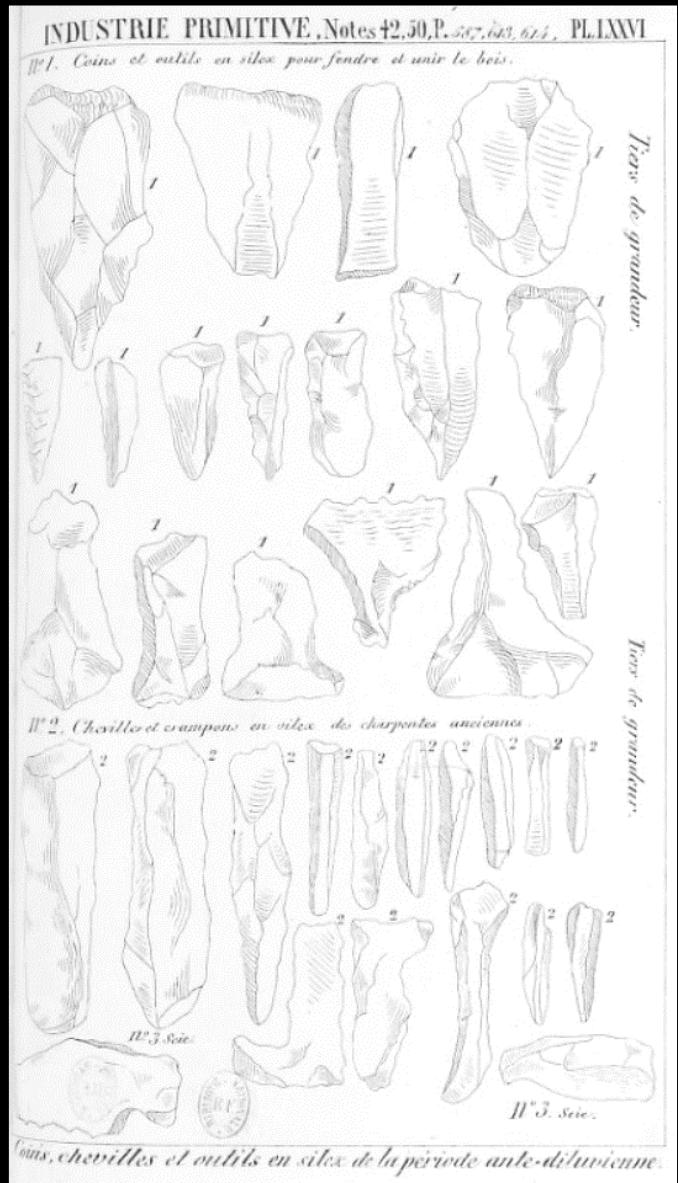
- **Gisement de la Portelette (1837-1838)**
- **Gisement de Menchecourt (1840-1842)**
- **Gisement de l'Hôpital (1844)**



Banc de l'Hopital,
Abbeville, 1839.
Exposition 2007
« La saga de l'Homme »
(collection MNHN)

Joseph Prestwich, On the occurrence of flint-implements, associated with the remains of animals of extinct species in beds of a late geological period, in France at Amiens and Abbeville, and in England at Hoxne *Phil. Trans. R. Soc. Lond.* 1860 150 277-317

Une Somme de recherches : Jacques Boucher de Perthes (1788-1868)



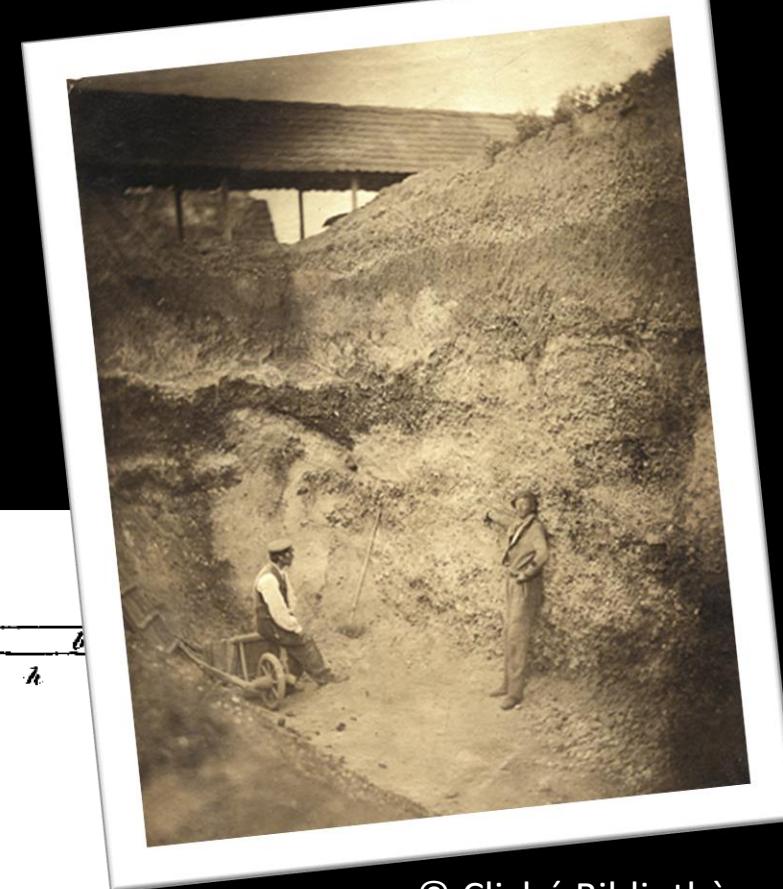
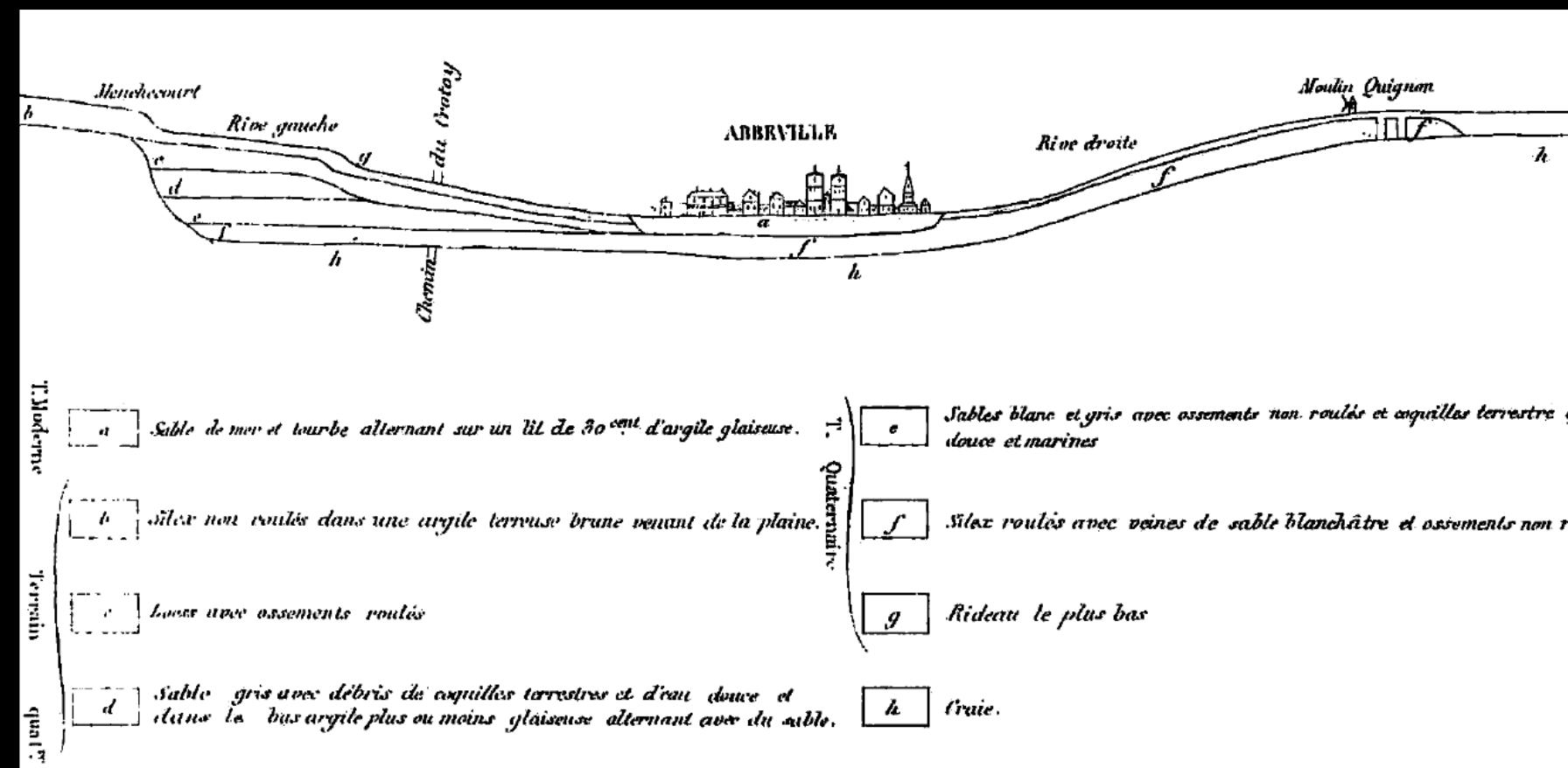
Jacques Boucher de Perthes, *Antiquités celtiques et antédiluviennes : mémoire sur l'industrie primitive et les arts à leur origine.*
Paris : Treuttel et Wurtz, 1847, 1864 (vol. 1 & 3)

Une Somme de recherches : la première vague

Marcel-Jérôme Rigollet (1786-1854)
& Charles-Joseph Buteux (1794-1876)

Premières fouilles systématiques

Premières descriptions stratigraphiques des alluvions
de la moyenne terrasse d'Amiens et de Saint-Acheul



© Cliché Bibliothèques
d'Amiens Métropole

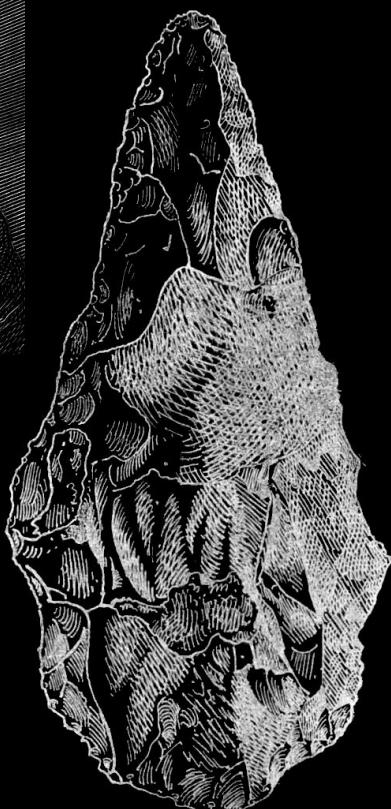
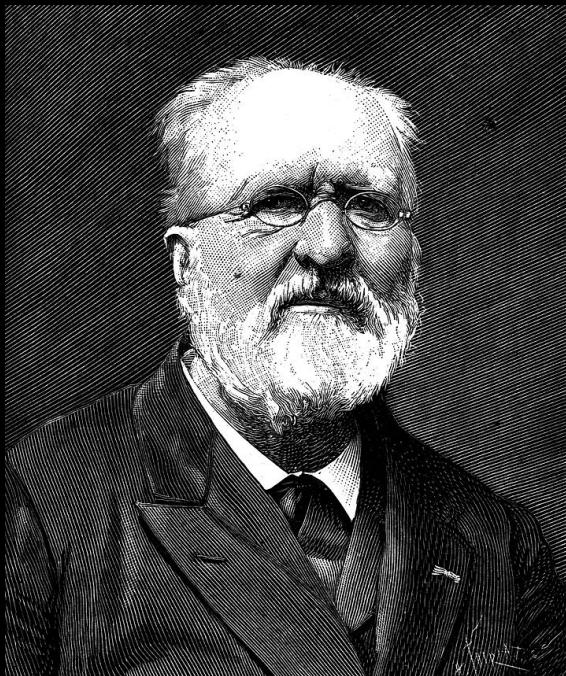
Buteux (Charles-Joseph)
« Esquisse géologique du
département de la Somme »,
Mémoires de l'Académie d'Amiens,
vol. 5, 1843.

Une Somme de recherches : la deuxième vague

1872

Gabriel de Mortillet (1821-1898)

CLASSIFICATION



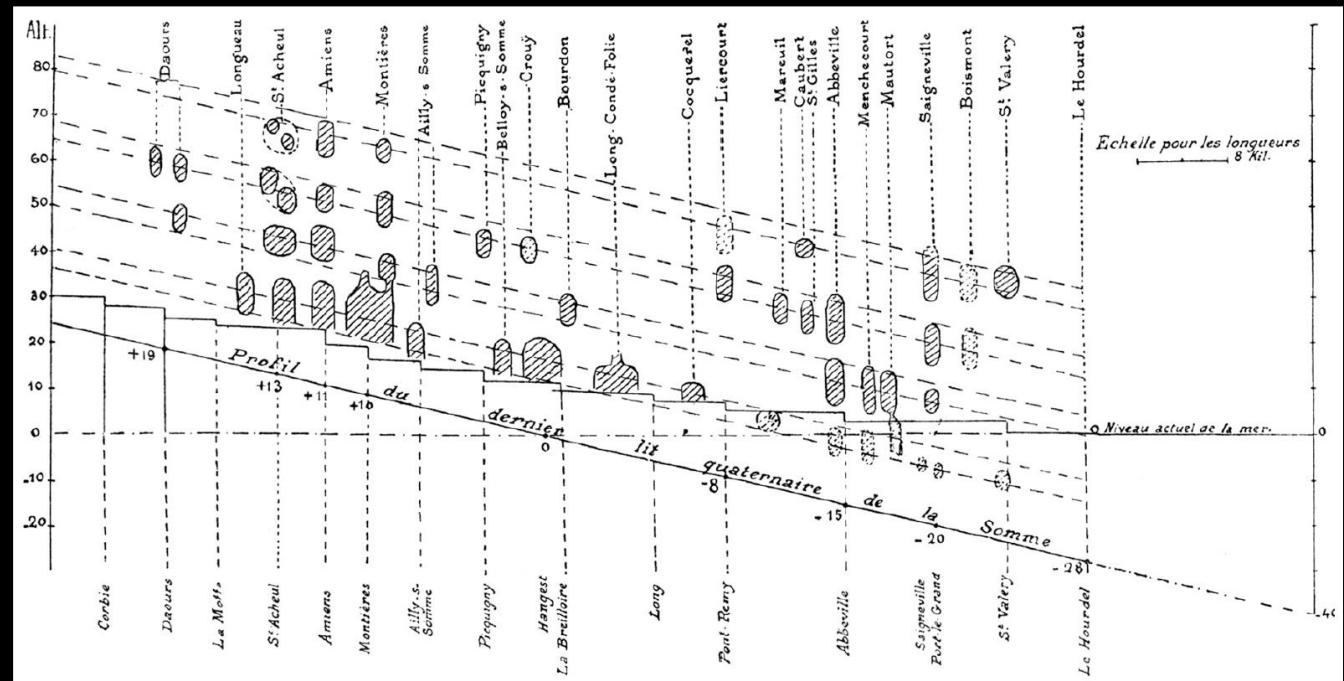
PIERRE TAILLÉE ARCHÉOLITHIQUE OU PALÉOLITHIQUE		SOLUTRÉEN Epoque de Solutré. TYPES : Pointes de silex en feuille de laurier taillées de deux côtés. Fig. 6 et 7.	CLIMAT FROID ET SEC	Homme brachycéphale et mésatécéphale, se rapprochant de nos races actuelles. La Lesse, Cro-Magnon, Laugerie-Basse, Baoussé-Roussé, Solutré (partie).
INSTRUMENTS UNIQUEMENT EN PIERRE TAILLÉE		MOUSTIÉRIEN Epoque du Moustier TYPES : Pointes de silex retaillées d'un seul côté et racloirs. Fig. 3 et 4.	GLACIAIRE : CLIMAT FROID ET HUMIDE	Grand développement de l'ours des cavernes. Rhinocéros. Homme dolichocéphale, type assez inférieur. Engis, l'Olmo.
ACHEULÉEN Epoque de Saint-Acheul. TYPES : Grands instruments de pierre en forme d'amande. Fig. 1.		PRÉGLACIAIRE : CLIMAT TEMPÉRÉ	Hippopotame. Eléphant antique. Homme, type le plus inférieur. Néandertal, Eguisheim, la Naulette, Denise.	

Une Somme de recherches : la deuxième vague

Victor Commont (1866-1918)



V. Commont. Les terrasses fluviales de la vallée de la Somme. *Bulletin archéologique*, 1911.



V. Commont.
L'industrie des graviers
supérieurs à Saint-
Acheul. *Revue d'école
d'Anthropologie*, 1907.

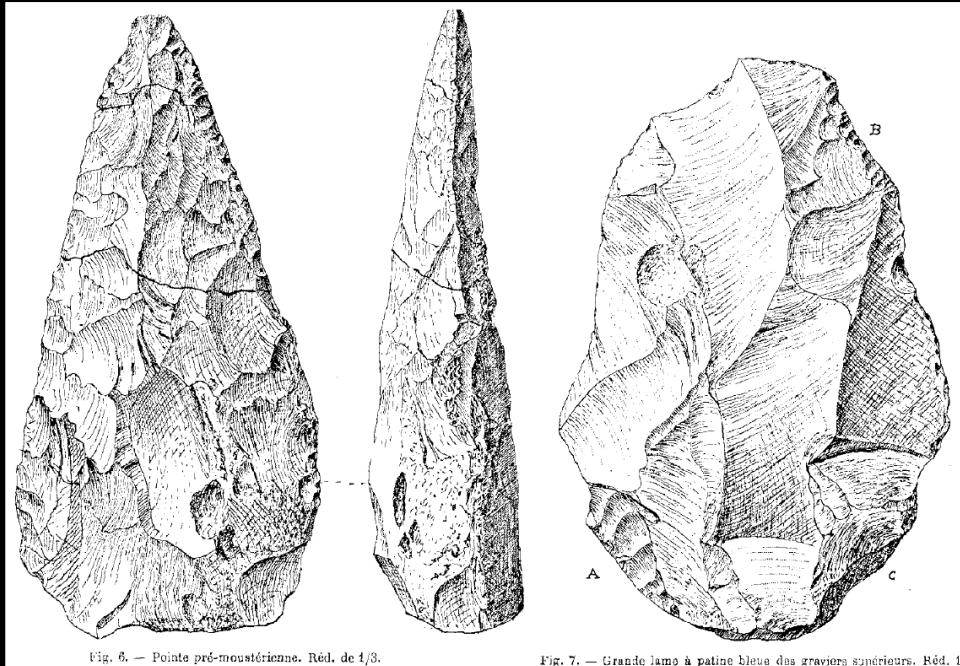
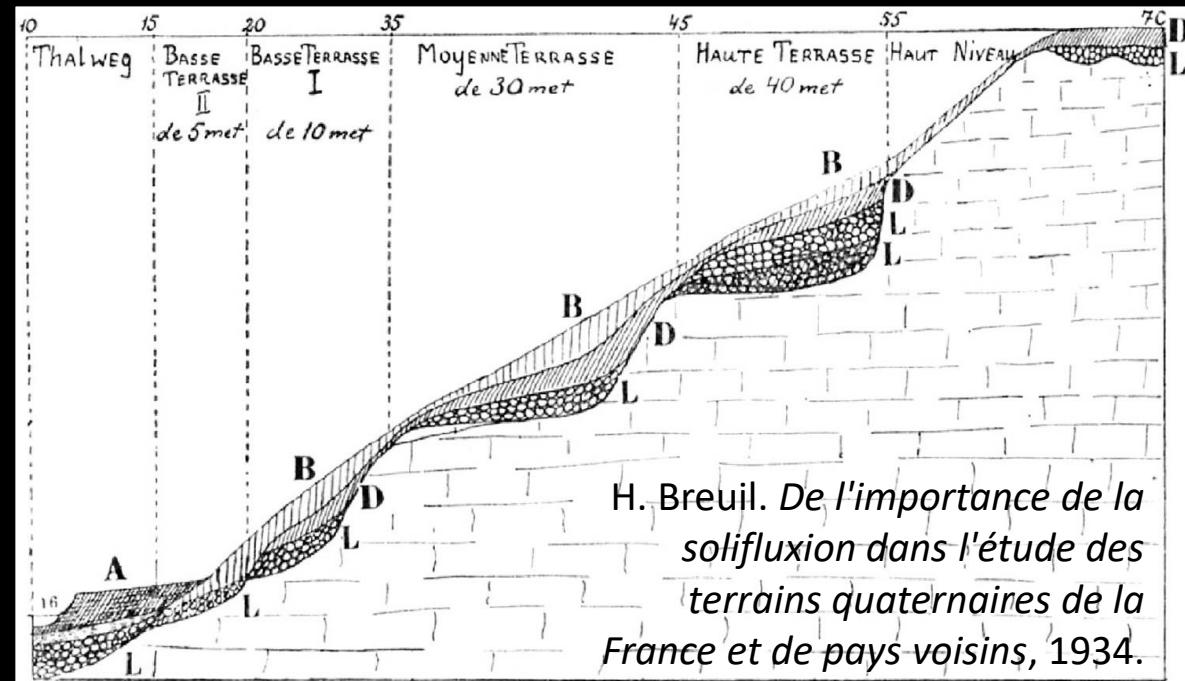


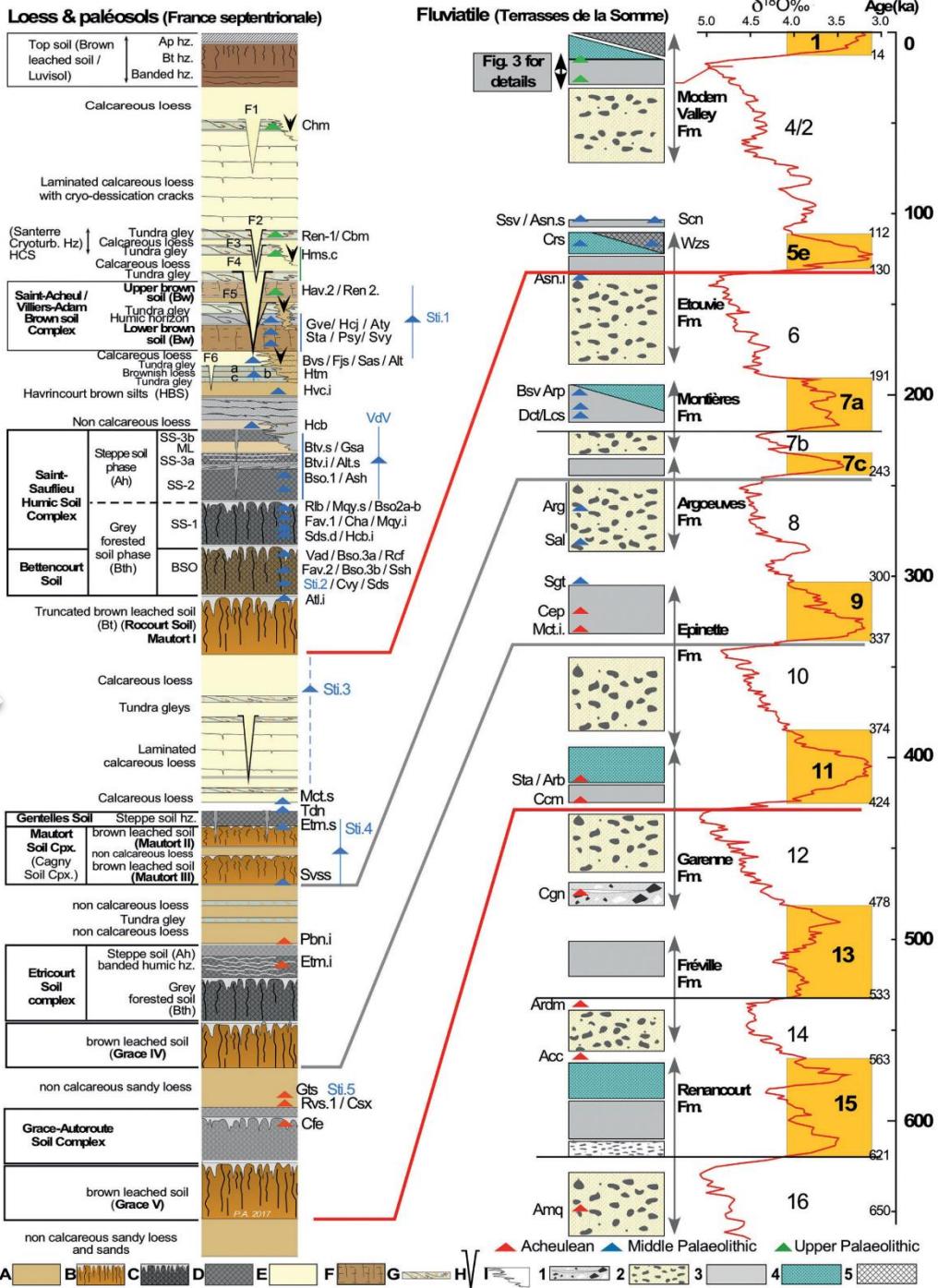
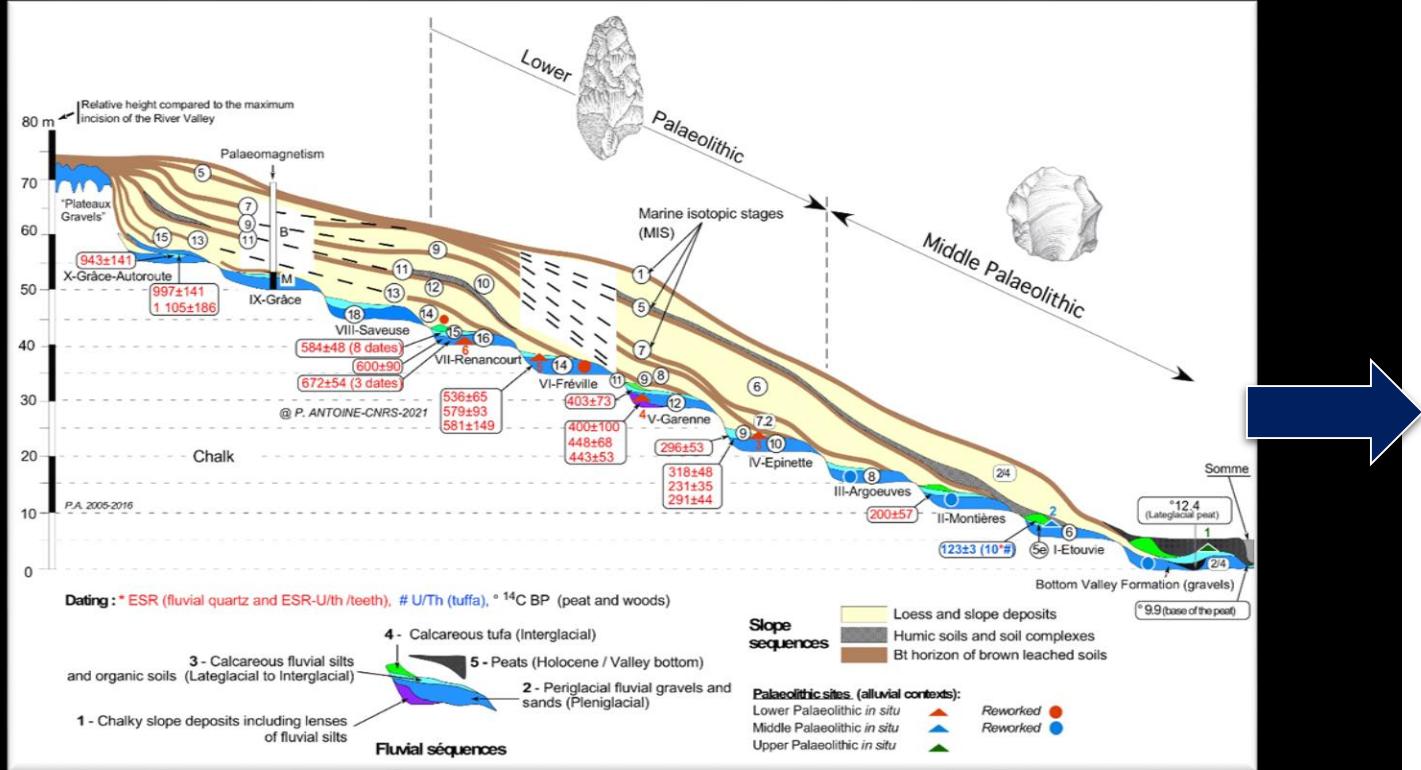
Fig. 6. — Pointe pré-moustérienne. Rédu. de 1/3.

Fig. 7. — Grande lame à patine bleue des graviers supérieurs. Rédu. 1/3

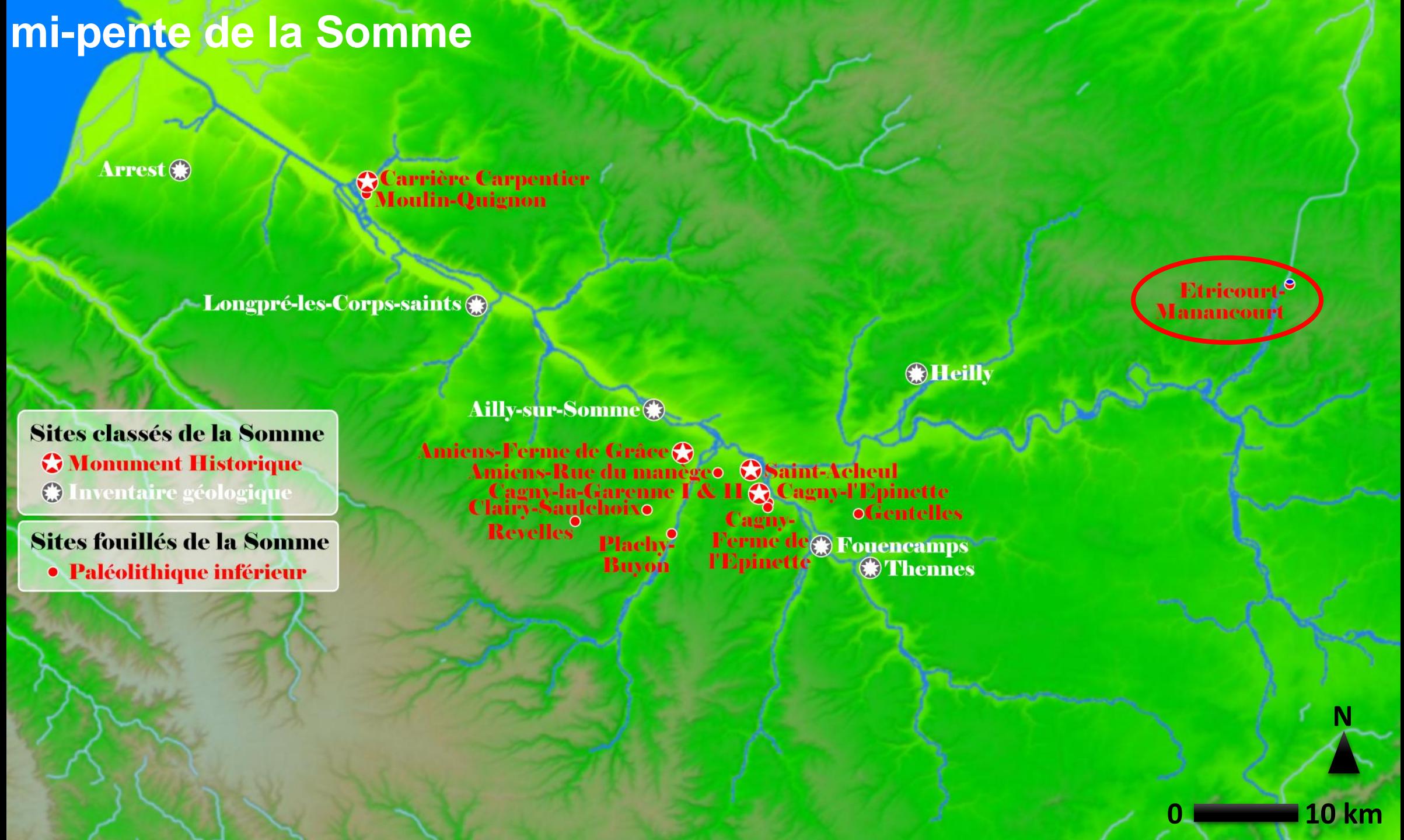


H. Breuil. *De l'importance de la solifluxion dans l'étude des terrains quaternaires de la France et de pays voisins*, 1934.

Les séquences loessiques



A mi-pente de la Somme



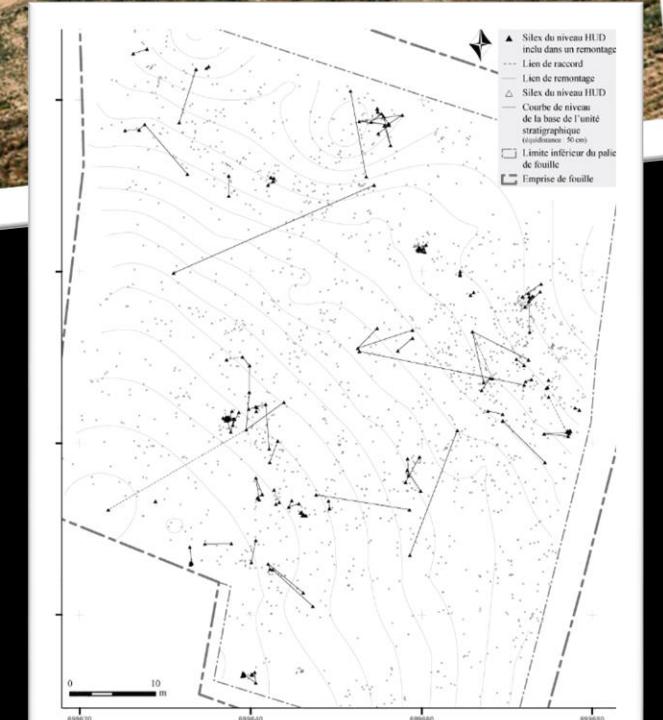
A mi-pente de la Somme

Etricourt-Manancourt (HUD)

D. Hérisson dir.

MIS 9a – ca 288 ka 4 300 m² 2 402 artefacts
56 remontages (229 artefacts)

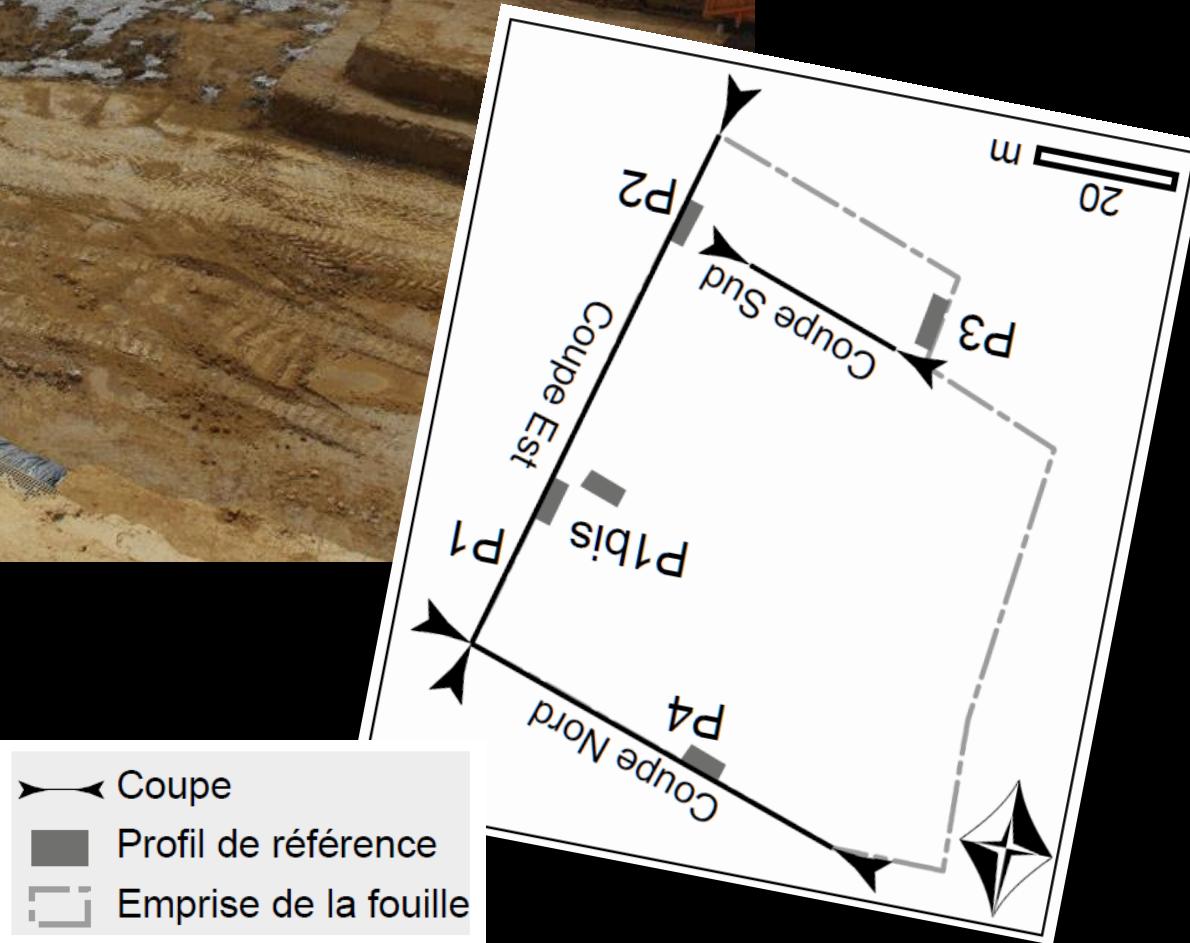
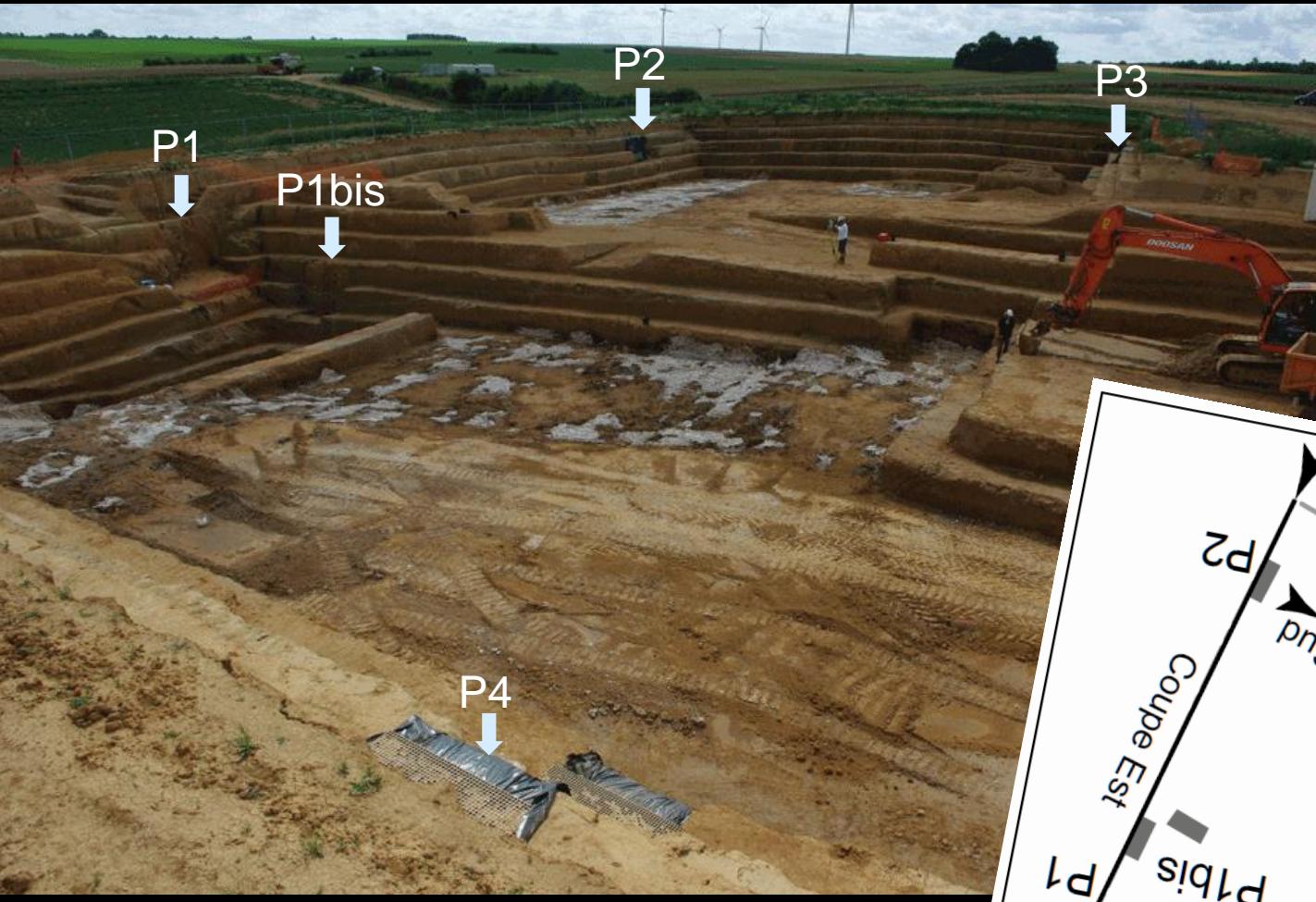
Hérisson *et al.*, 2016 QI



An exceptional stratigraphy



A reliable chronostratigraphical approach based on the sequential analysis



A reliable chronostratigraphical approach based on the sequential analysis

**Continuous column with
high resolution (1 sample / 5 cm)
=> 380 samples on 12 m**

- ✓ Sedimentology
- ✓ Magnetic susceptibility
- ✓ COT (CHN, NF ISO 10694)
- ✓ Micromorphology (110 blocks)
- ✓ Loess mineralogy



Dating on sediment

- ✓ IRSL
- ✓ OSL (vSL, TTOSL ?...to be done)

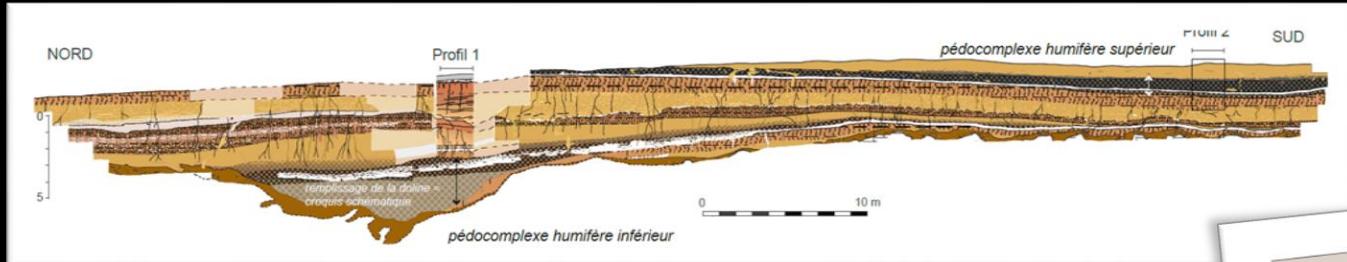


Dating on artifact

- ✓ TL on burnt flint

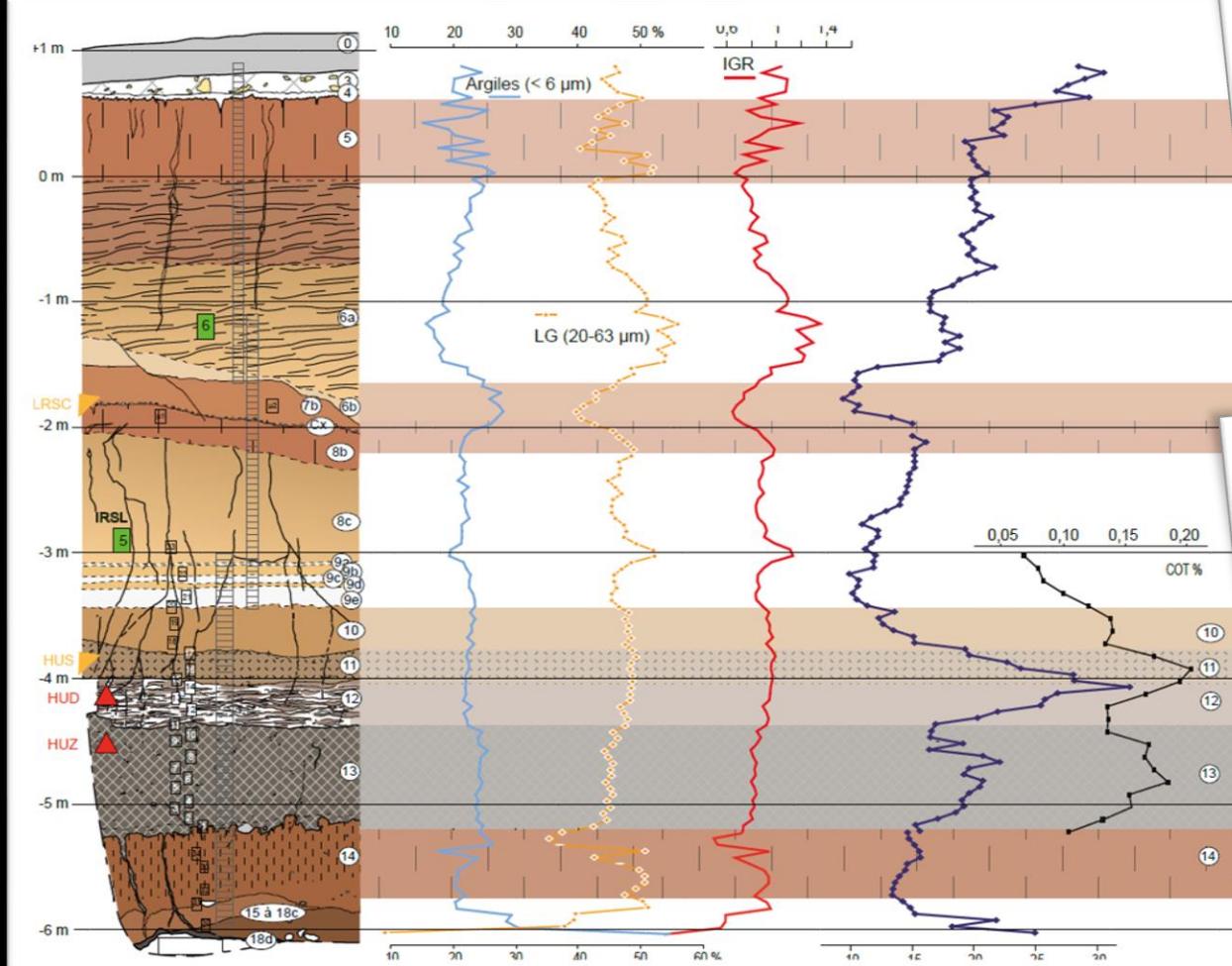


A reliable chronostratigraphical approach based on the sequential analysis

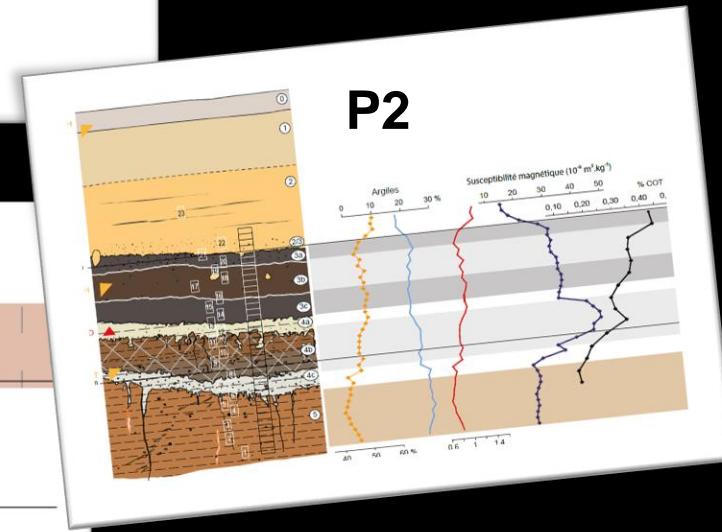


Coutard et al., 2018,
Quaternaire

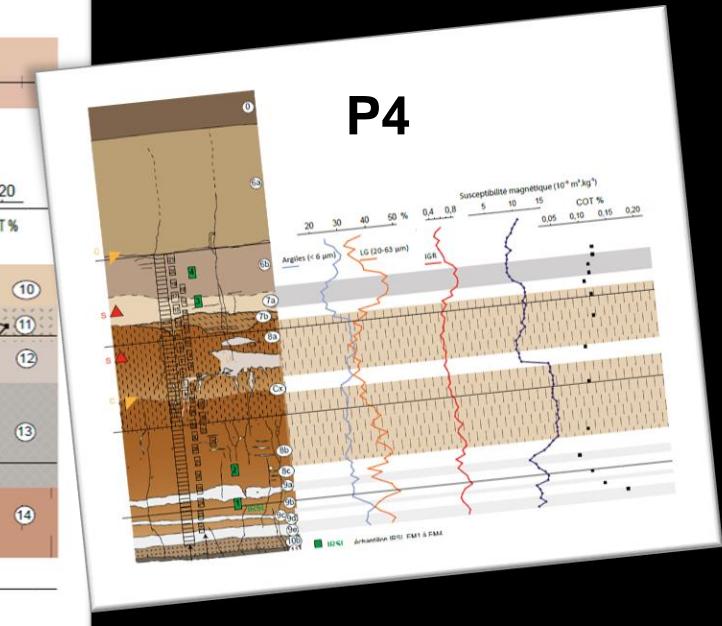
P1 + P1bis



P2



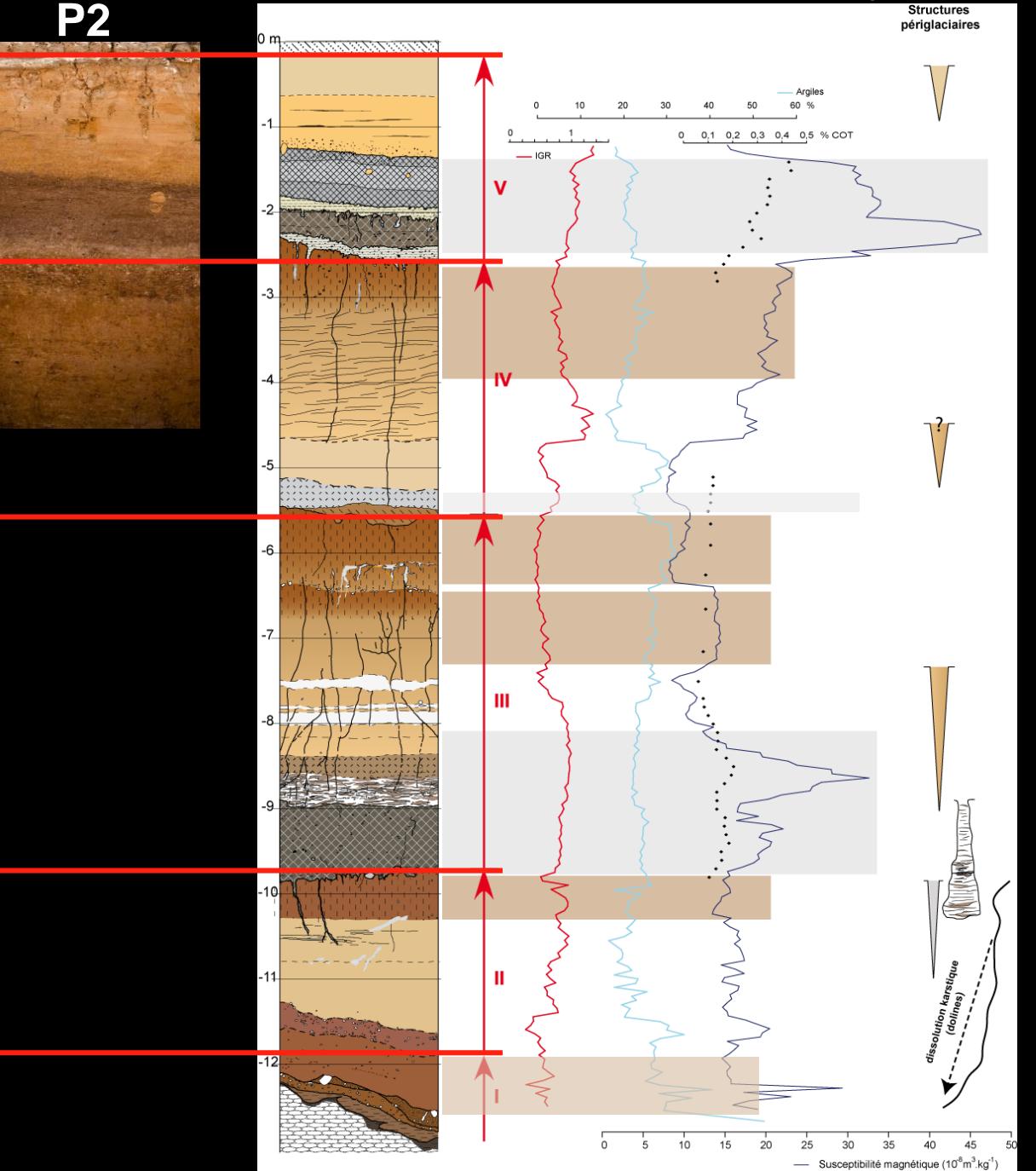
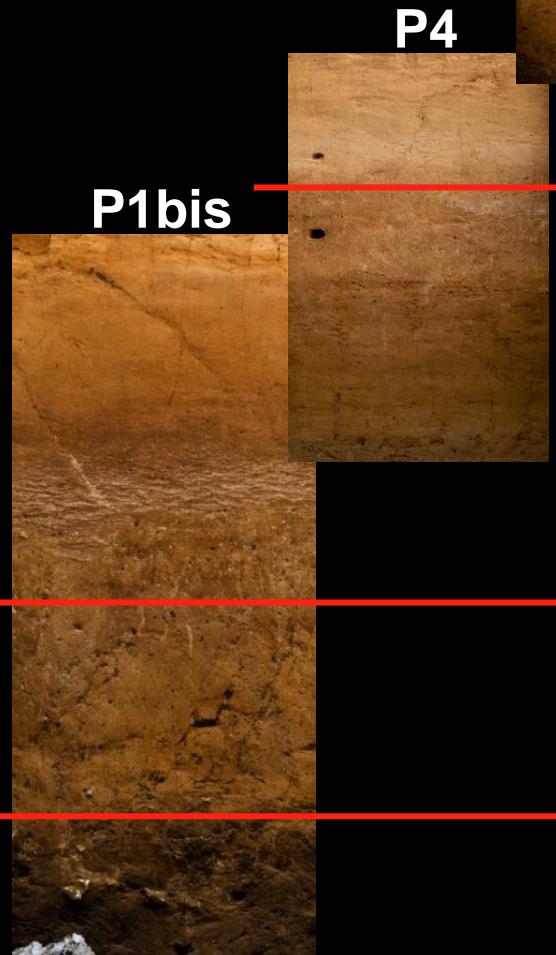
P4



A reliable chronostratigraphical approach based on the sequential analysis

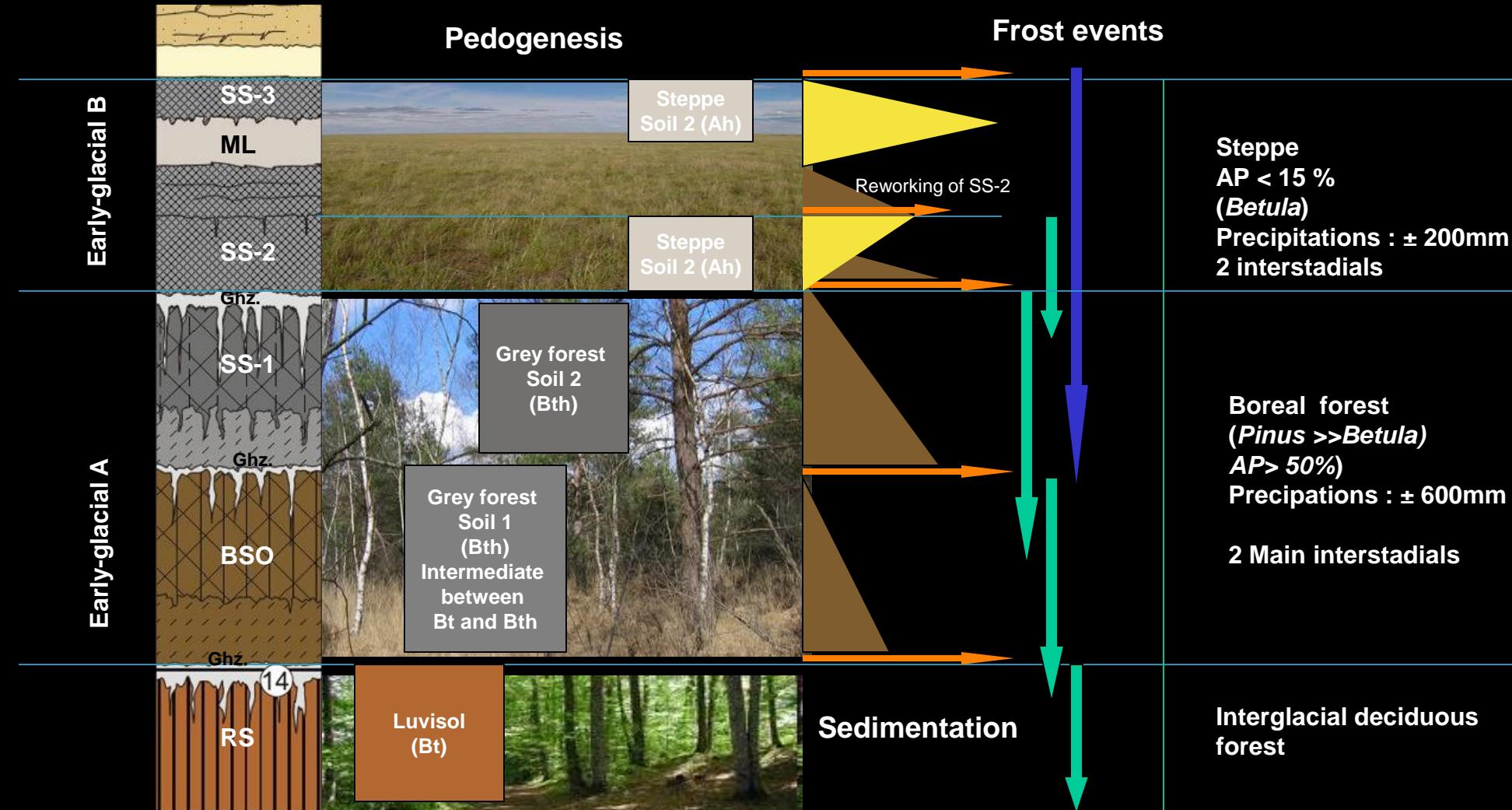
P2

5 stacked
glacial-interglacial
cycles

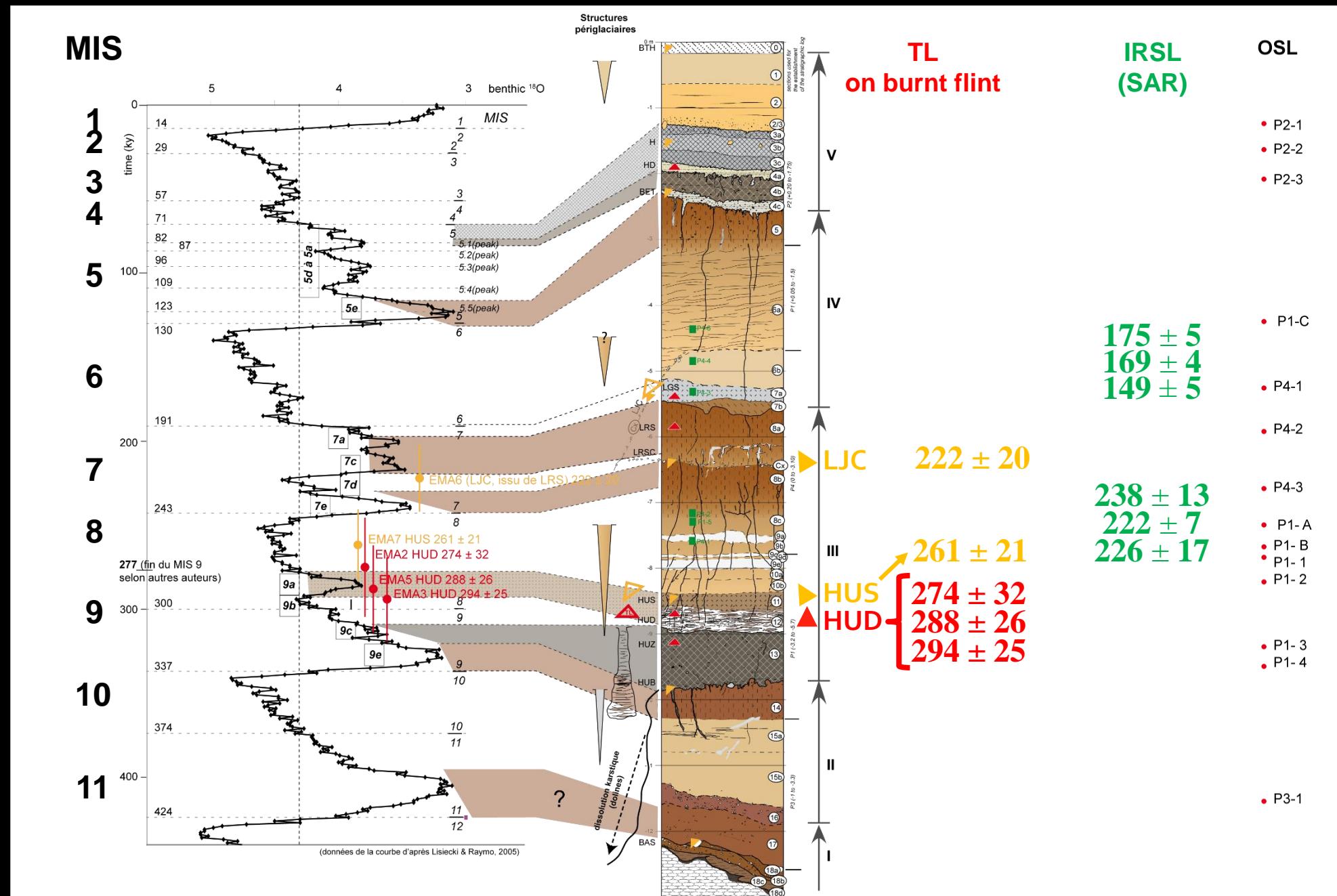


Cadre paléoenvironnemental

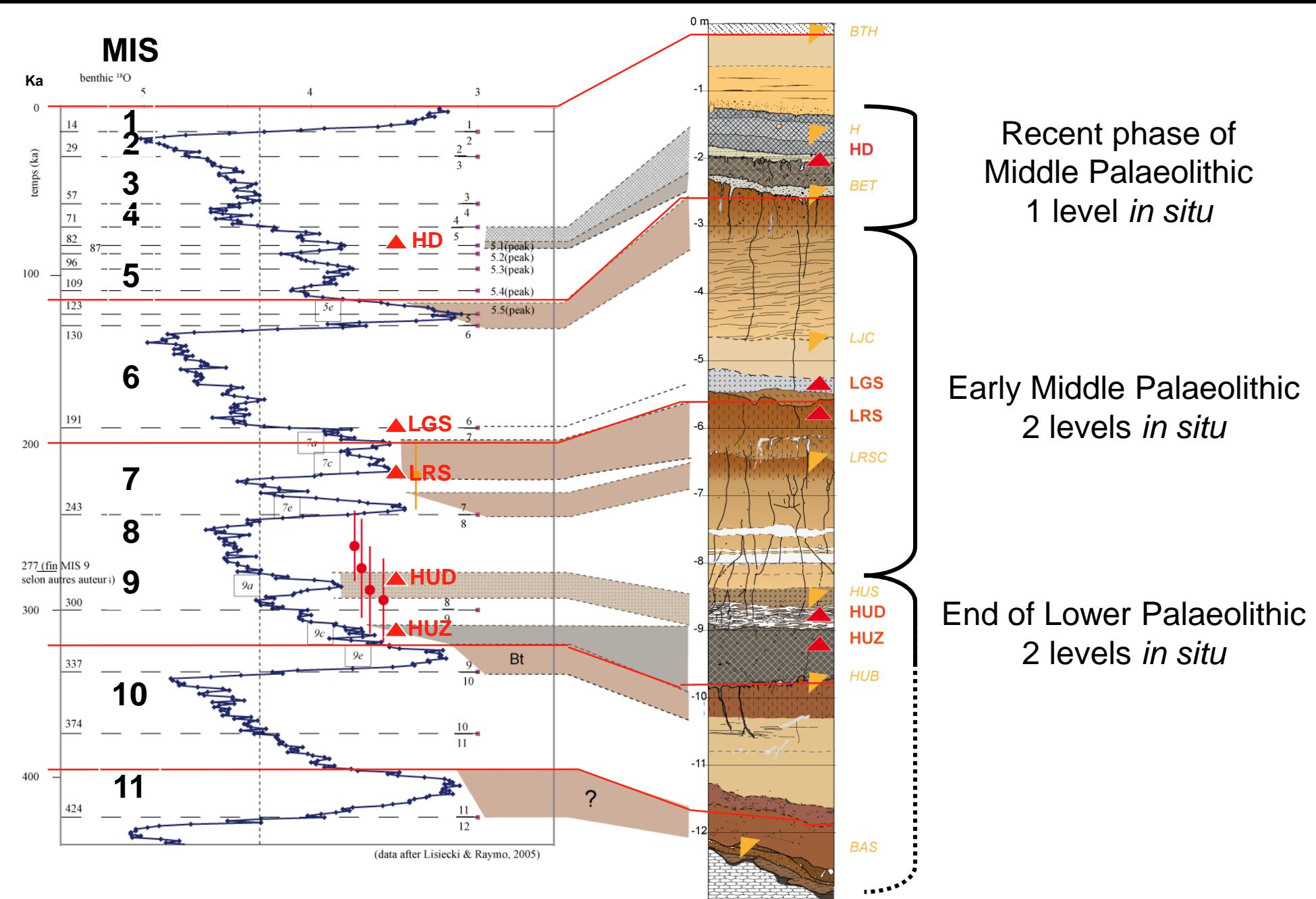
Weichselian Early-glacial soil complexes in N. France



A reliable chronostratigraphical approach based on the sequential analysis

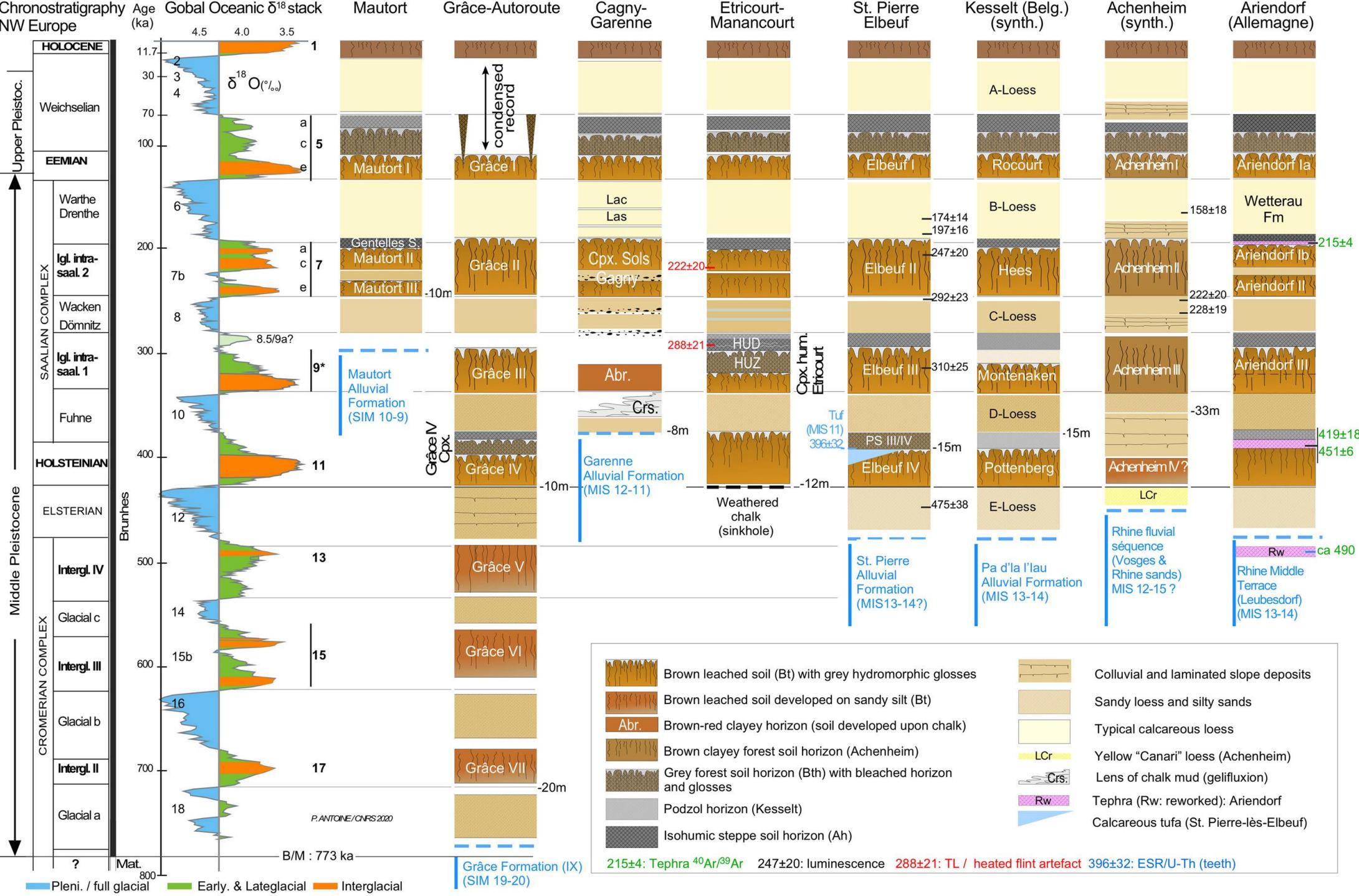


Chronostratigraphic position of human occupations



Correlation with isotopic stages and reference loess– palaeosol sequences for the Middle Pleistocene of western Europe

Antoine et al.,
2021 JQS



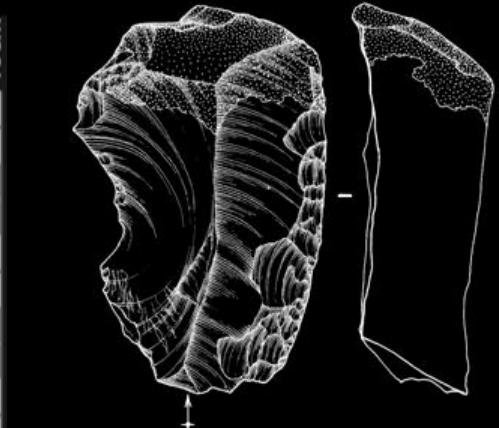
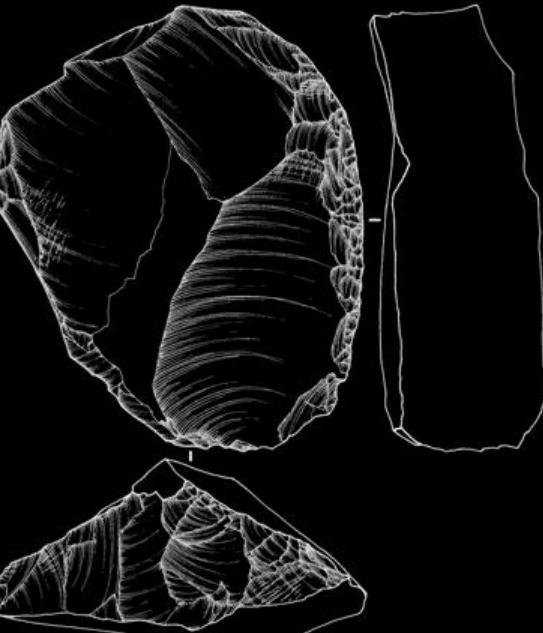
A mi-pente de la Somme Etricourt- Manancourt (HUD)

D. Hérisson dir.

Couteaux
à dos corticaux

Séquences
unipolaires
courtes sécantes

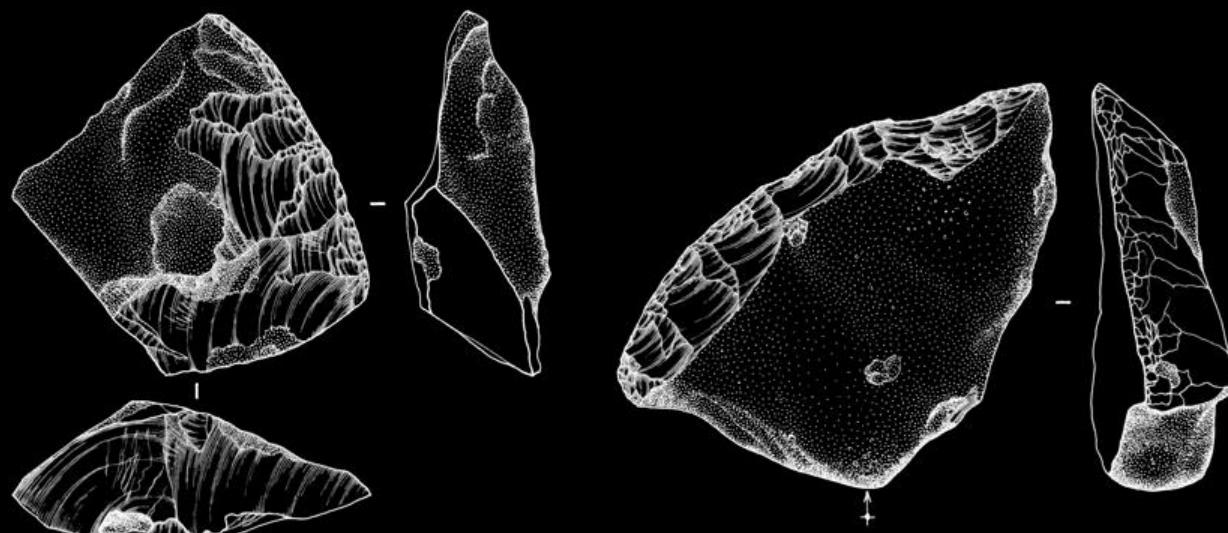
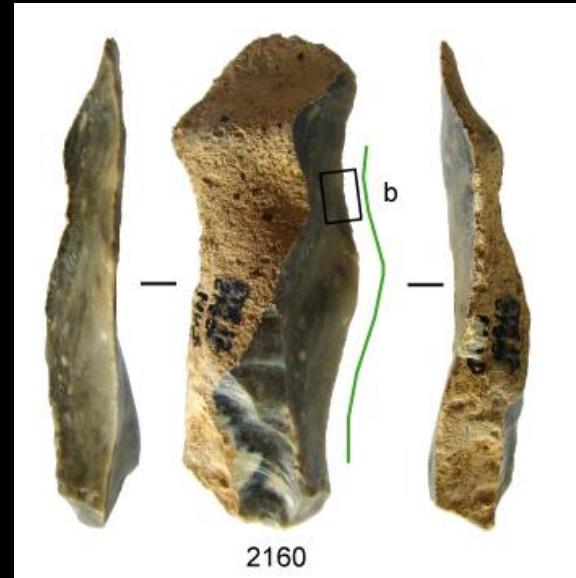
10cm



Tracéologie

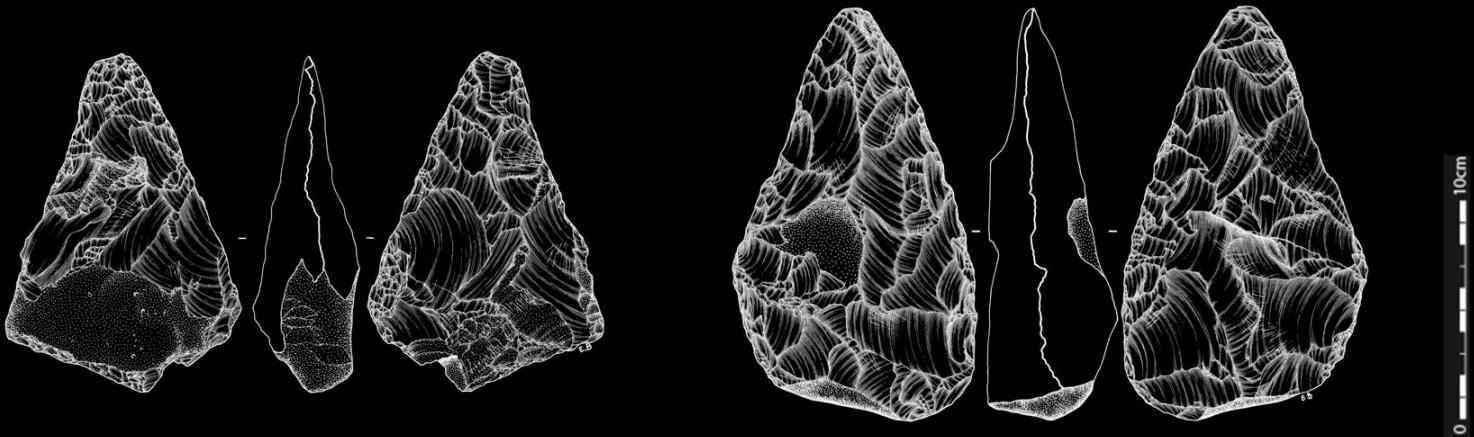
131 pièces
avec traces

découpe de
+ 80% matière tendre
à mi dure



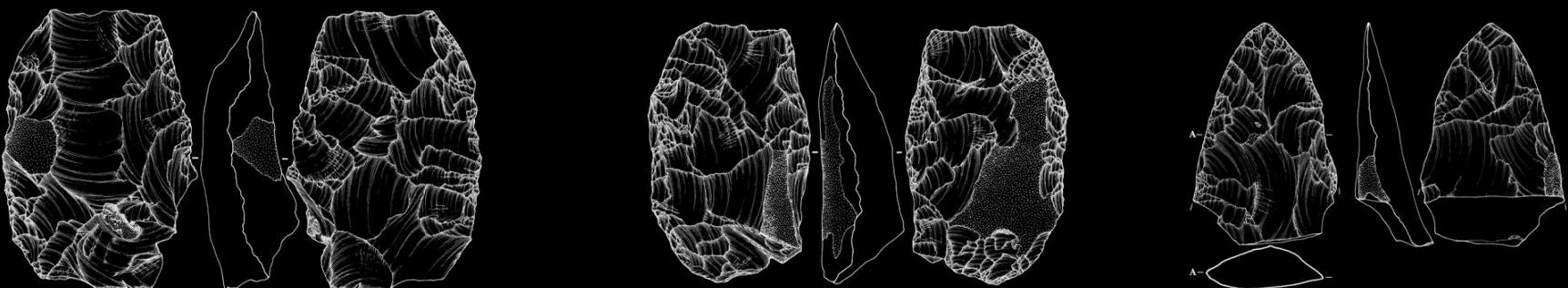
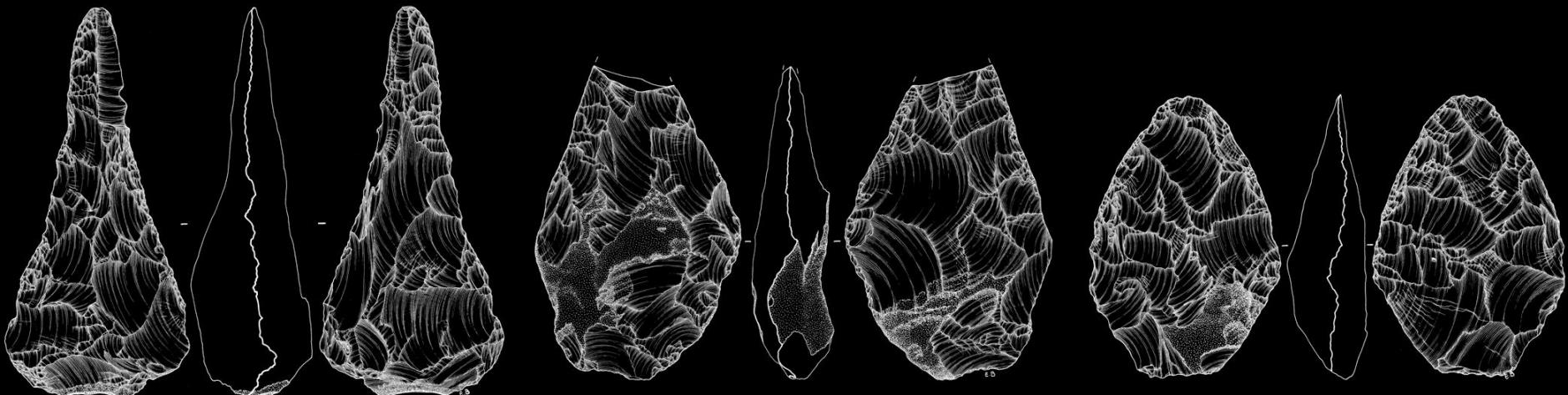
A mi-pente de la Somme

Etricourt-
Manancourt
(HUD)



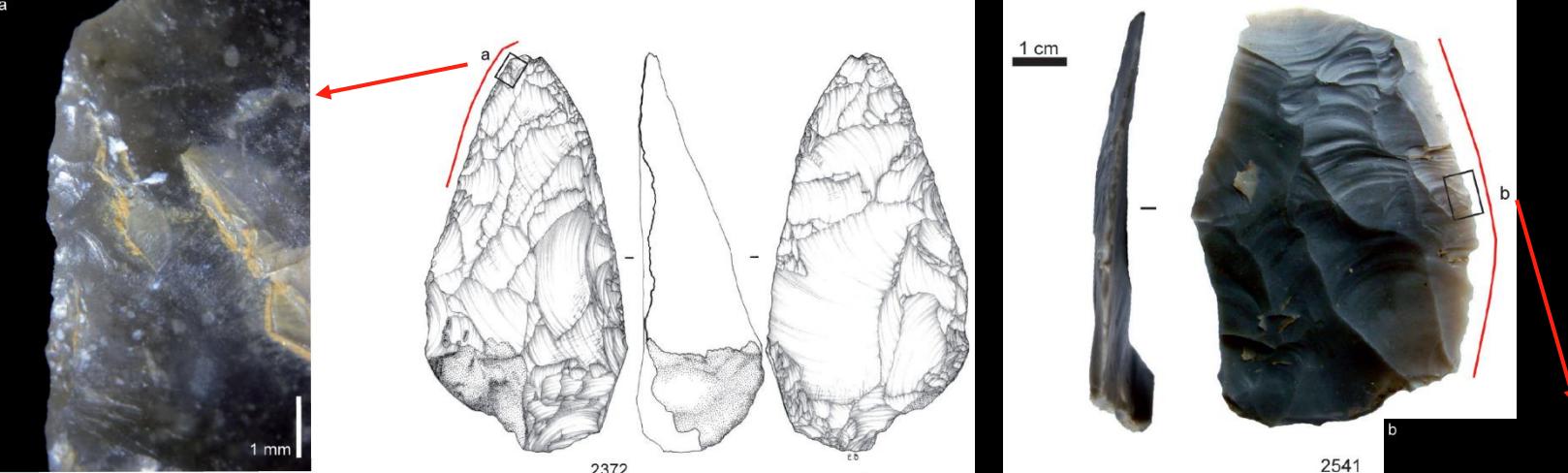
10cm

D. Hérisson dir.

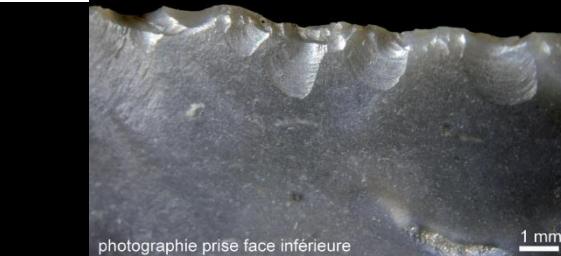
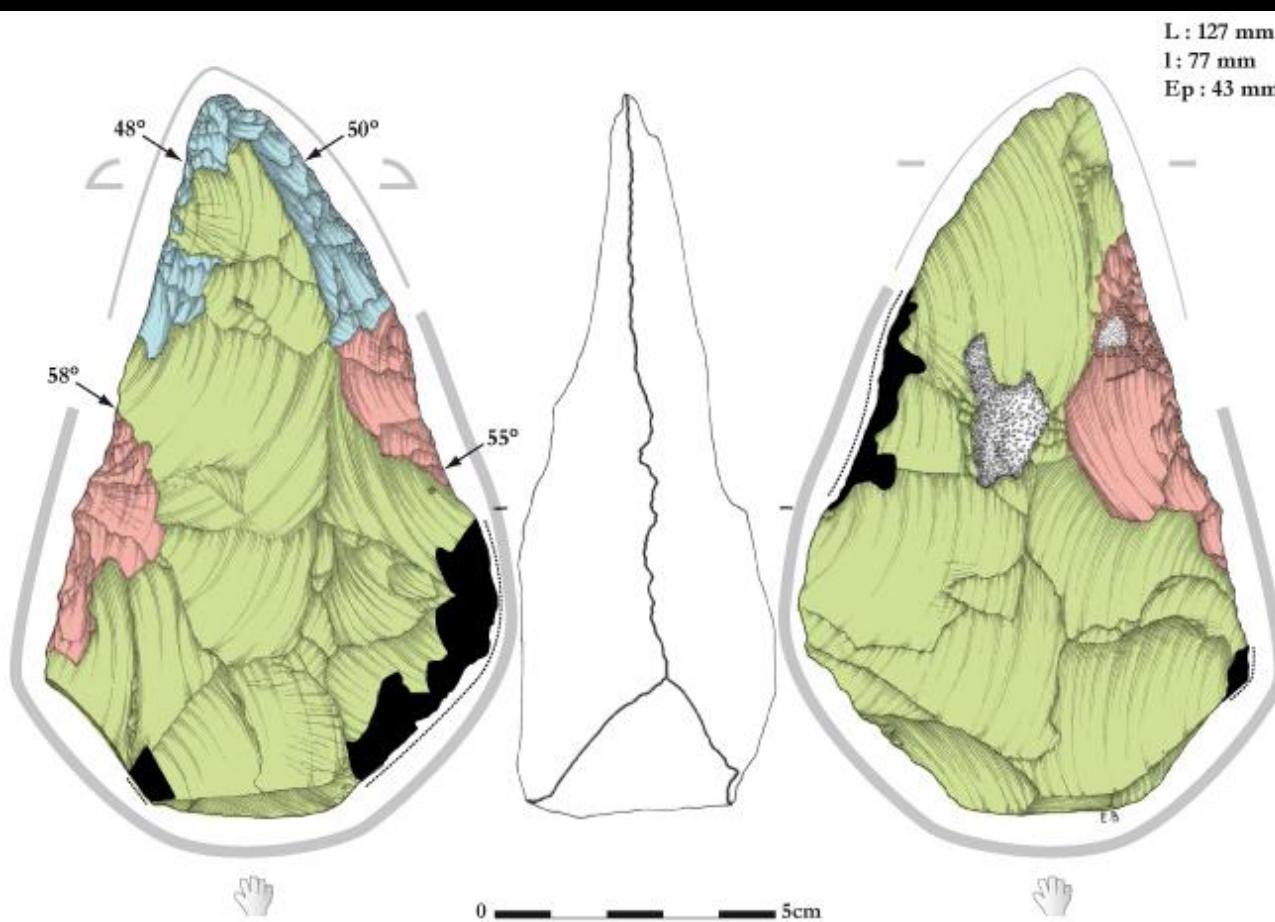


A mi-pente de la Somme

Etricourt- Manancourt (HUD)



D. Hérisson dir.



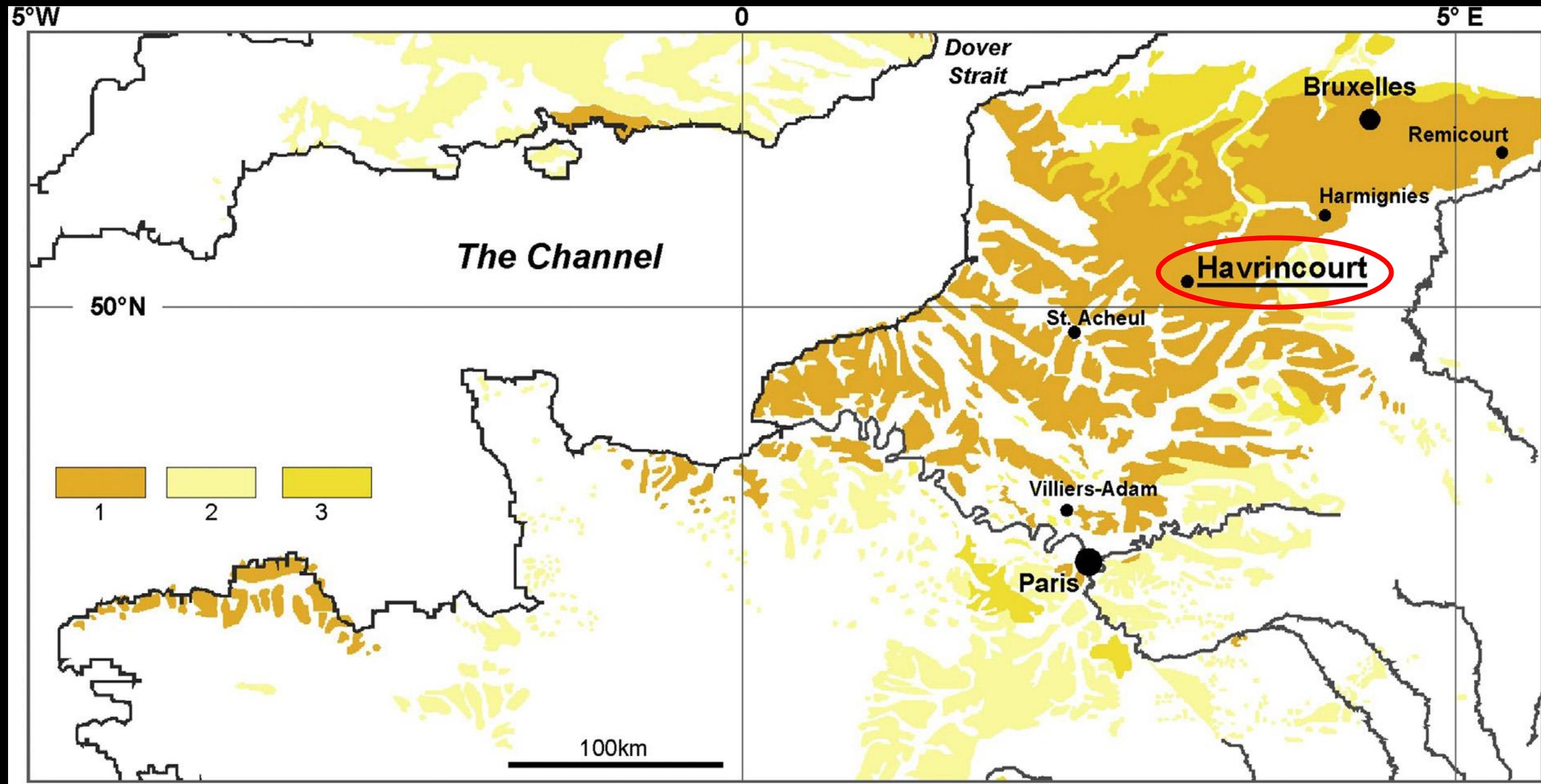
Tracéologie

13 bifaces et
5 éclats de façonnage

Découpe d'une matière
tendre à mi dure

Usure intense

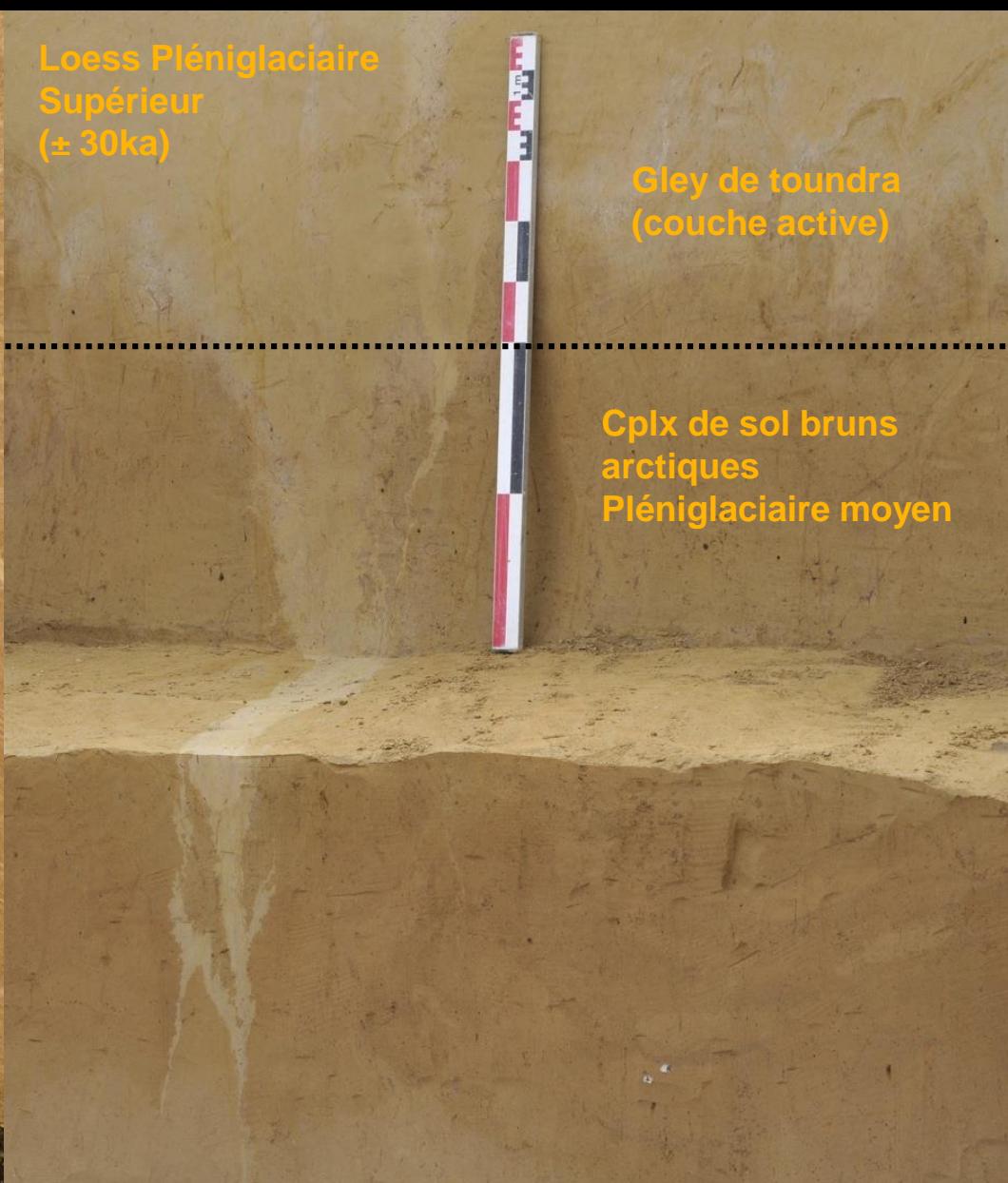
Havrincourt II 2012



Havrincourt II 2012



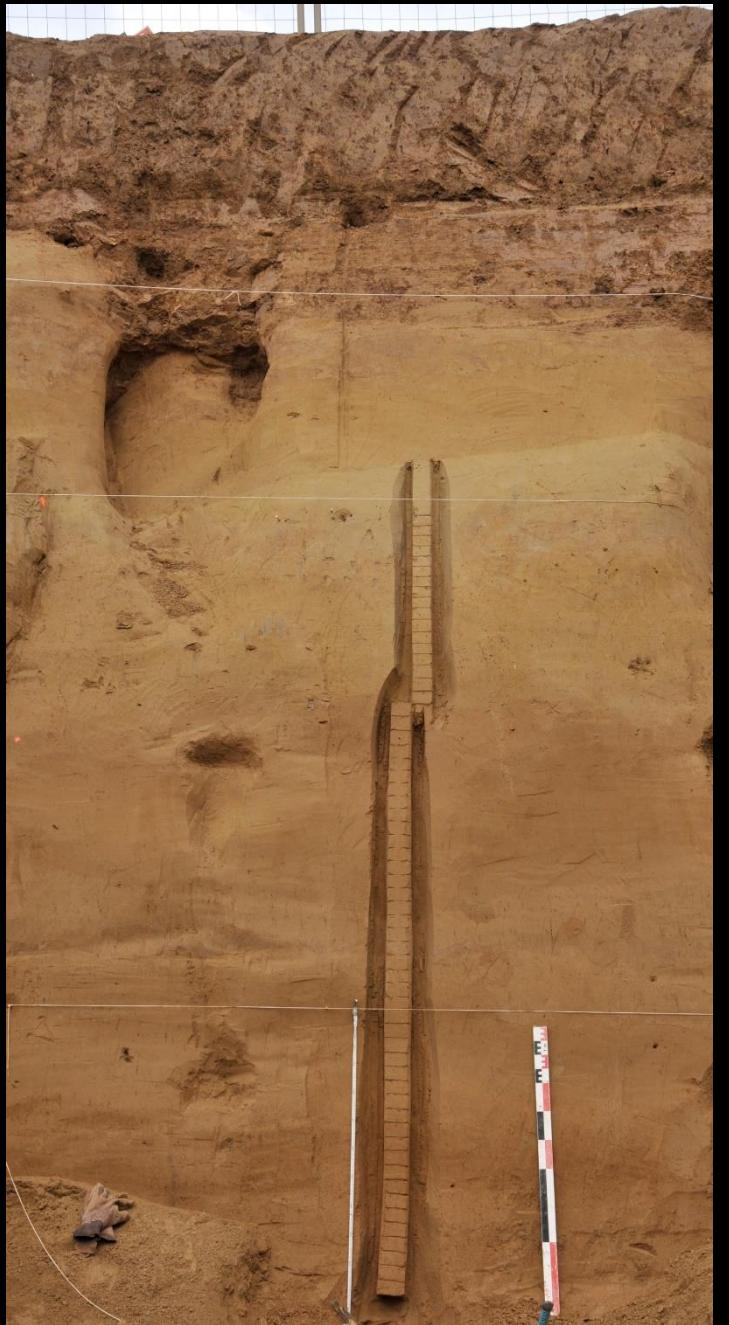
I - Transition Pléniglaciaire moyen / Pléniglaciaire supérieur : réseau principal de grandes fentes à coins de glace



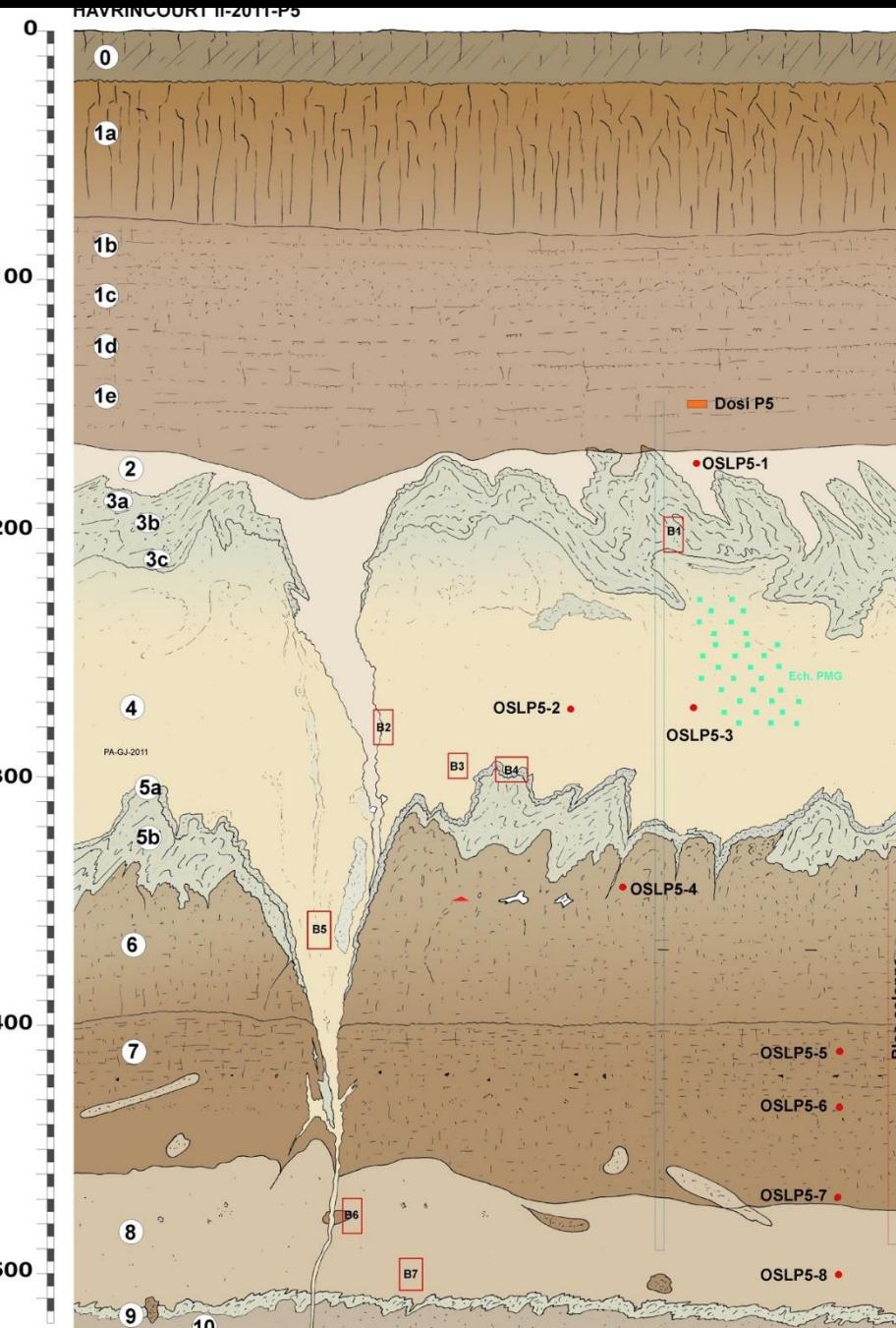
Havrincourt II P5



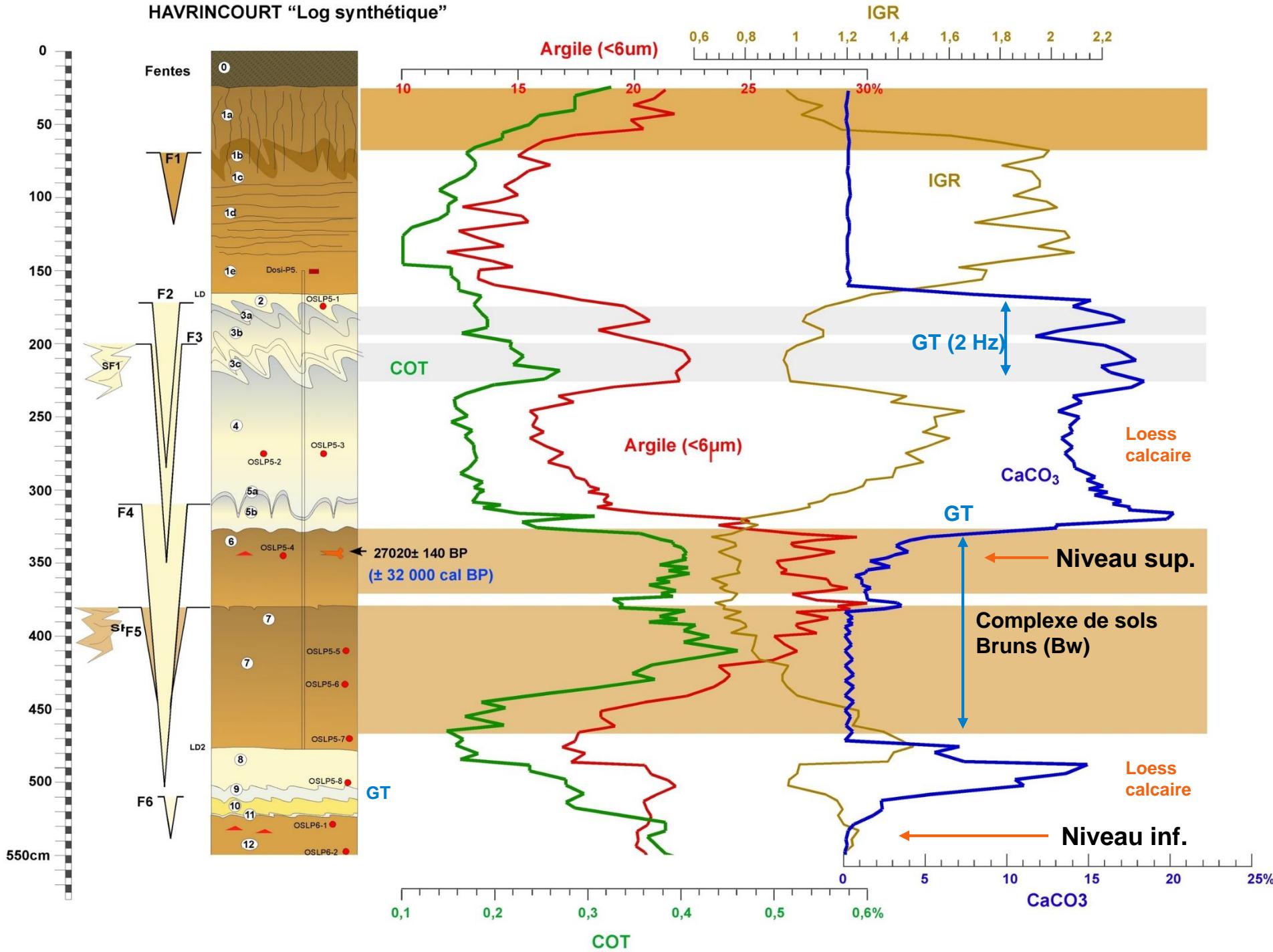
Des prélèvements effectués en nombre et par différentes approches pour un calage chronostratigraphique précis et fiable

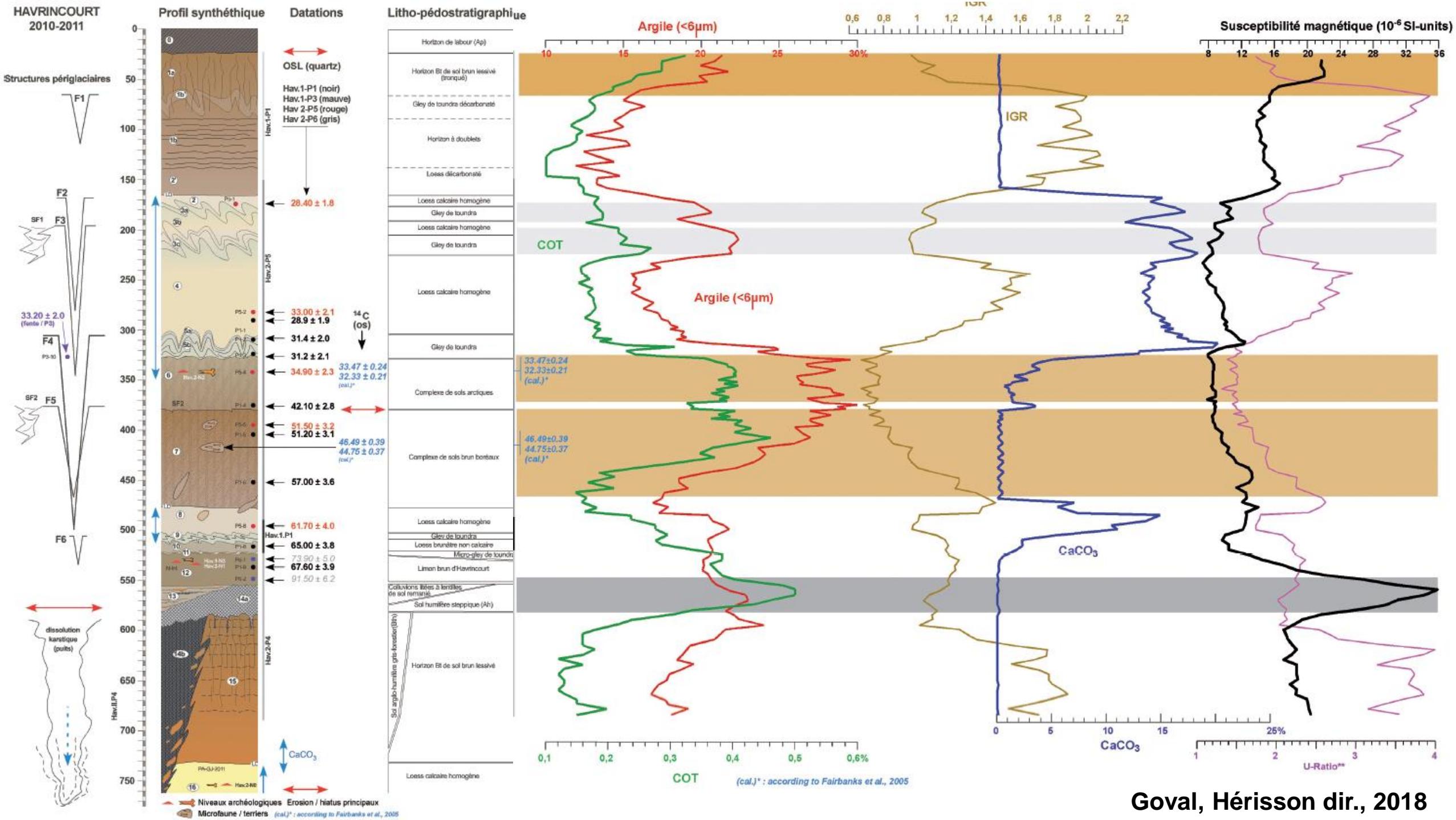


I - HAVRINCOURT II P5



HAVRINCOURT "Log synthétique"

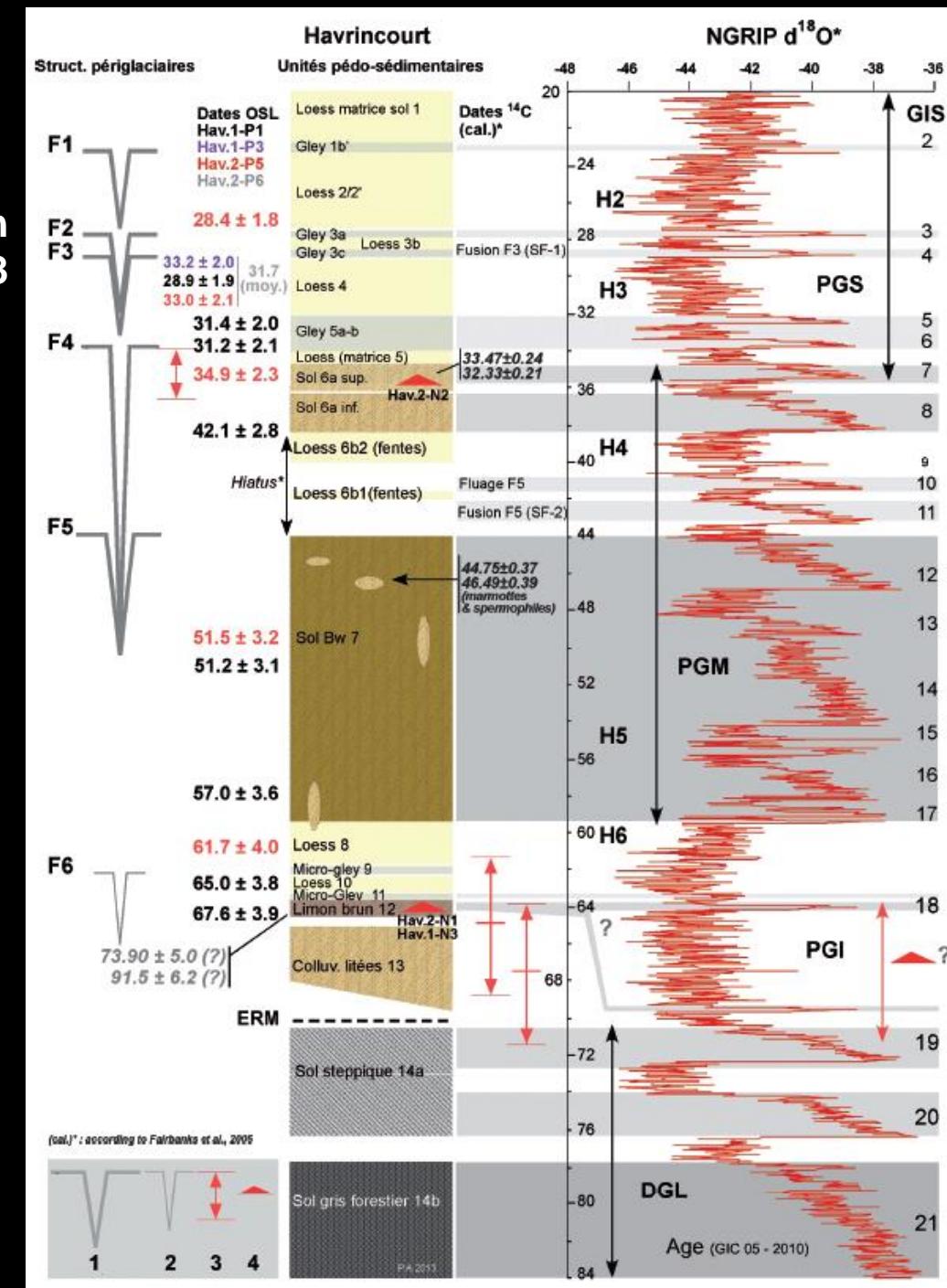
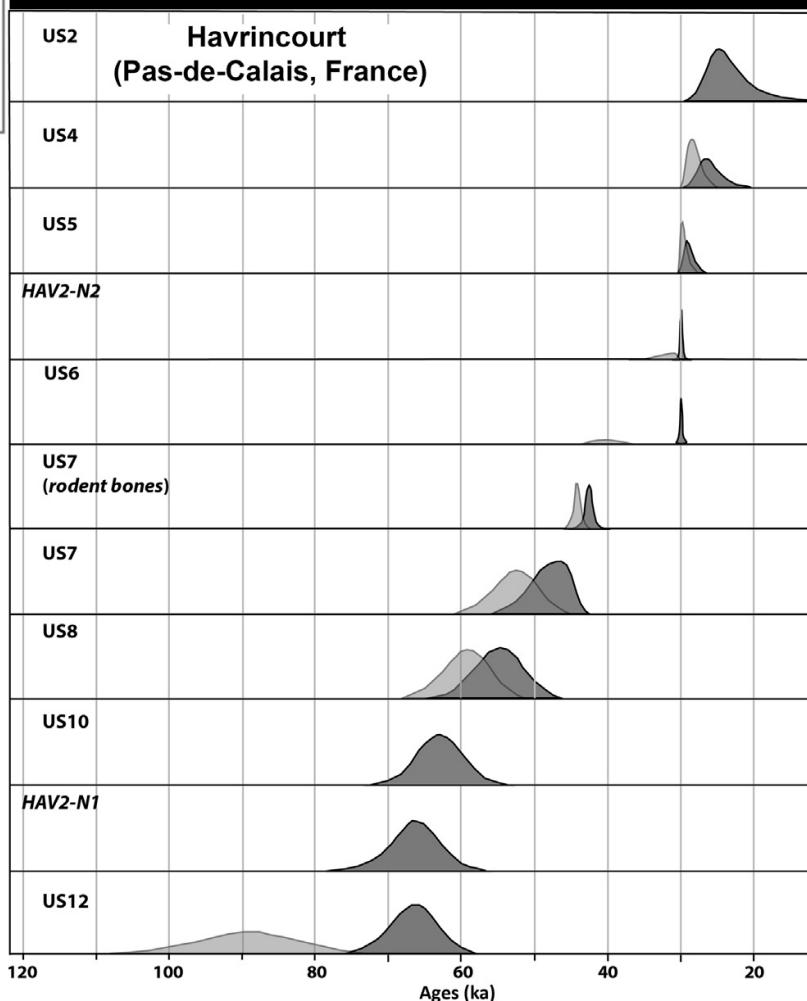
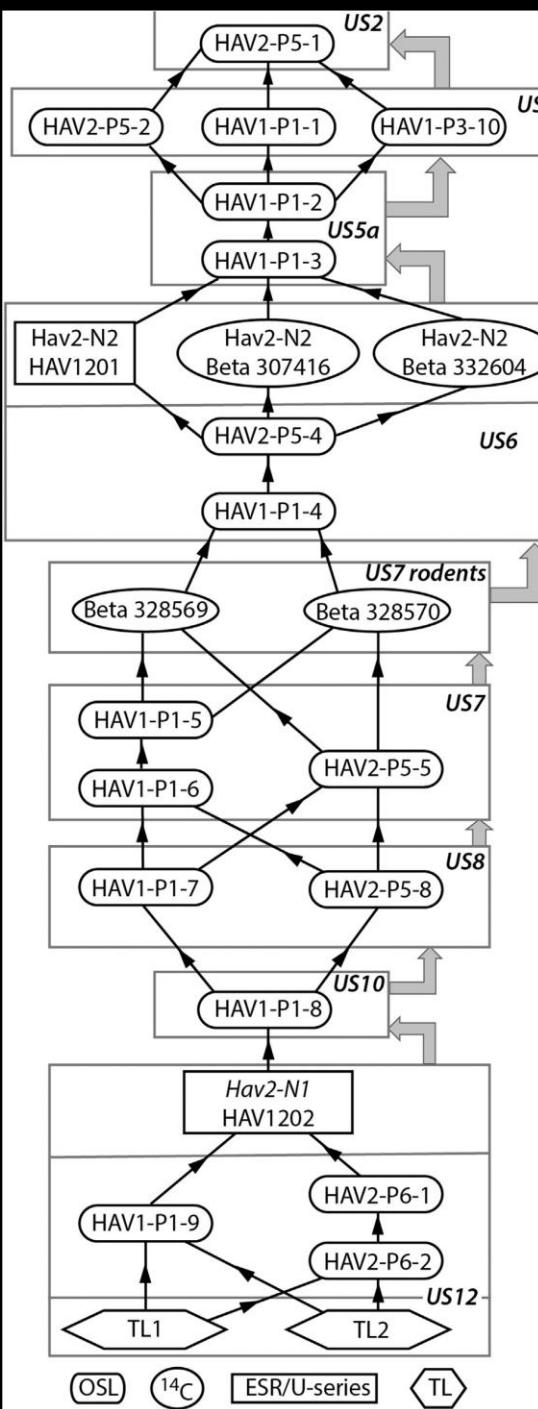




Chronomodel et chronostratigraphie

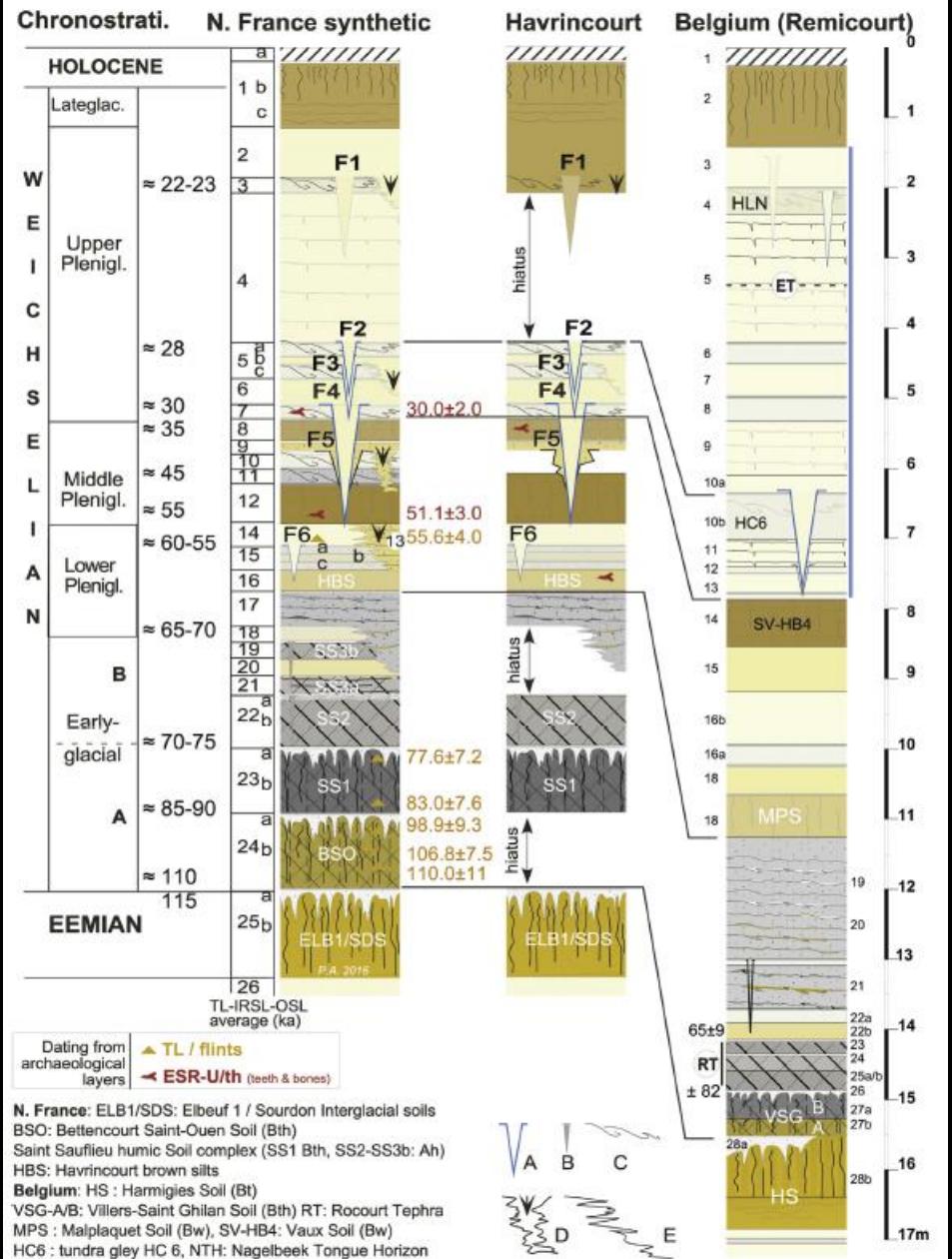
Goval, Hérisson
dir., 2018

Guérin et al.,
2017 QG

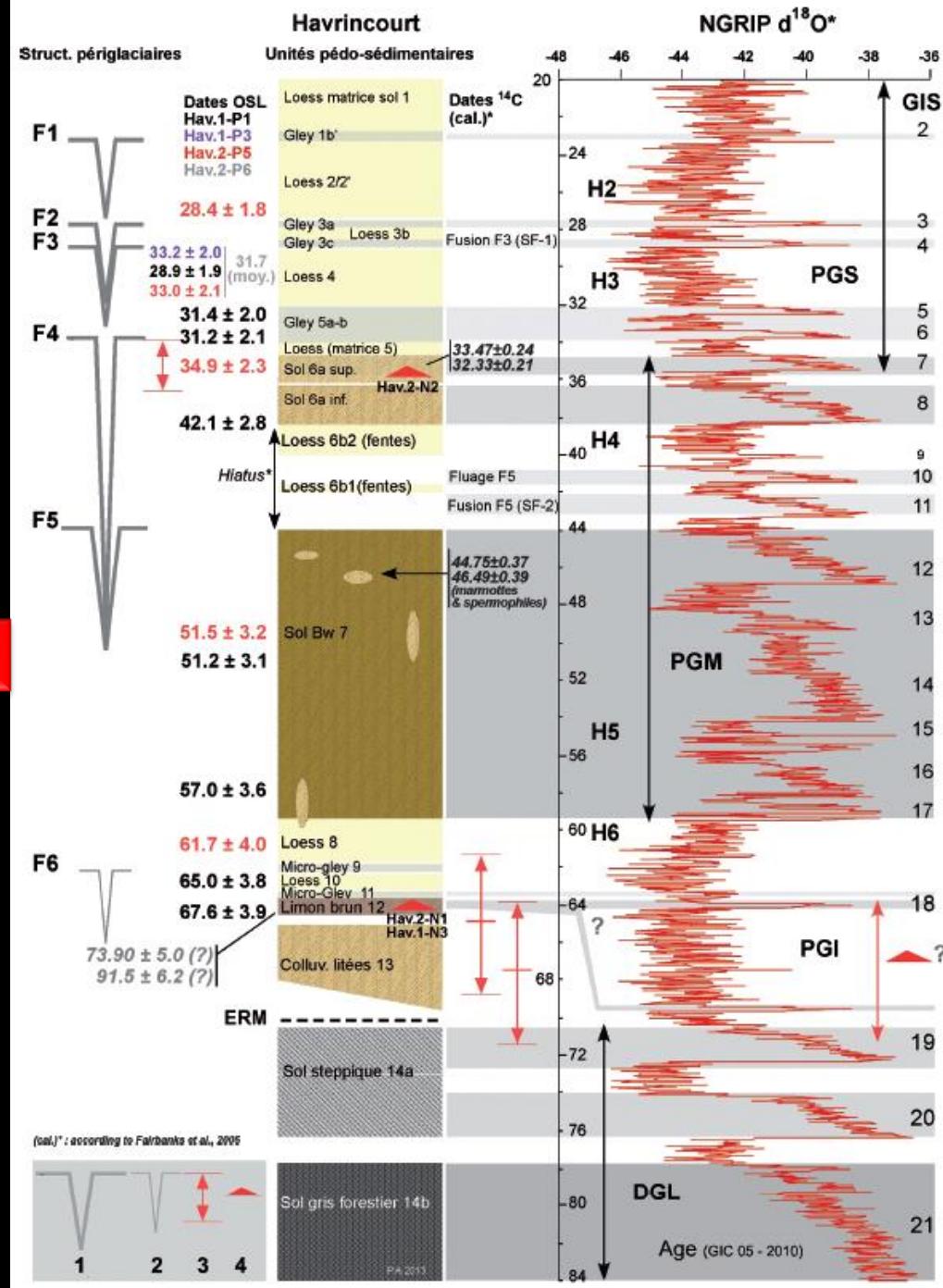


Chronomodel et chronostratigraphie

Goval, Hérisson
dir., 2018

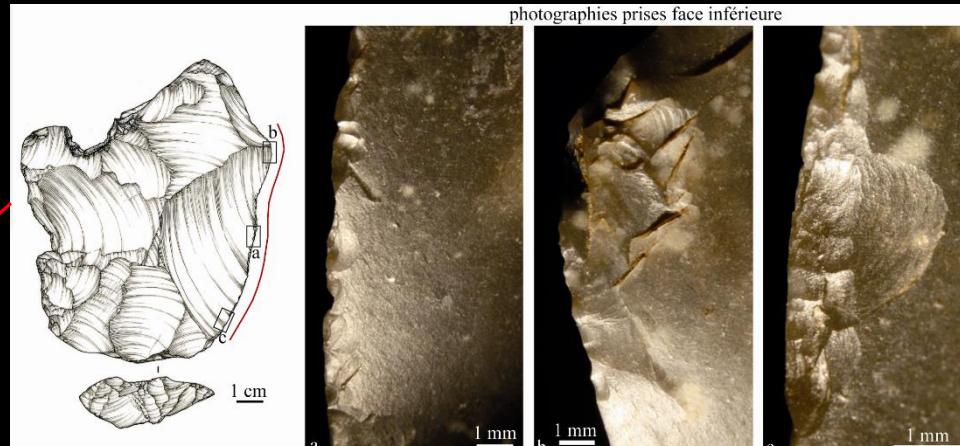
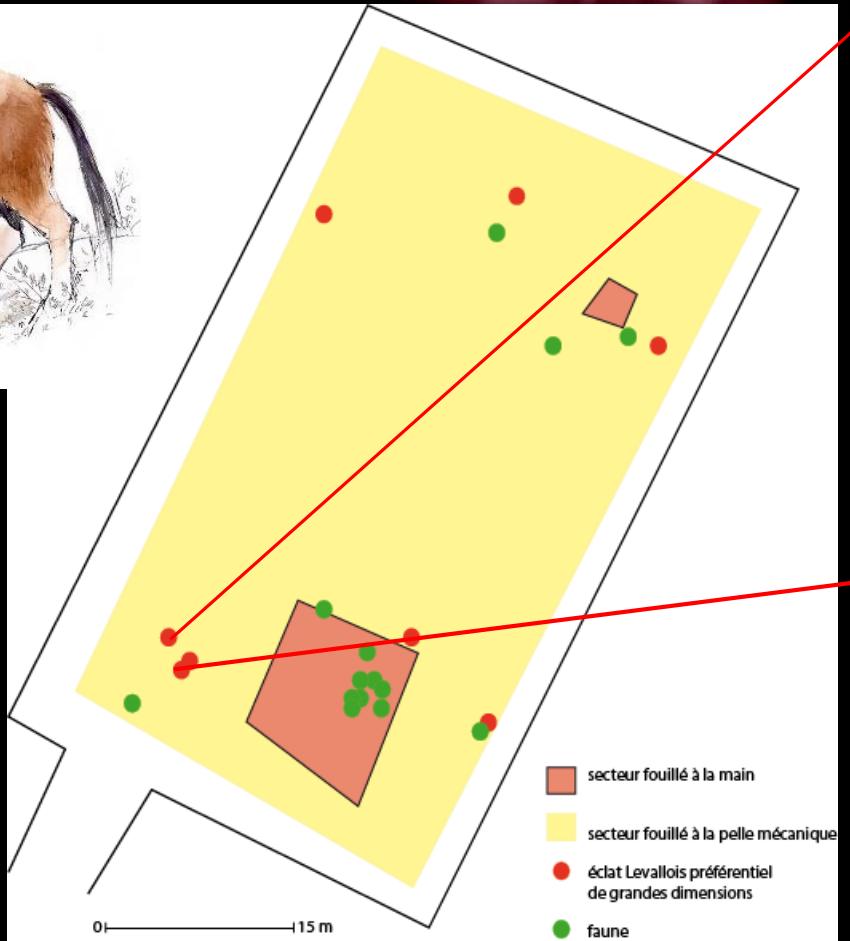


Guérin et al.,
2017 QG

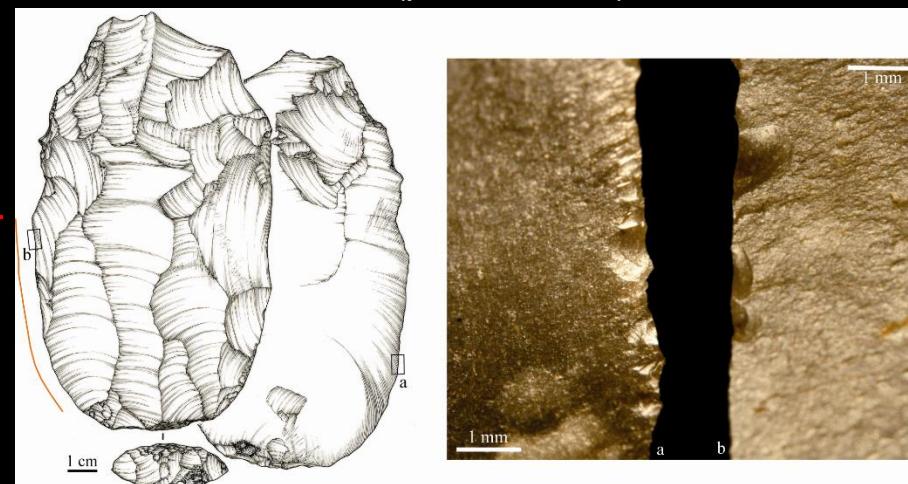


MIS 4 : 65 ka

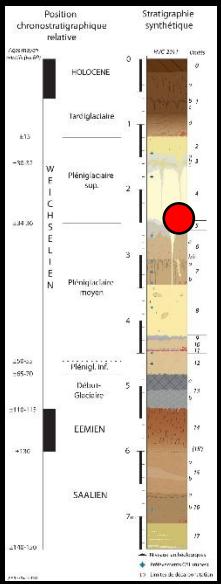
Havrincourt 1 (2010)
E. Goval dir.



Esquillements liés à la coupe de matière tendre à mi-dure (percussion ?)



Esquillements liés à la coupe de matière tendre

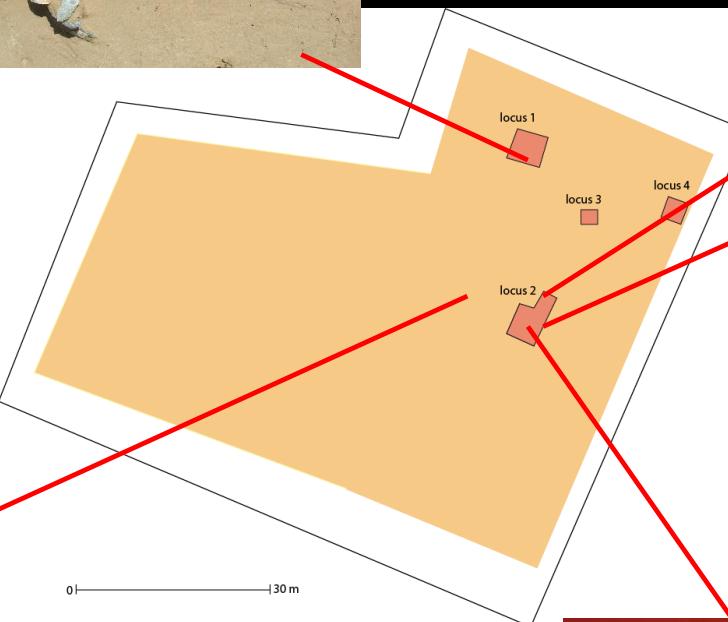


Niveau gravettien Hav2-N2



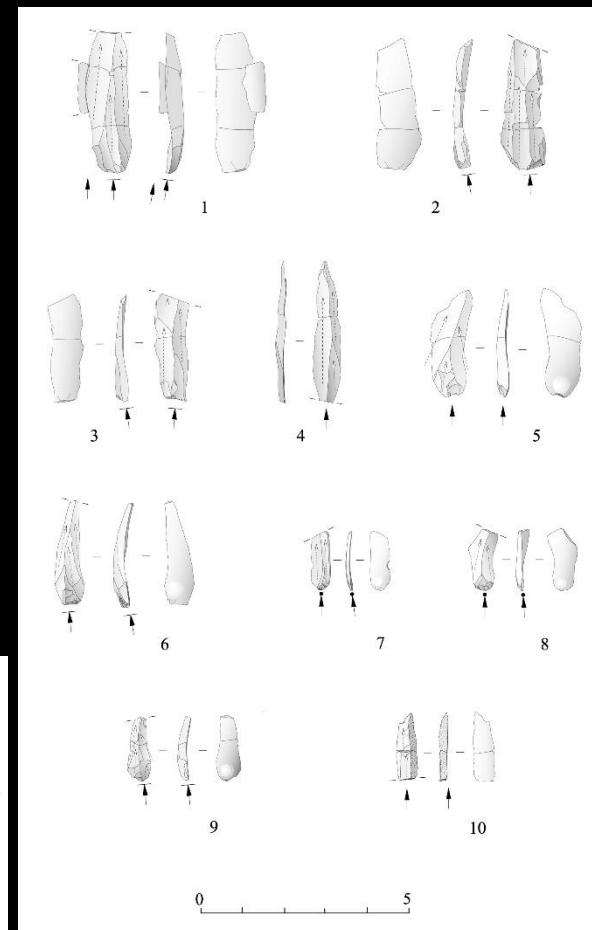
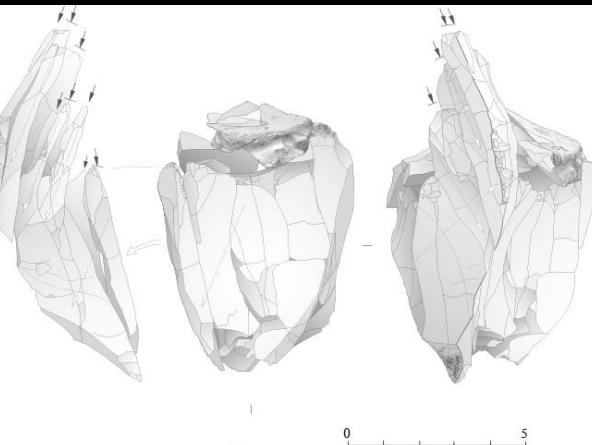
4 concentrations où le silex est associé à la faune.

**Chaque concentration s'étend de 2 à
10 m² et comporte de 100 à 450
artefacts**

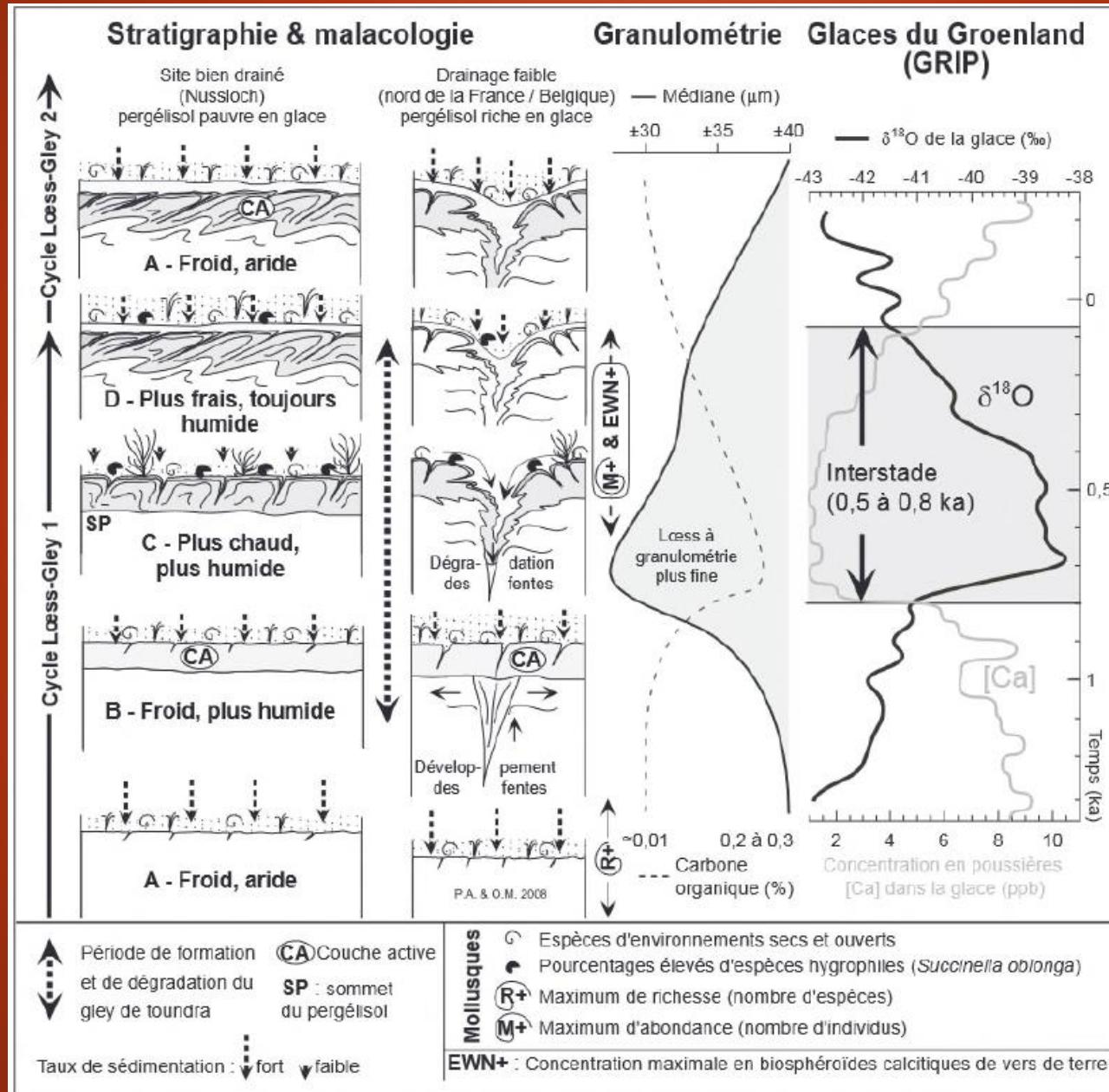


**Environ 7800 artefact
(dont 5050 esquilles)**

Environ 400 restes de faune



Apport de la malacologie

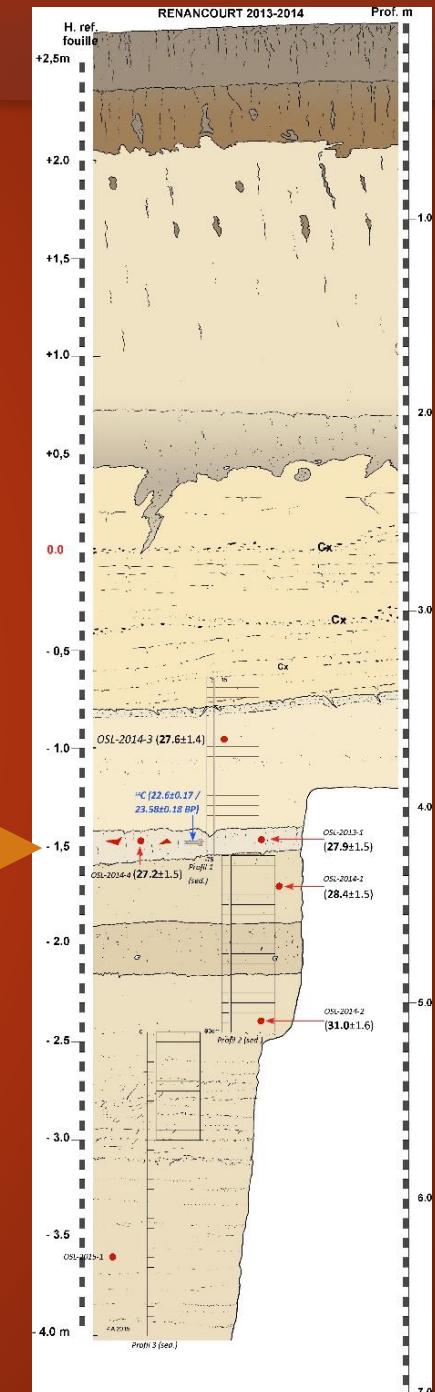


Antoine et al., 2009 modifié dans Moine et al. 2011

Amiens-Renancourt 1



Paris (2020)

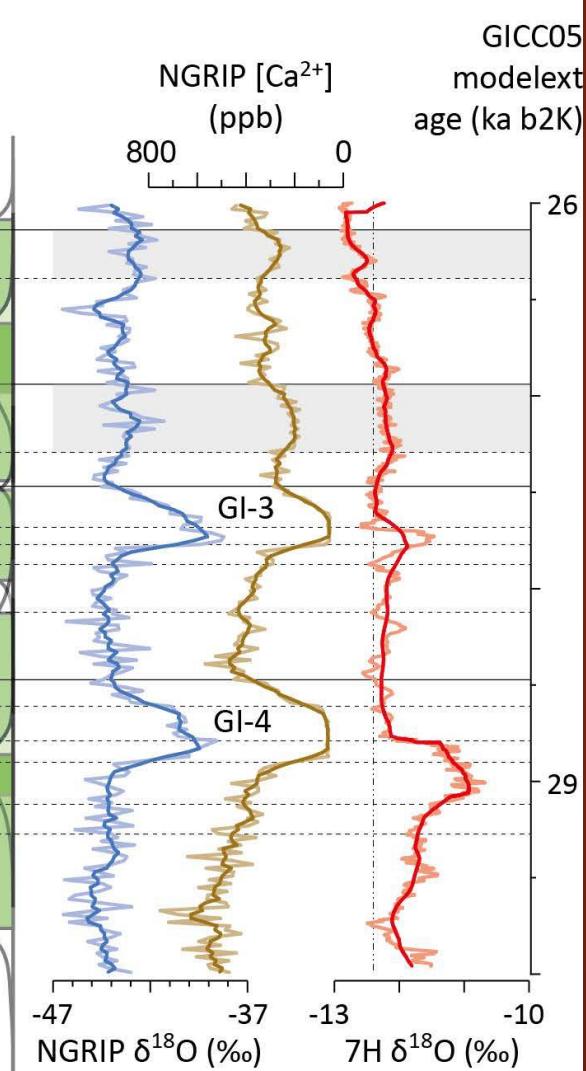
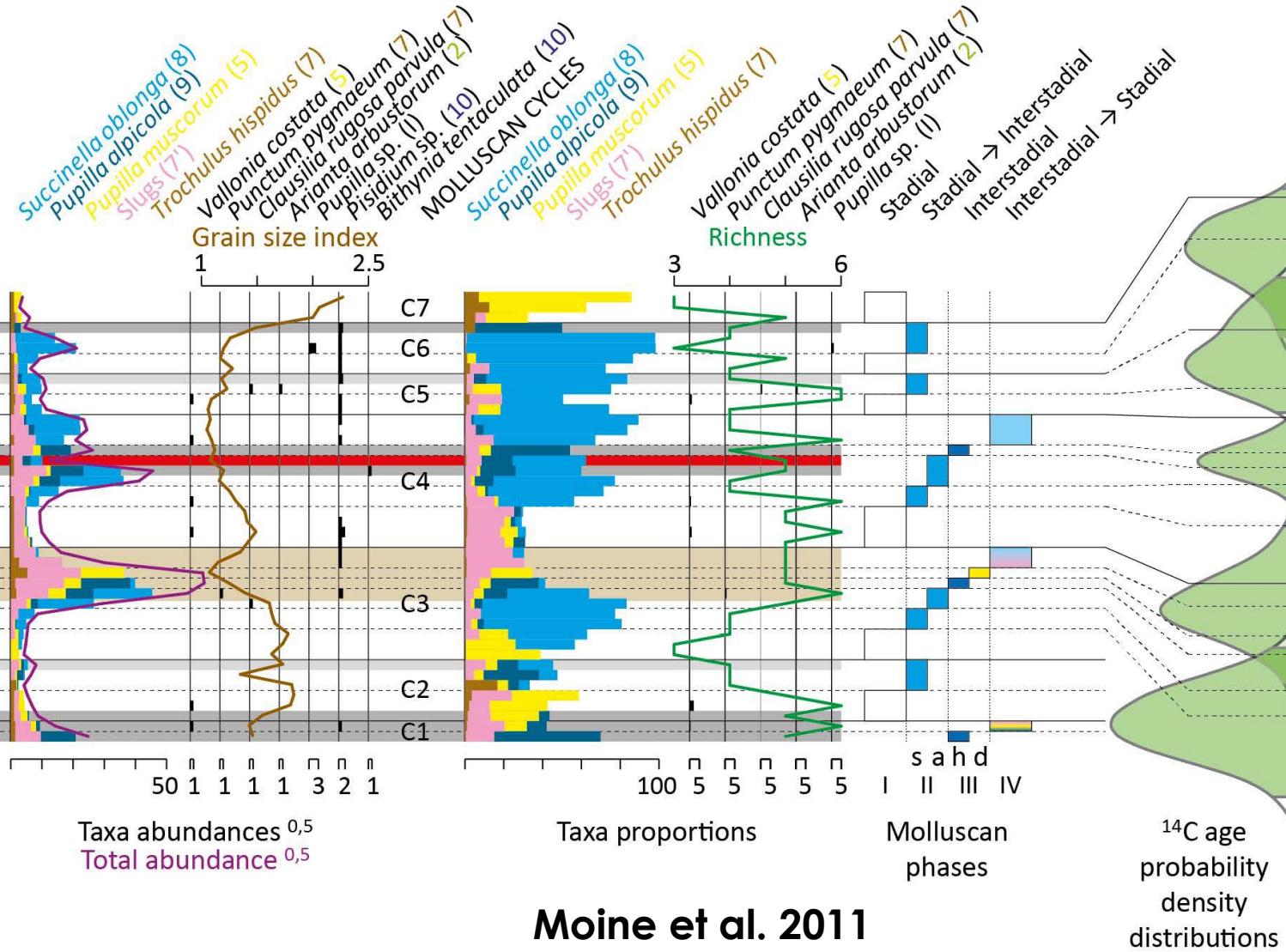
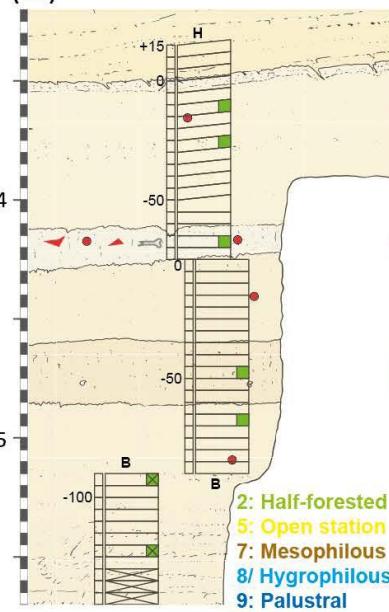


Amiens-Renancourt 1

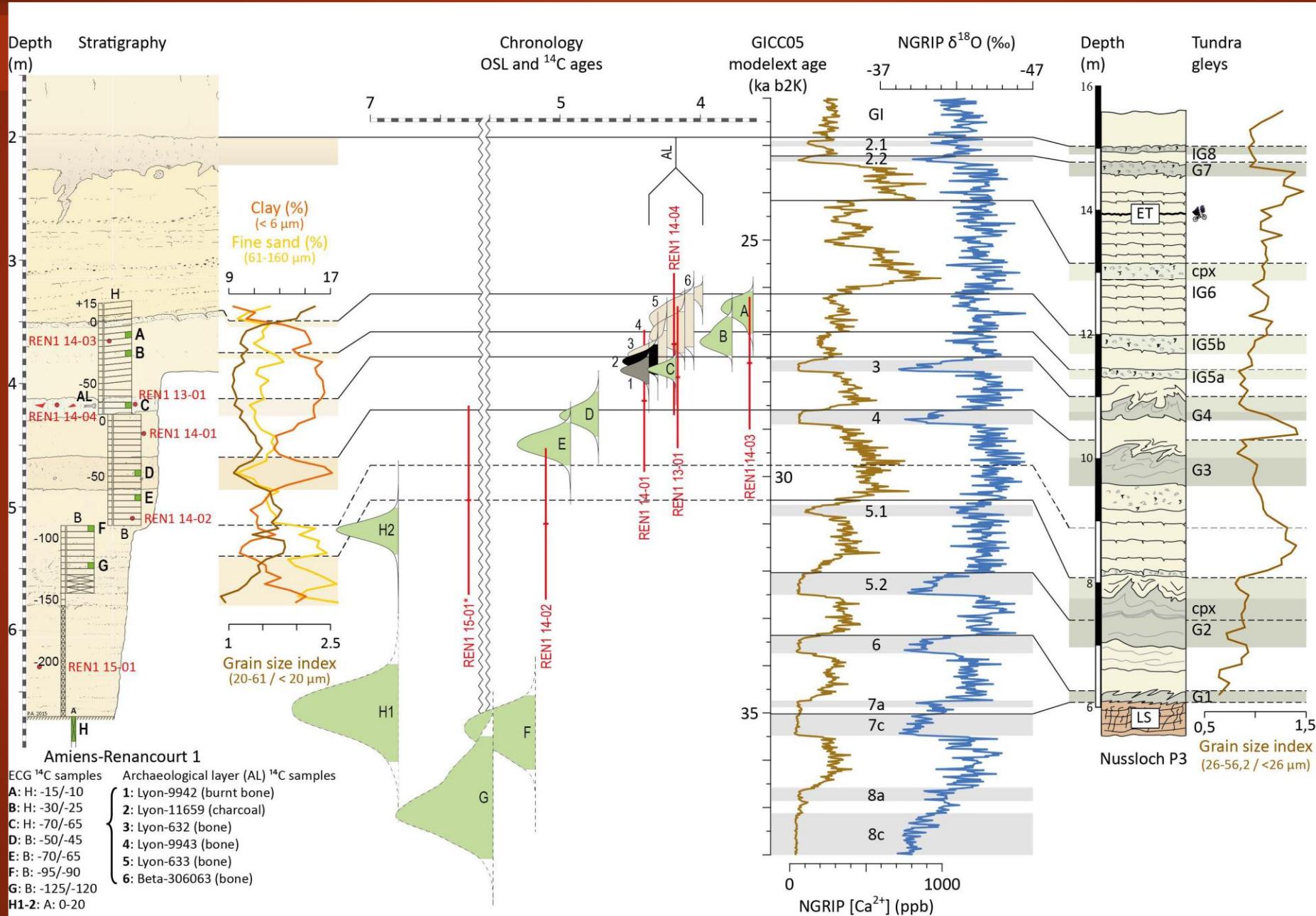


Depth (m)

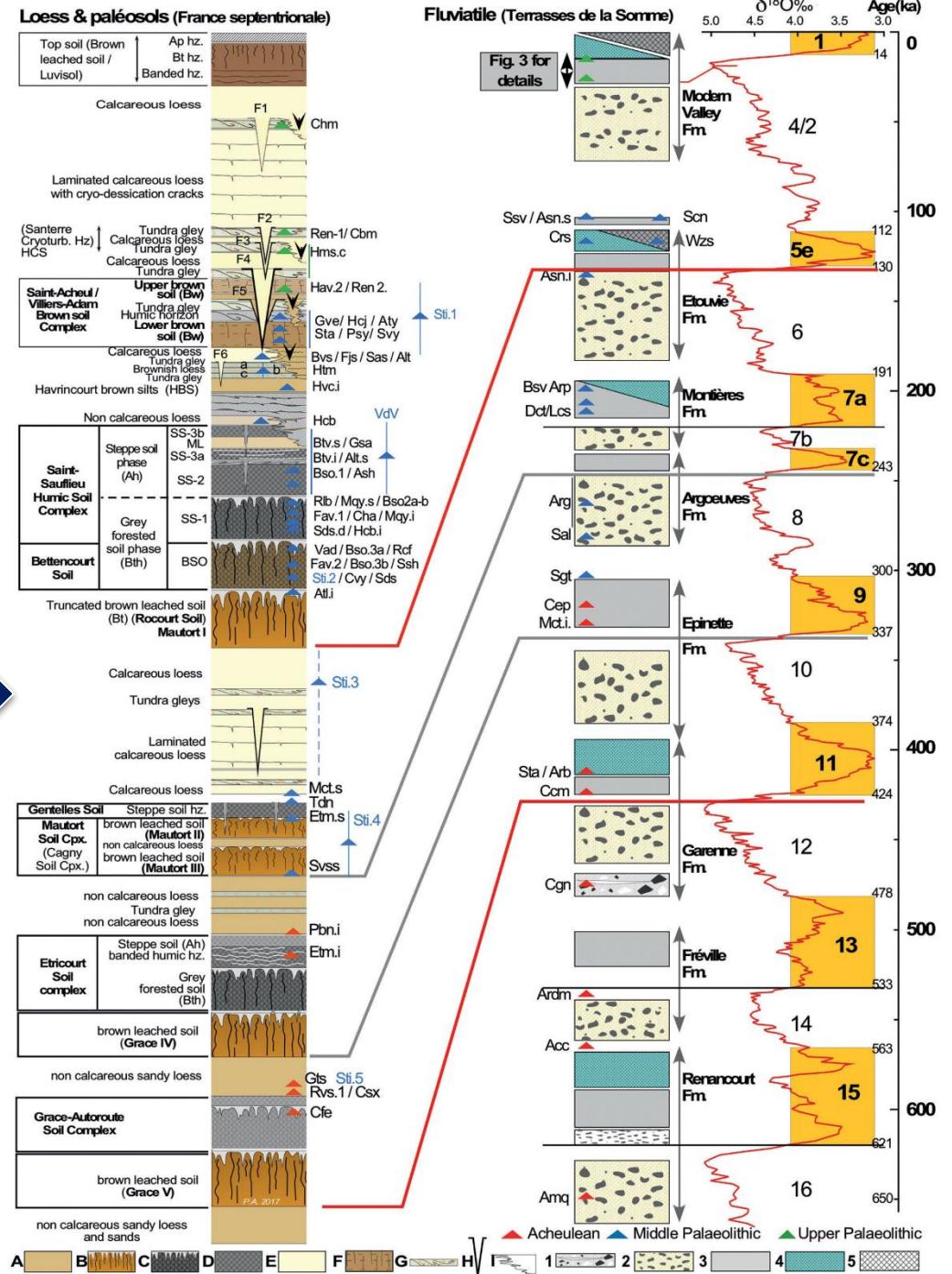
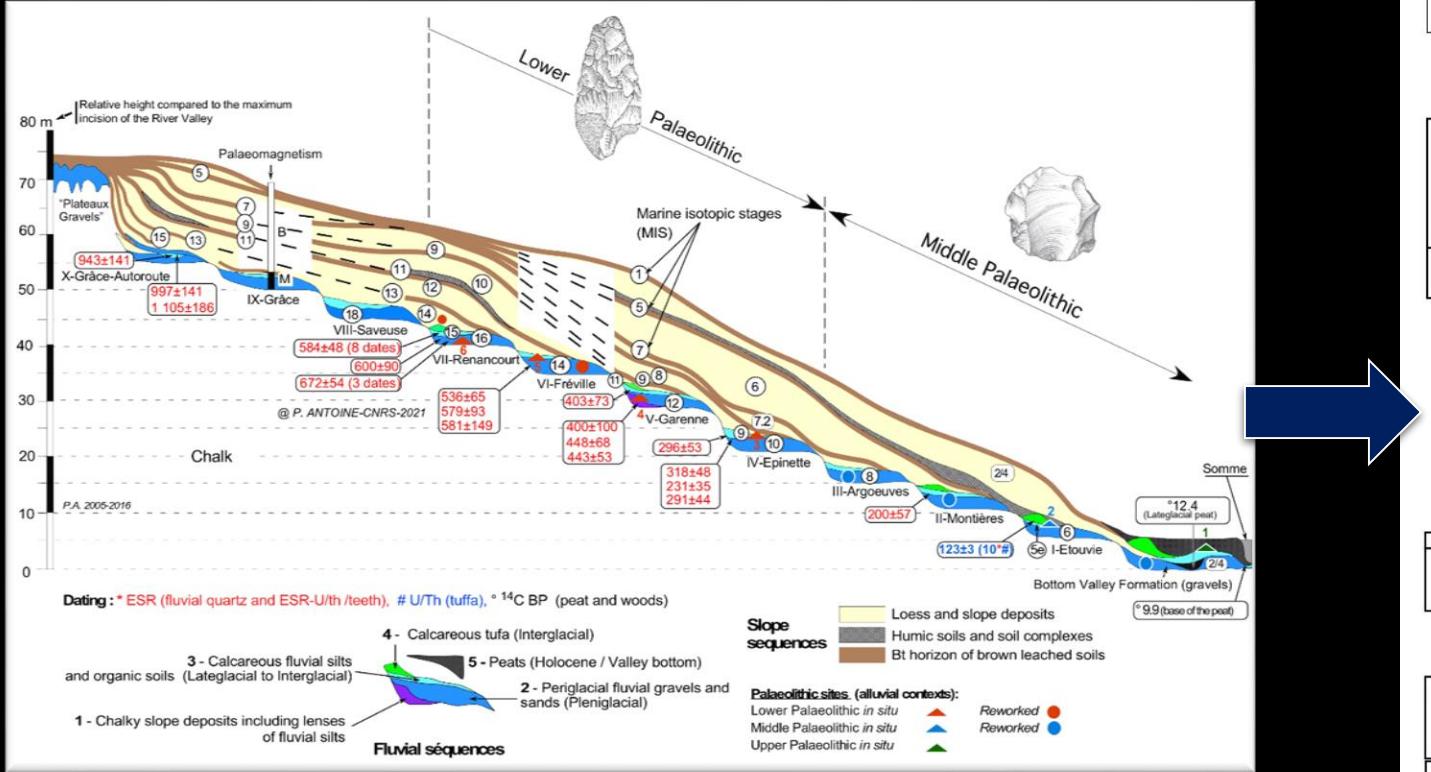
Stratigraphy



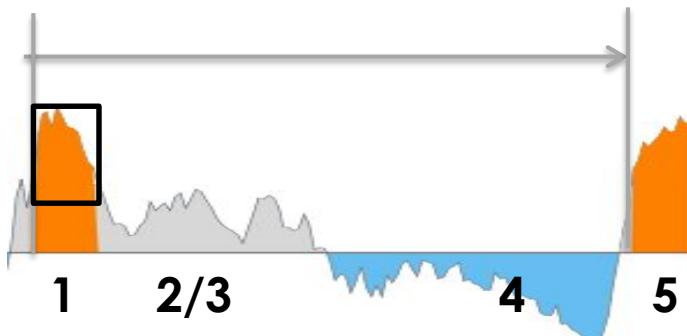
Amiens-Renancourt 1



Les séquences fluviatiles

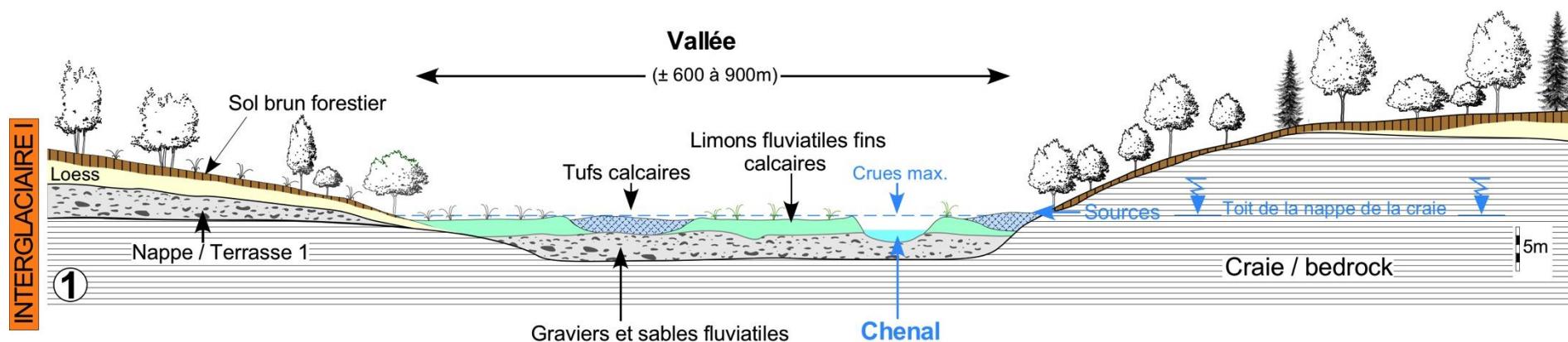


Summary : evolution model for one alluvial formation (terrace) during a single Interglacial-glacial cycle

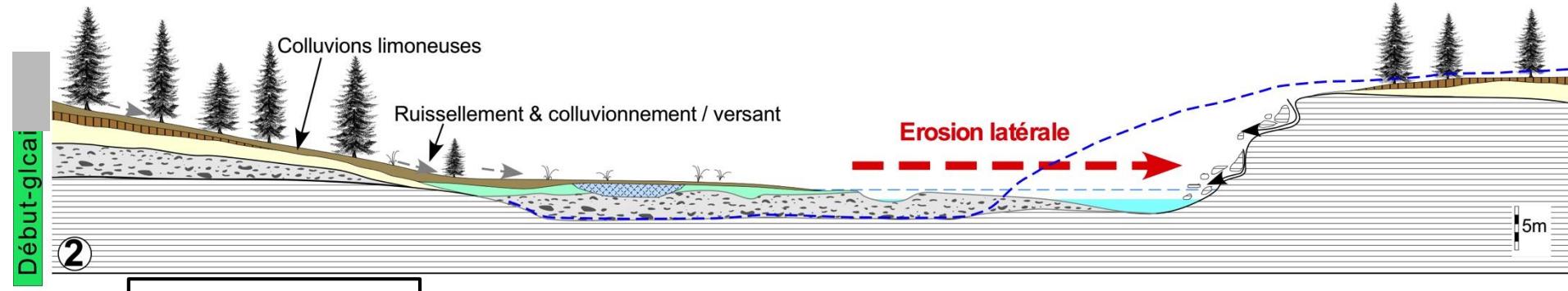


The Interglacial-glacial cycle :

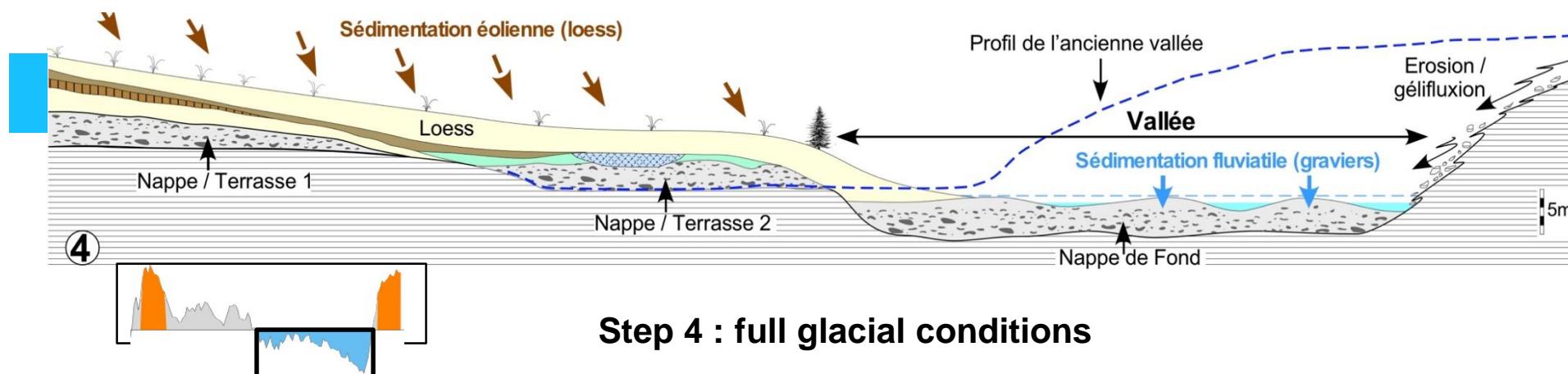
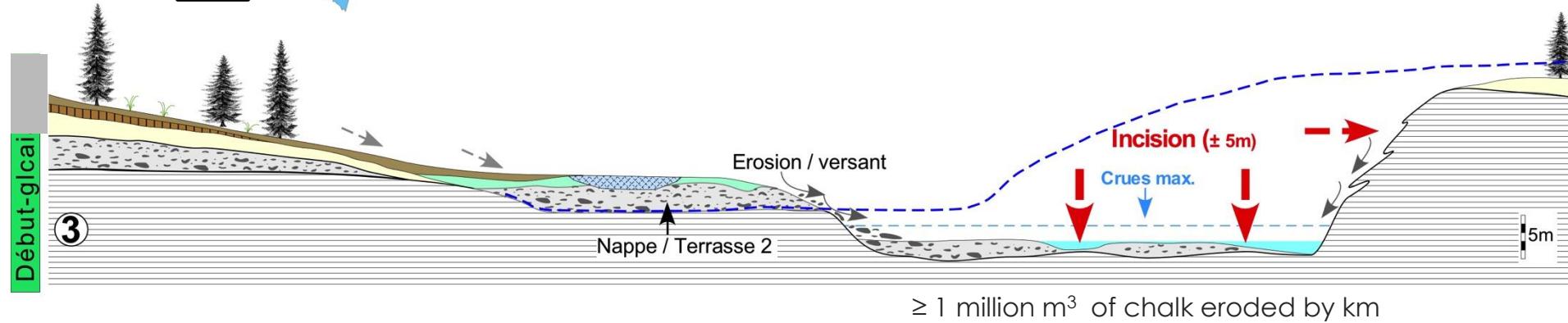
1 & 5 interglacial /
2-3 Early-glacial (transition)
4 : full glacial



Step 1 / initial situation : full Interglacial

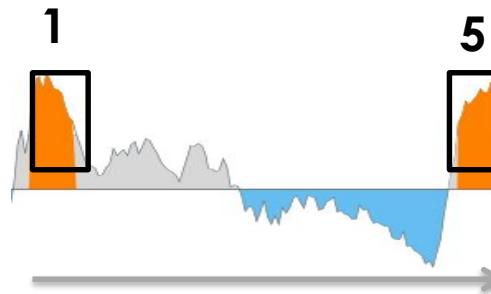


Steps 2 & 3 beginning of the Glacial period



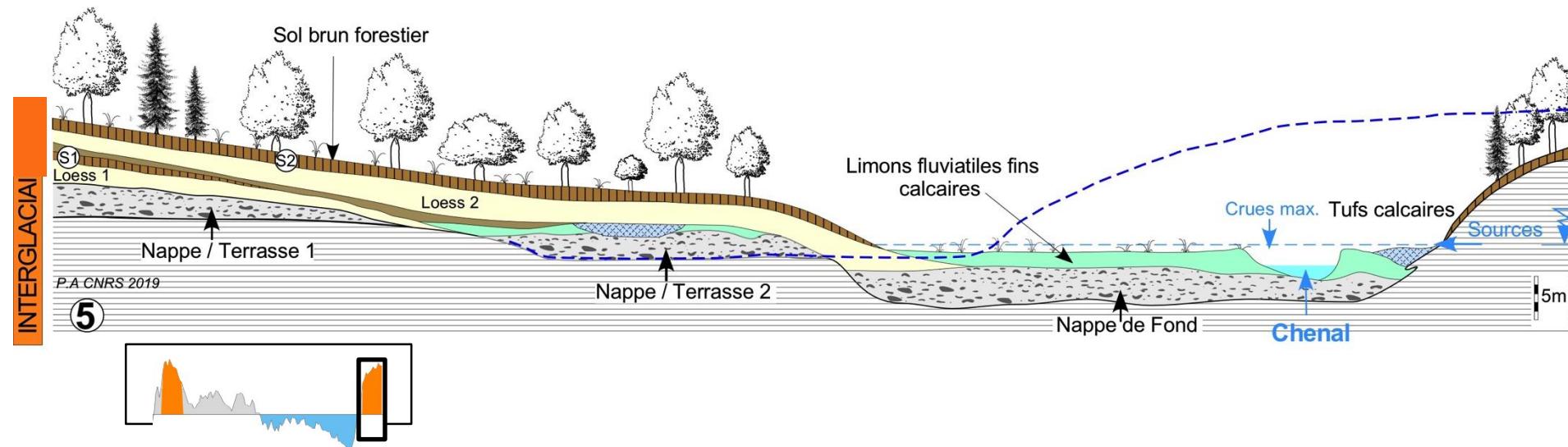
Step 5 : following interglacial

Summary : from one Interglacial to Another (1 to 5) ...

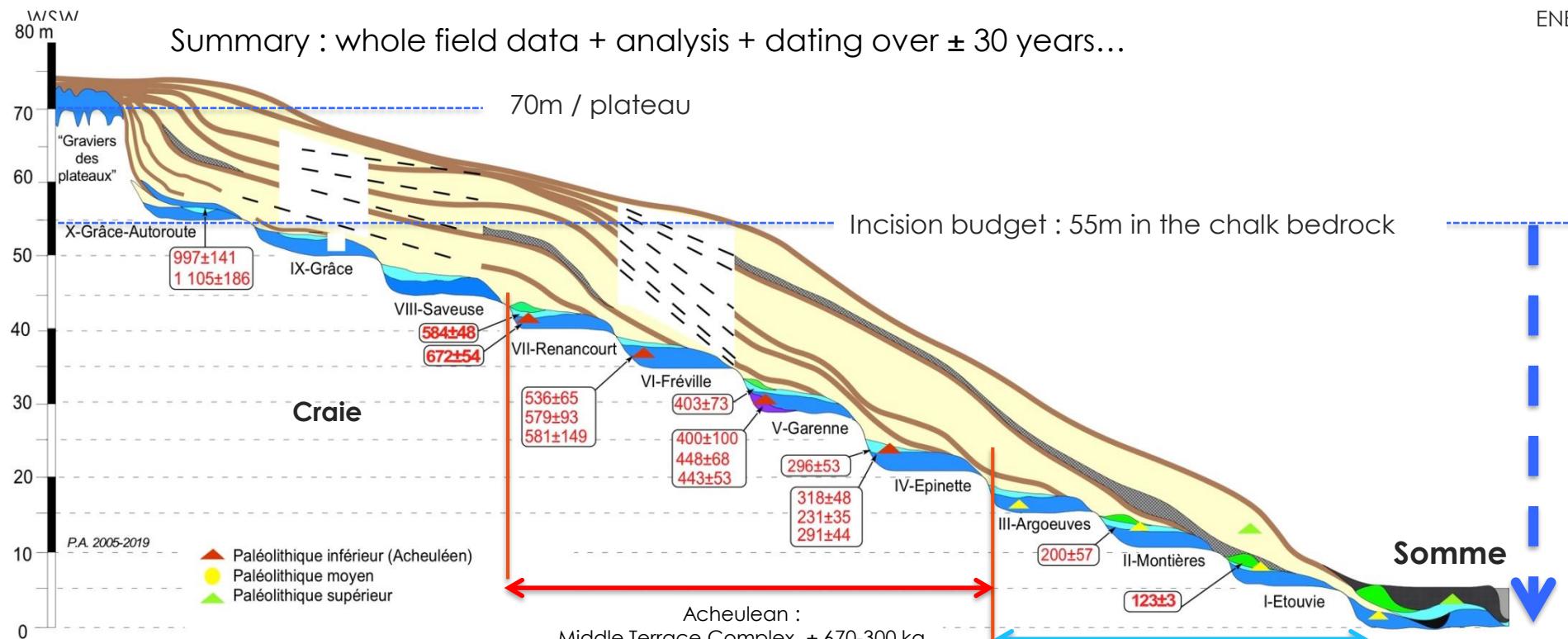


Remain of former valley 1 : Terrasse

New valley 2



@ Summary : global cross-section of the Middle Somme Valley fluvial terrace system



1) 10 stepped alluvial formations (+5/6 to + 55 m)

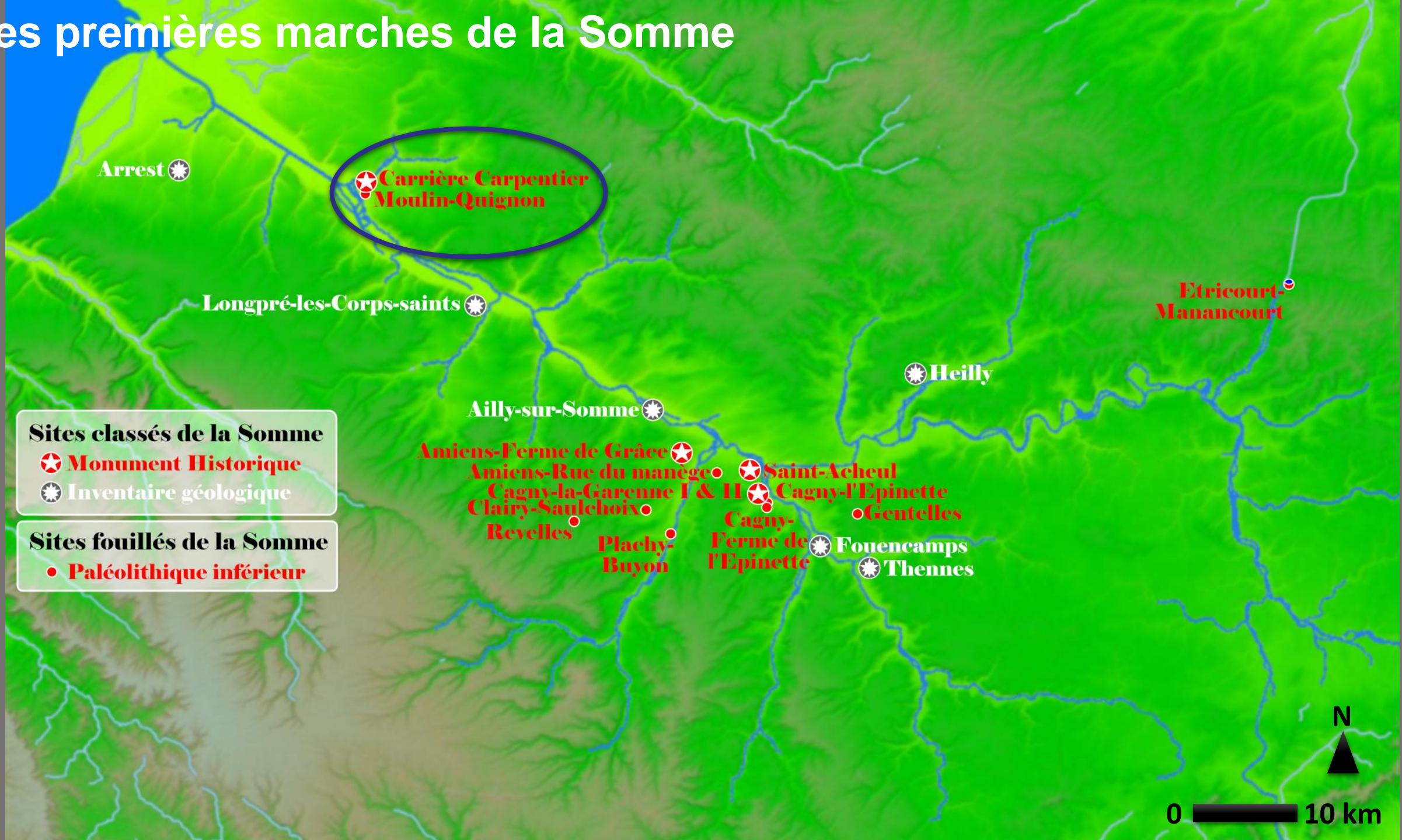


2) Each alluvial formation : 1 glacial-interglacial cycle

3) Each bedrock step : 5-6 m incision / 1 million m³ of chalk / 1 km of valley

(according to : Antoine et al., 2002, 2007, 2010, 2016, 2019)

Les premières marches de la Somme



Les premières marches de la Somme

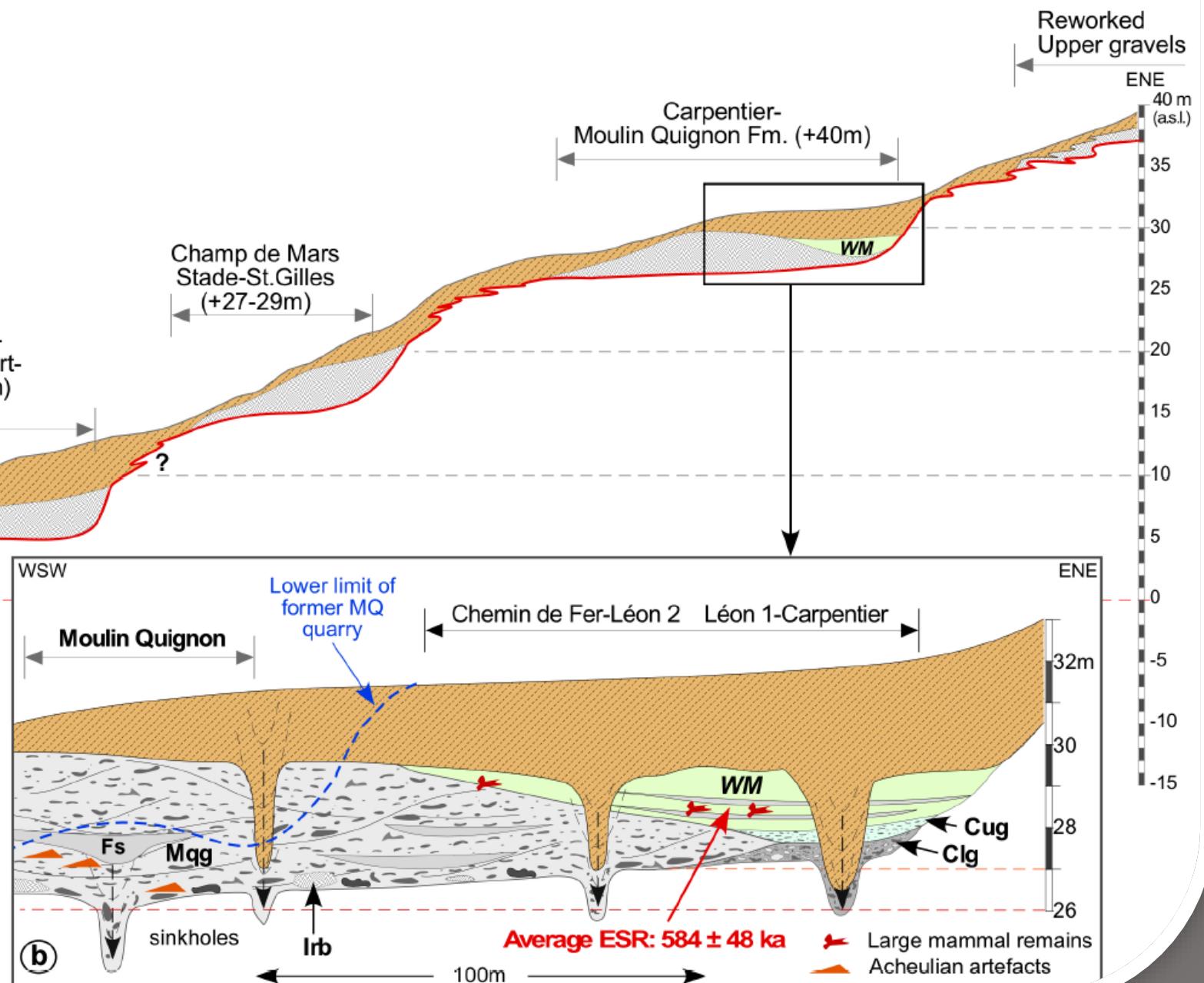
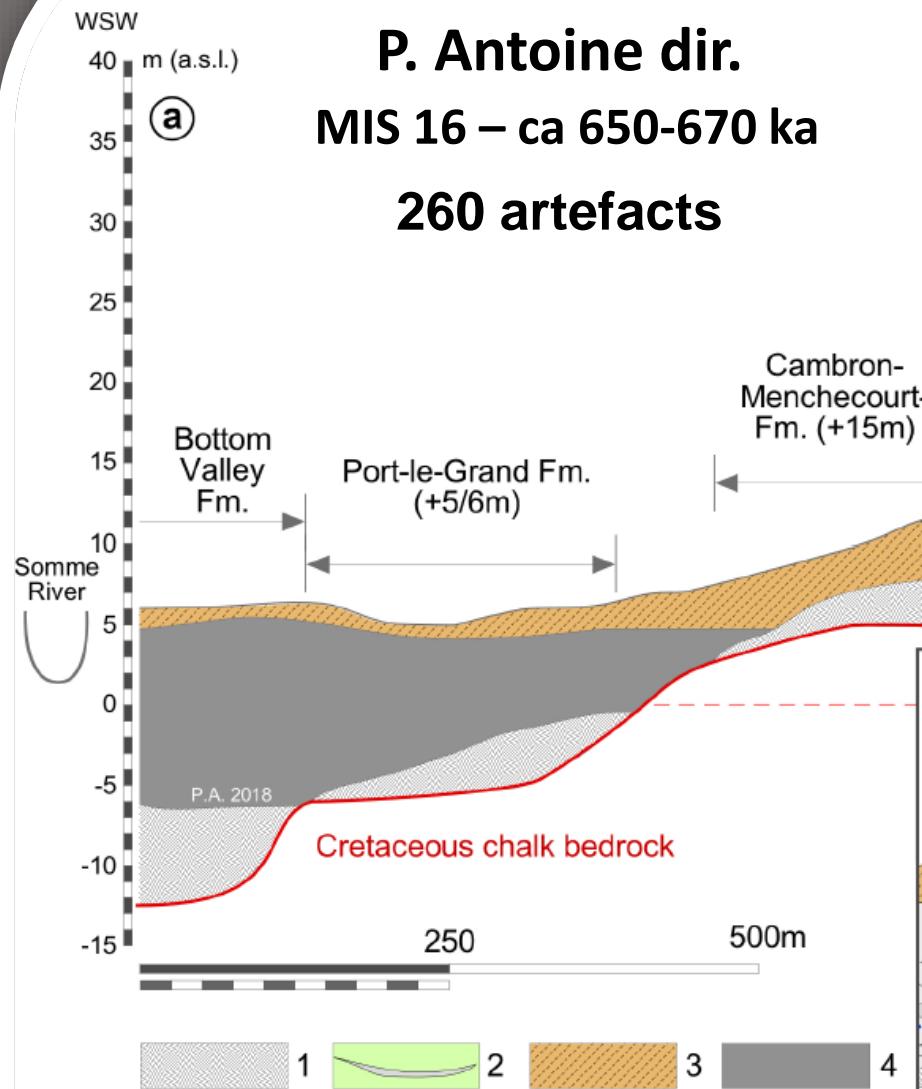
Antoine et al., 2019 NSR

Moulin Quignon

P. Antoine dir.

MIS 16 – ca 650-670 ka

260 artefacts



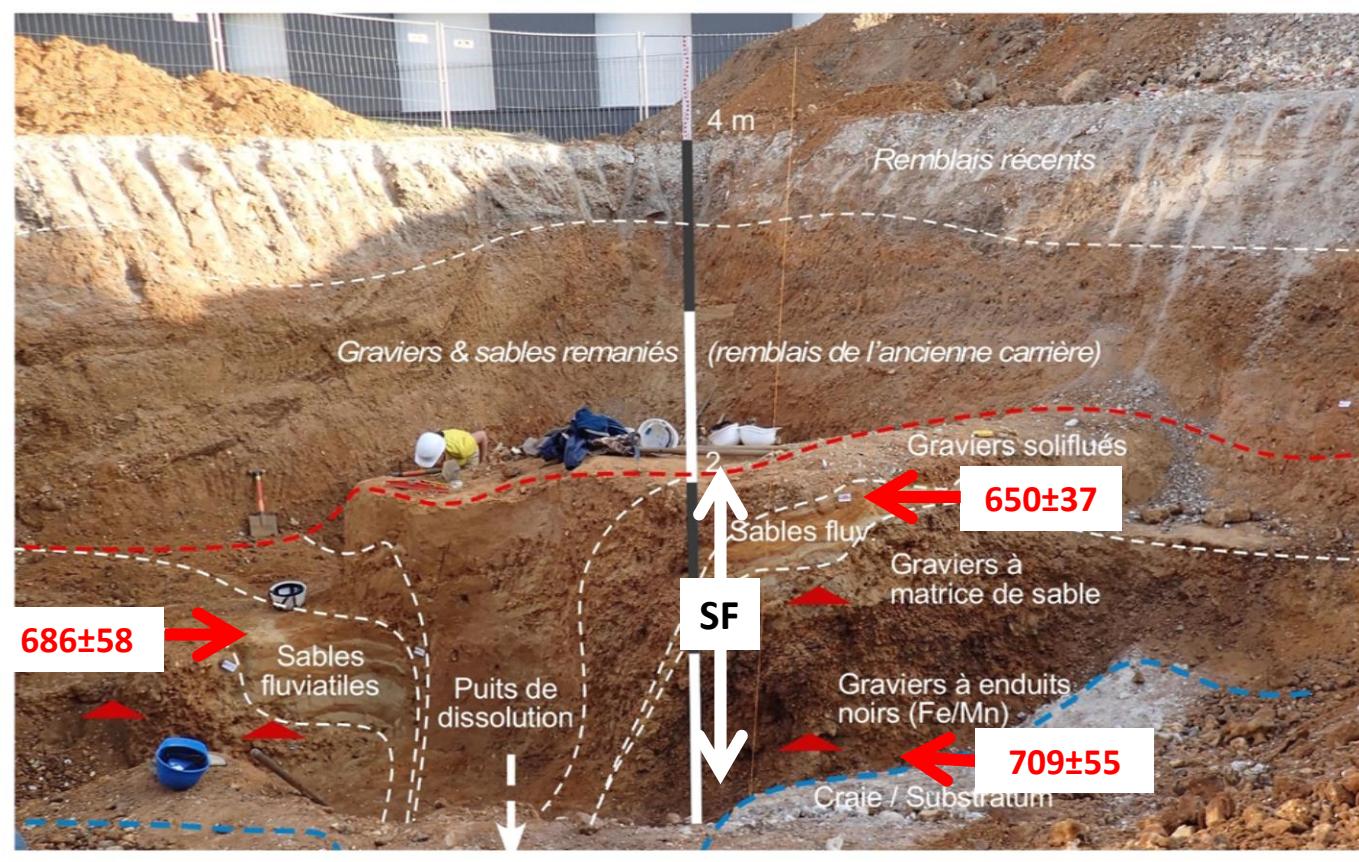
Les premières marches de la Somme

Moulin Quignon

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MIS 16 – ca 650-670 ka

260 artefacts



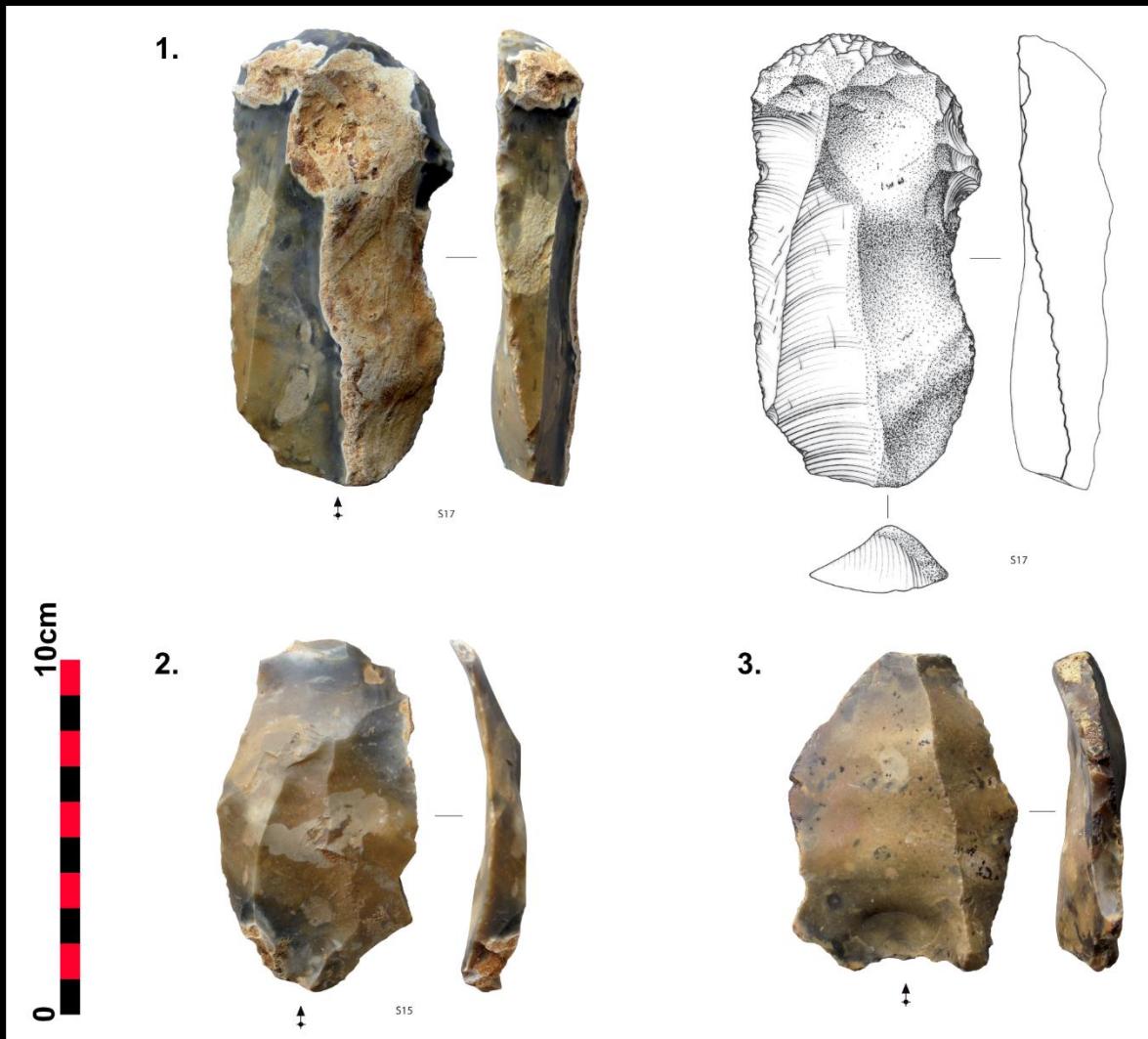
Antoine et al., 2019 NSR

Les premières marches de la Somme

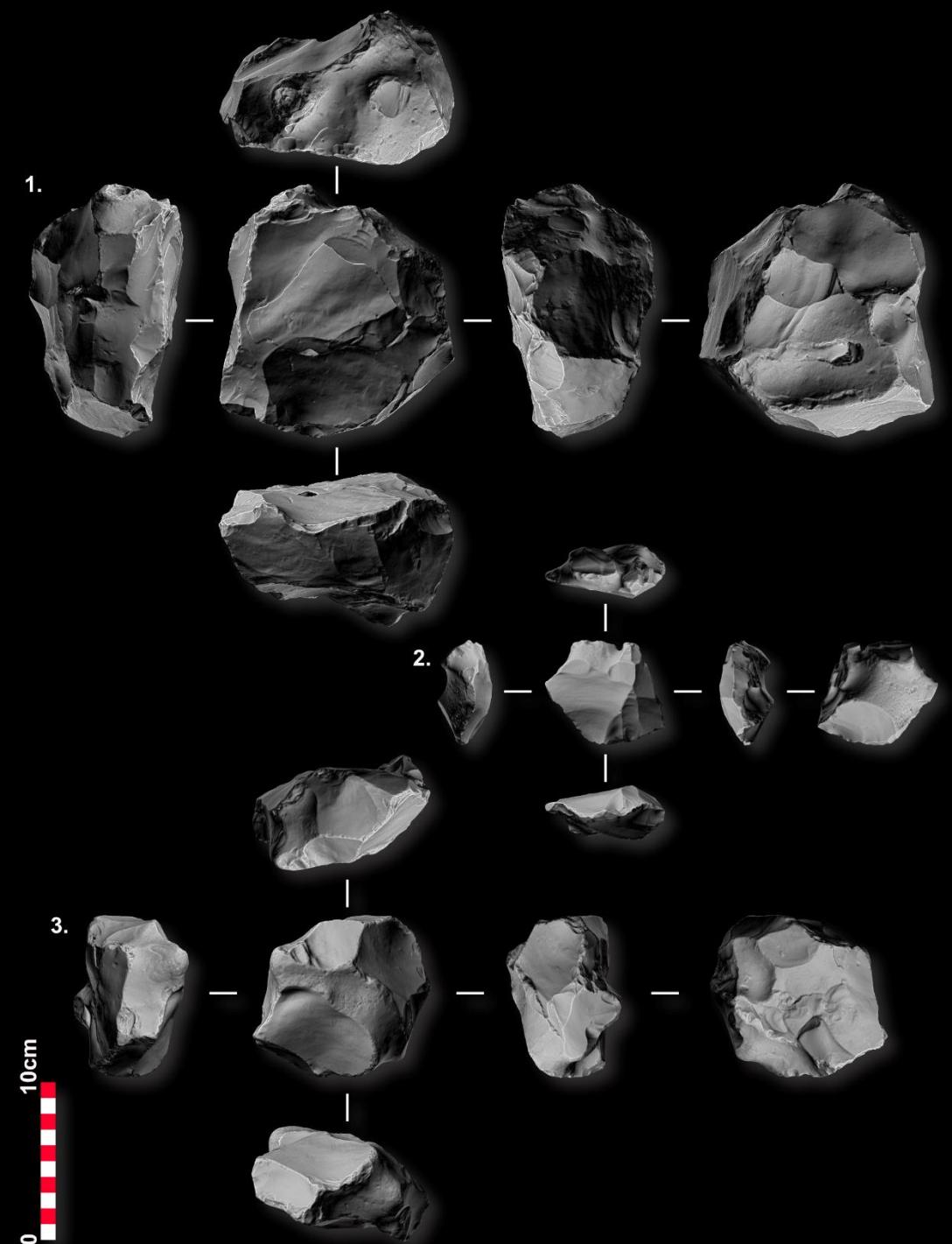
Moulin Quignon

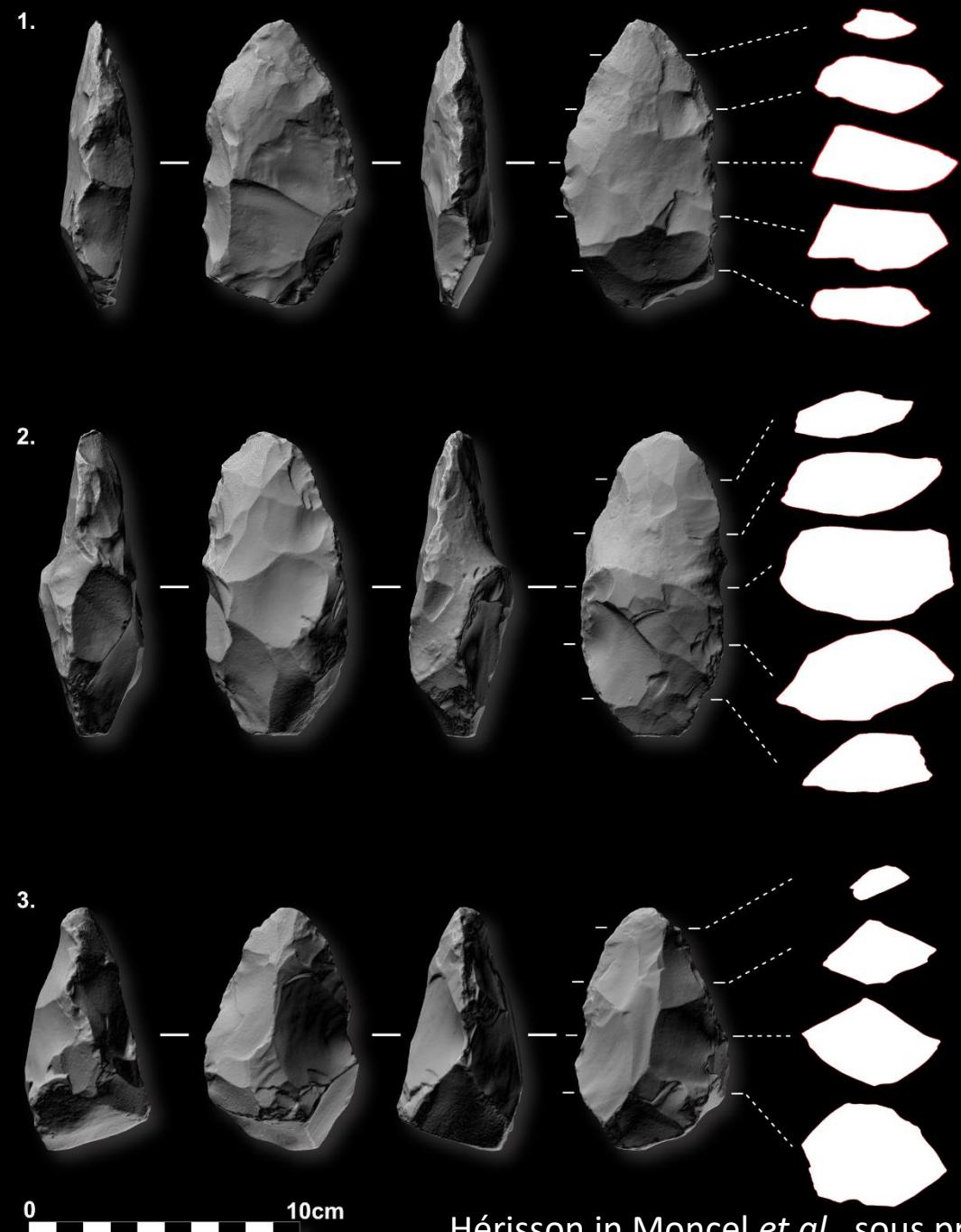
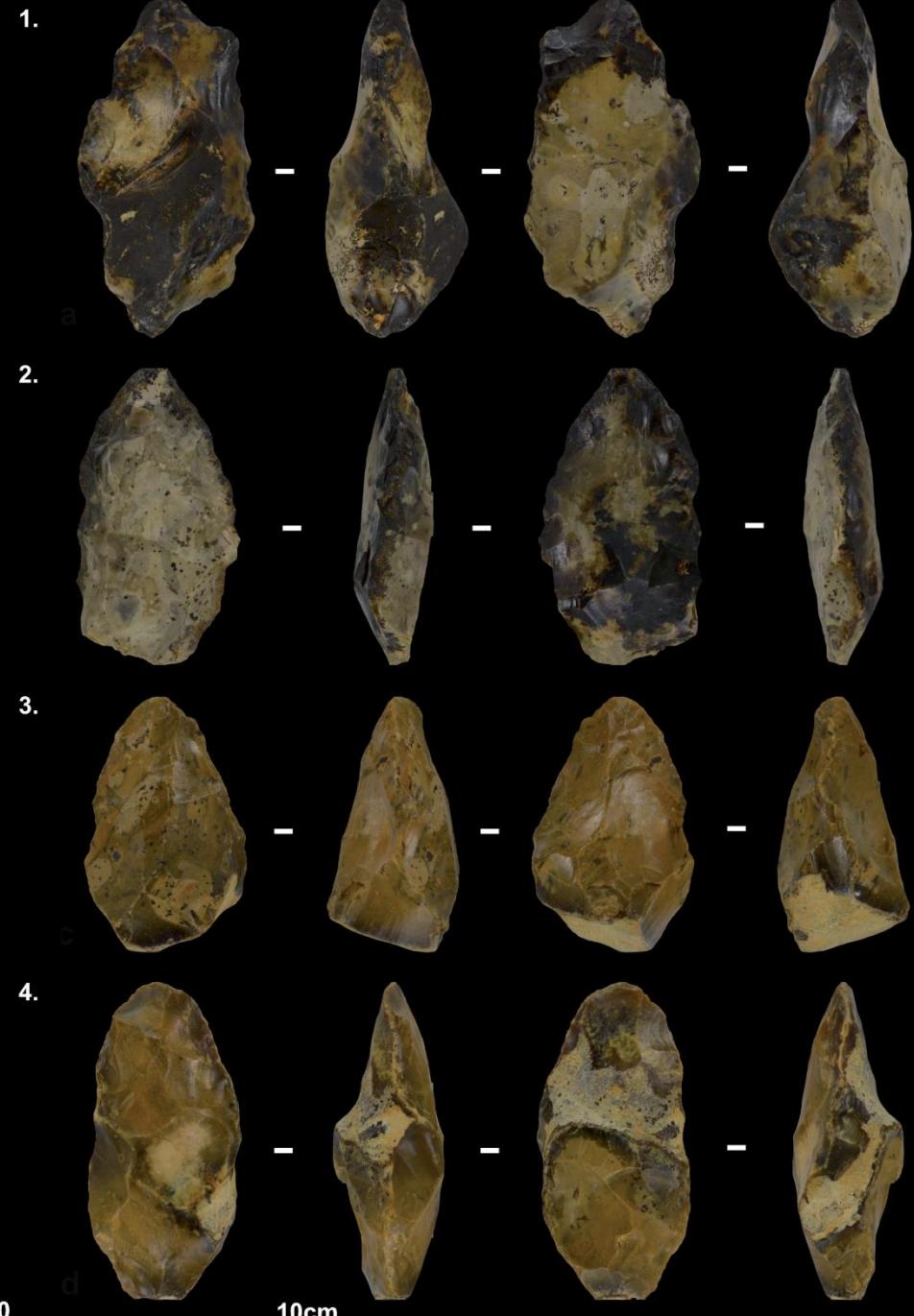
P. Antoine dir.

MIS 16 – ca 650-670 ka



Hérisson in Moncel *et al.*, sous presse





Hérisson in Moncel et al., sous presse

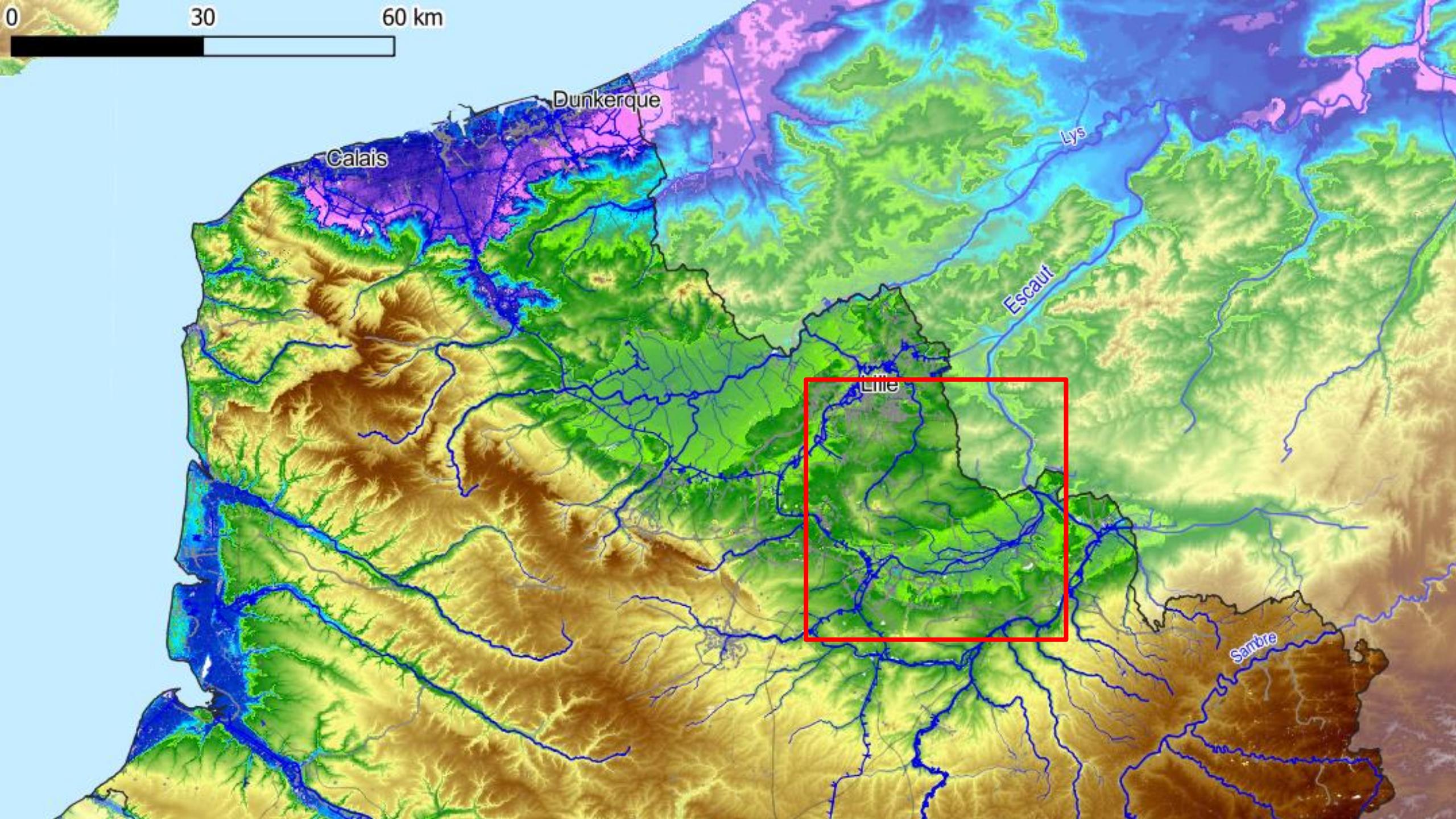
The site of Waziers (northern France, Scarpe plain)

A channel filling, continuous recording of the Saalian-Eemian transition to the Eemian climatic optimum



L. Deschodt, D. Hérisson, R. Amiot, P. Antoine, P. Auguste, J.-J. Bahain, S. Baillon, S. Coutard, A. Dietrich, C. Falguères, F. Fourel, A. Gauthier, B. Ghaleb, G. Hullin, G. Jamet, S. Lacroix, L. Lebreton, C. Lécuyer, N. Limondin-Lozouet, J.L Locht , S. Louquet, C. Maréchal, B. Masson, Y. Petite, S. Rorive, A. Sergent, Q Shao, F. Simon, N. Sévèque, E. Stoetzel, L. Vallin, C. Virmoux

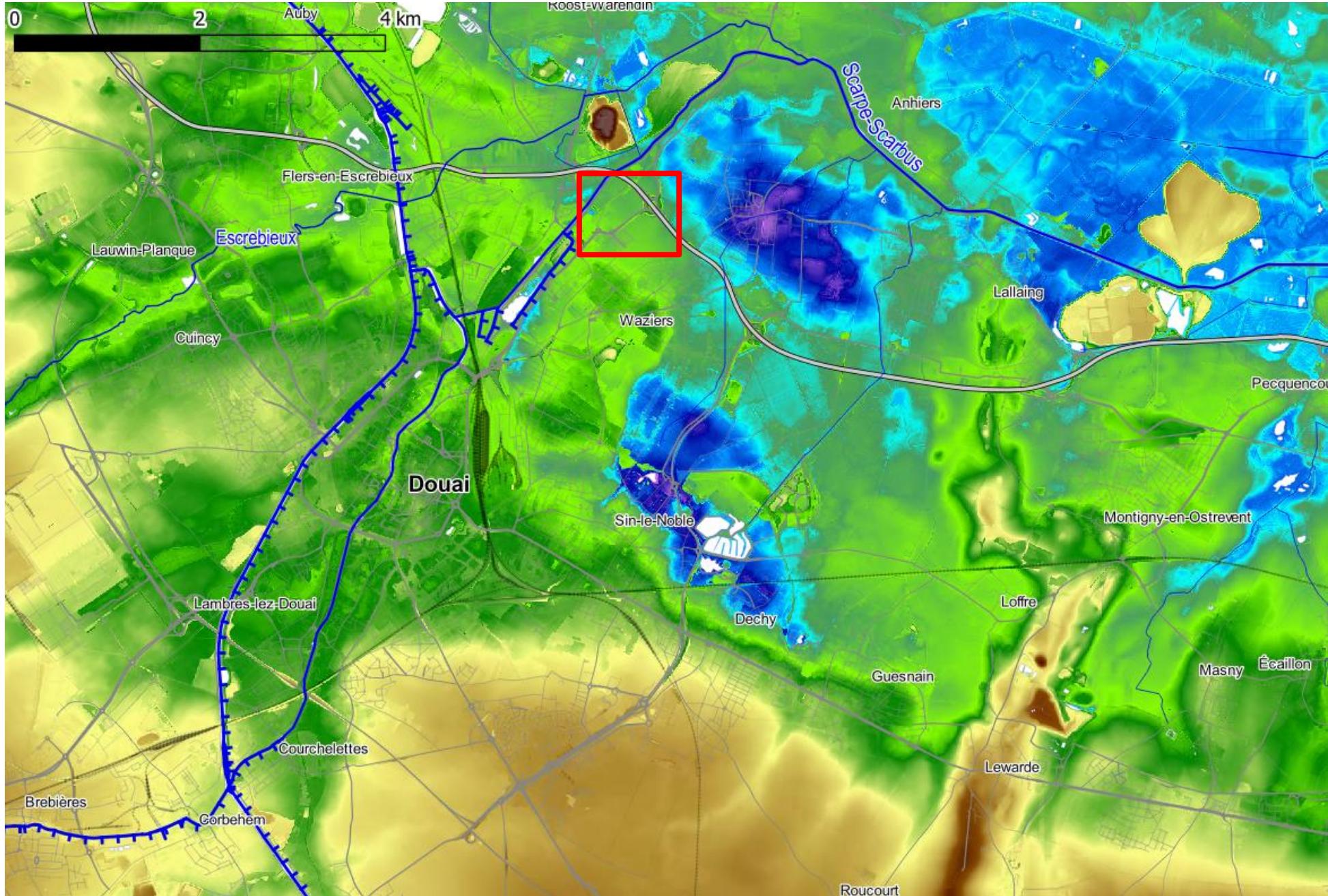




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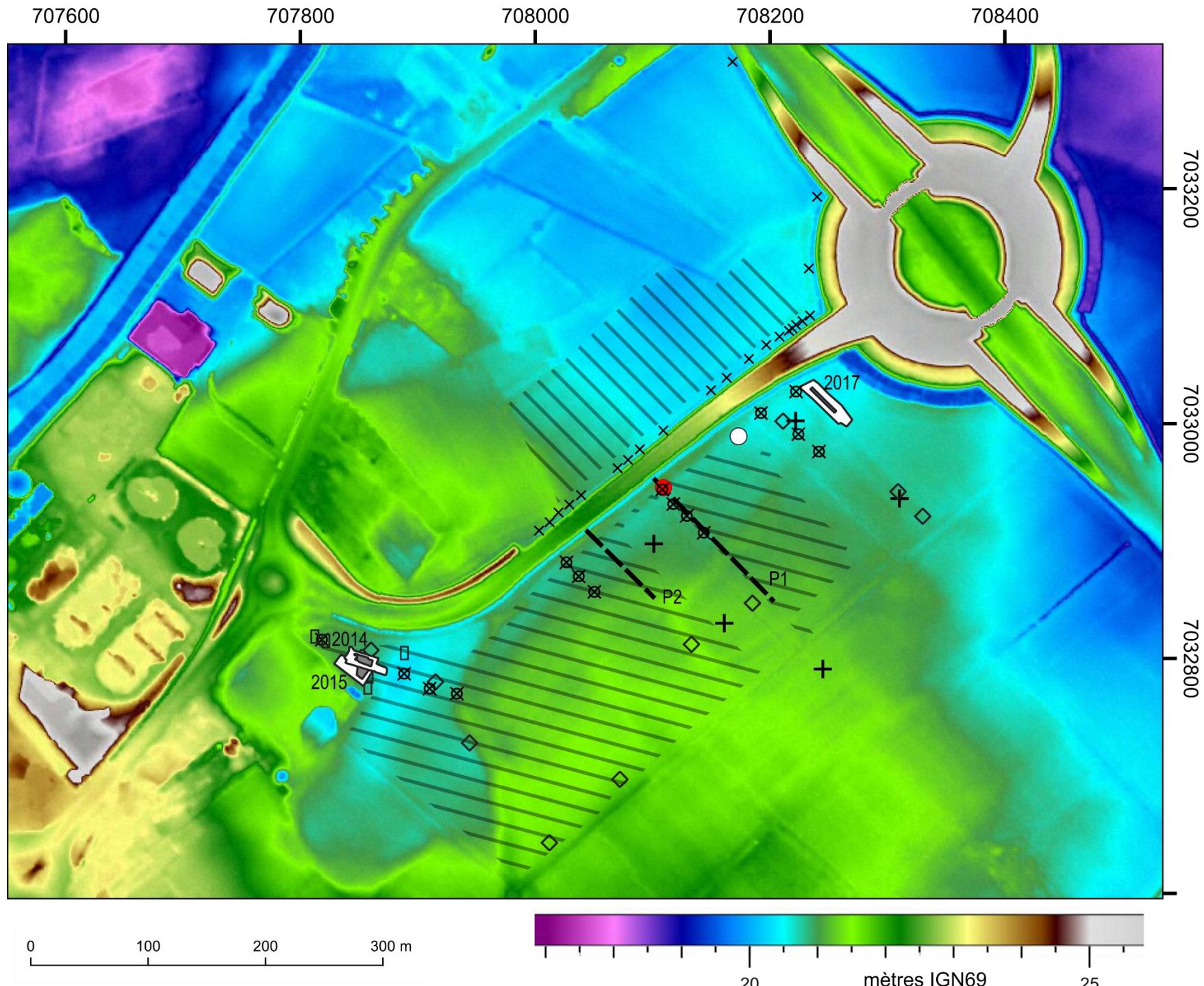
30

60 km



At the junction
between the
Ostrevant slope
and the Scarpe
plain :

an area intended
for the creation
of a business
park

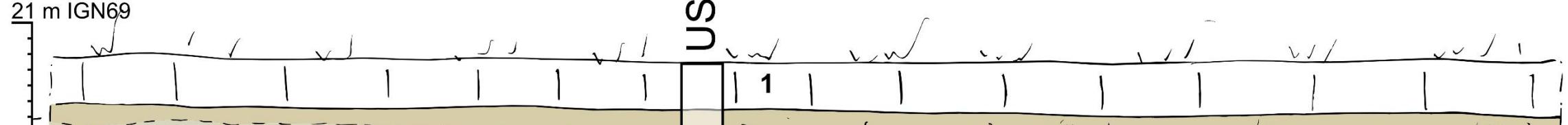


1 in April 2013, opportunistic observation while digging a sump

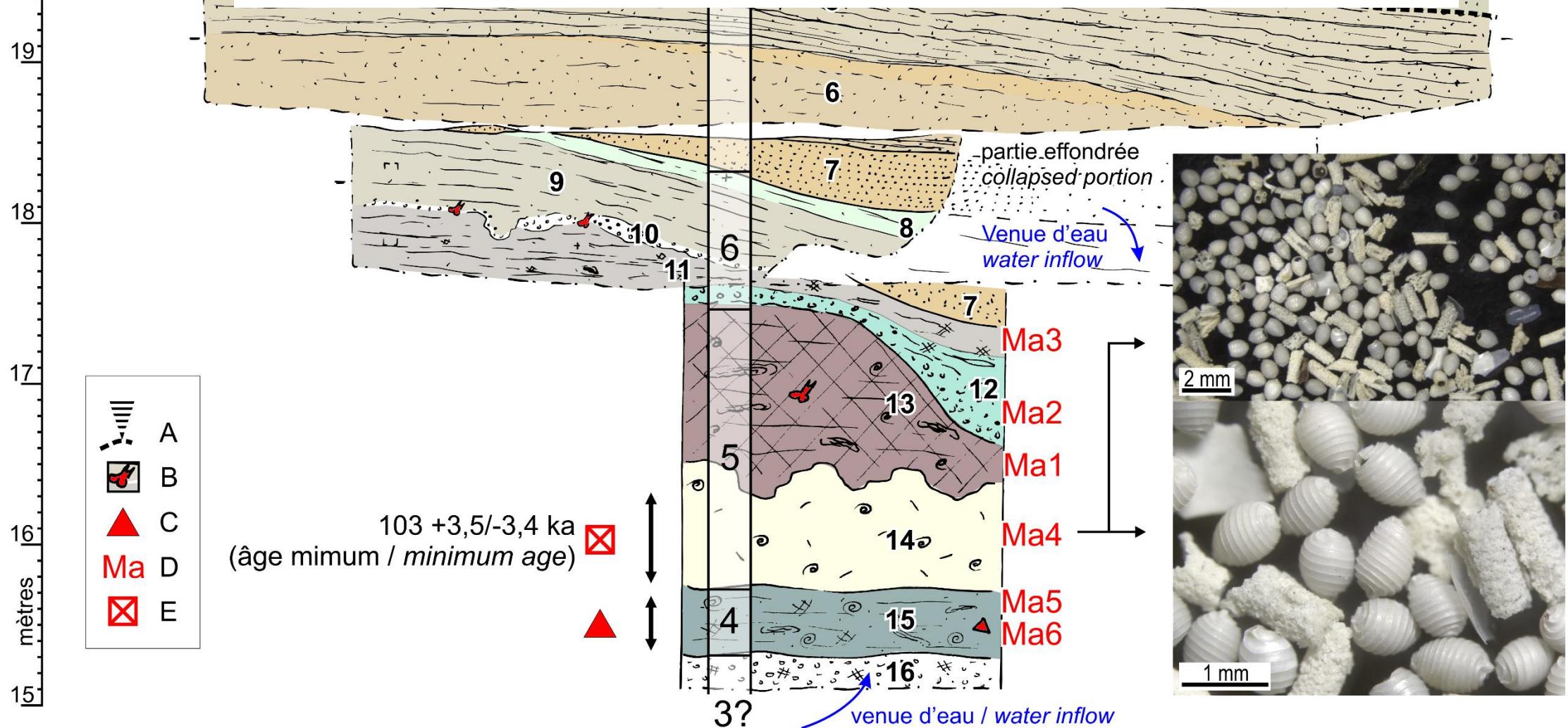


2





we found one more time the peat, with some fauna
the peat overlaying a calcareous deposit of characeous oogones
which have a minimum U-Th date at about 100 ka



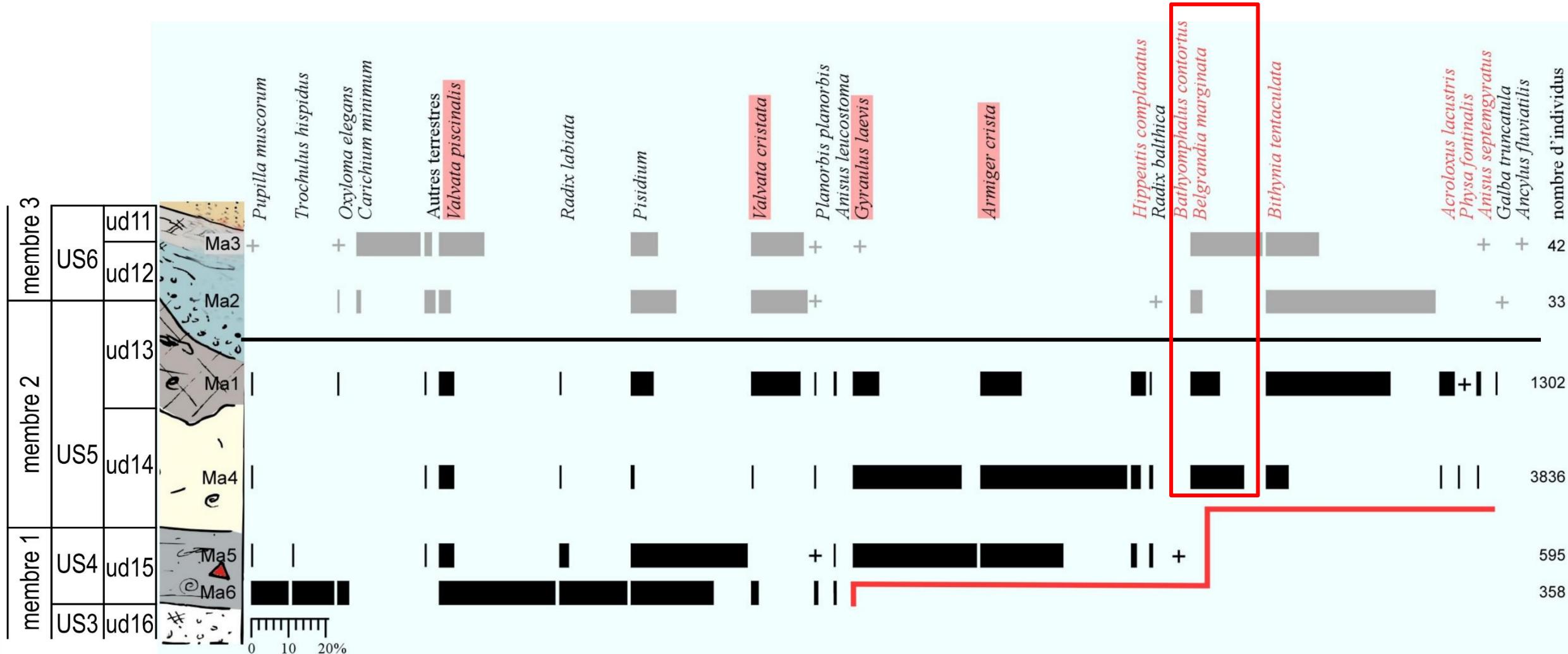


CC BY-SA 4,0
Lamiot



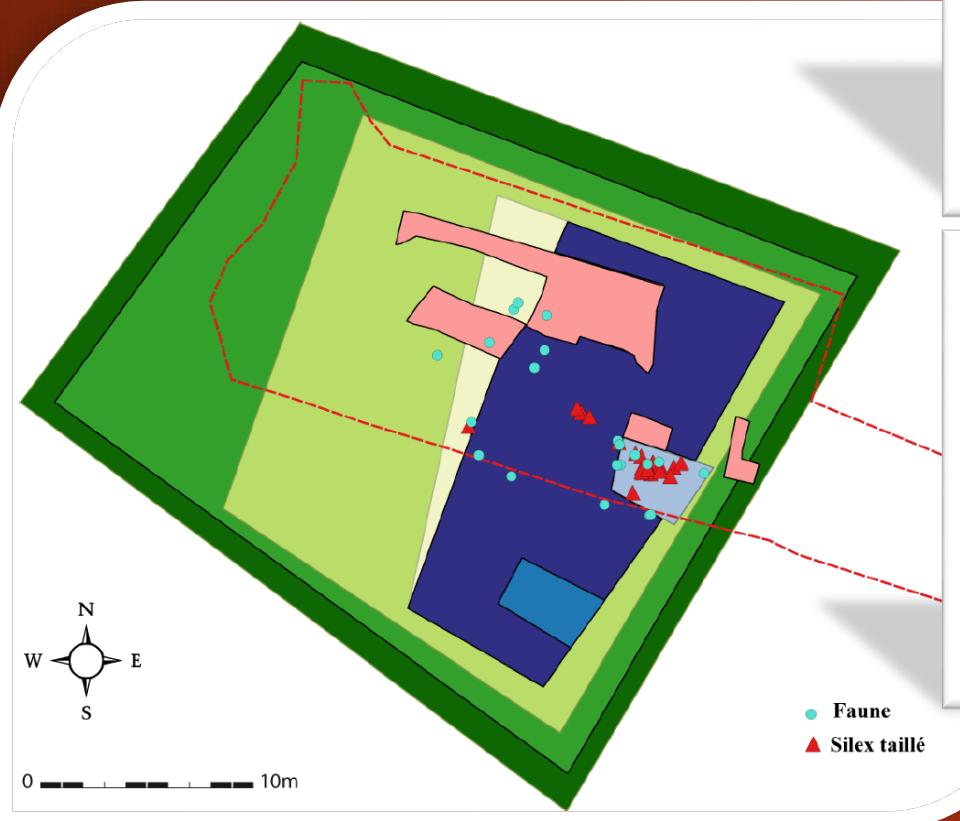
CC BY-SA 3,0
Christian Fischer

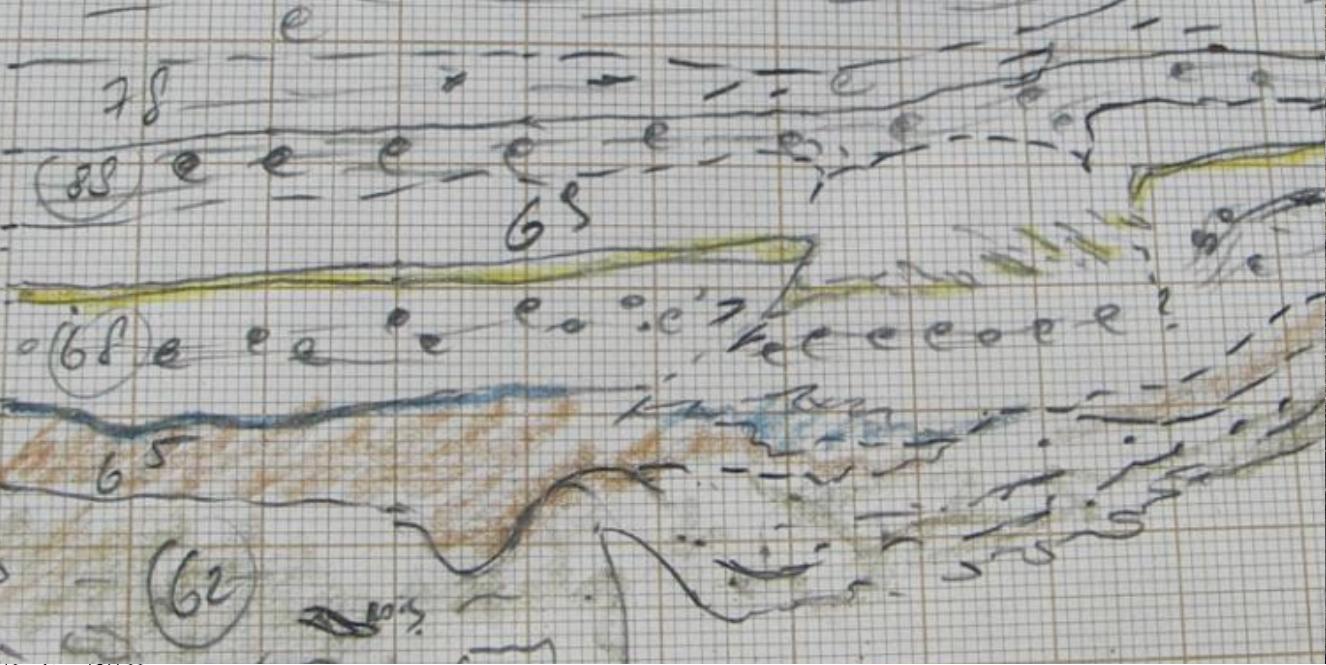
Malacofauna succession: transition from Glacial to Interglacial, with a species not present in the Holocene (*Belgrandia marginata*)



Waziers, une découverte inédite et exceptionnelle

Niveau N3 –
fouille 2015

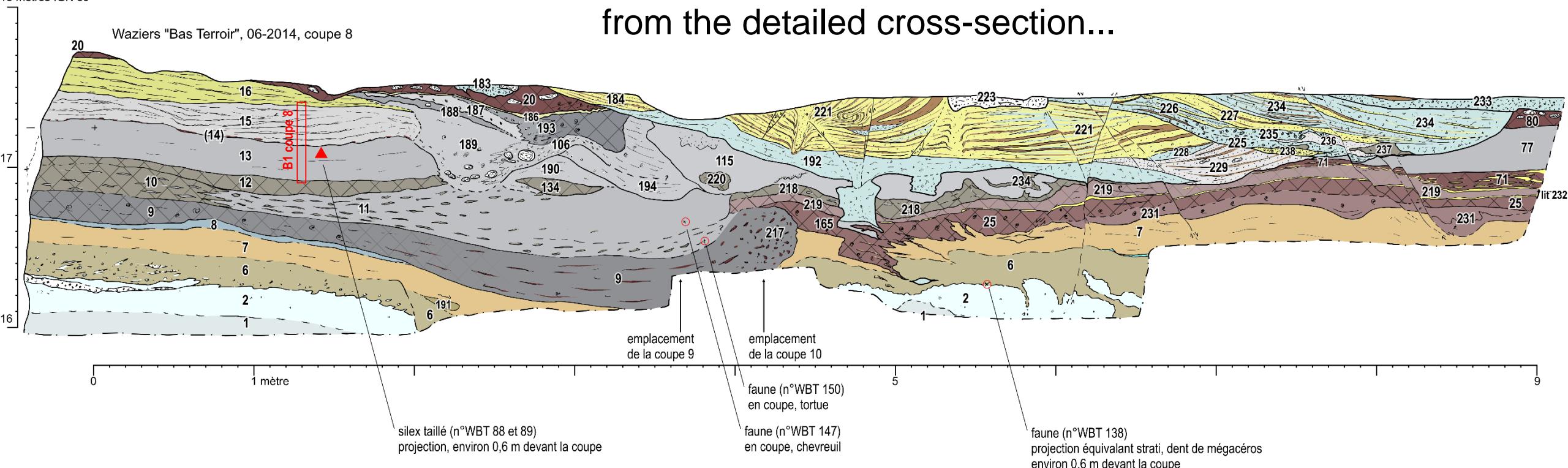


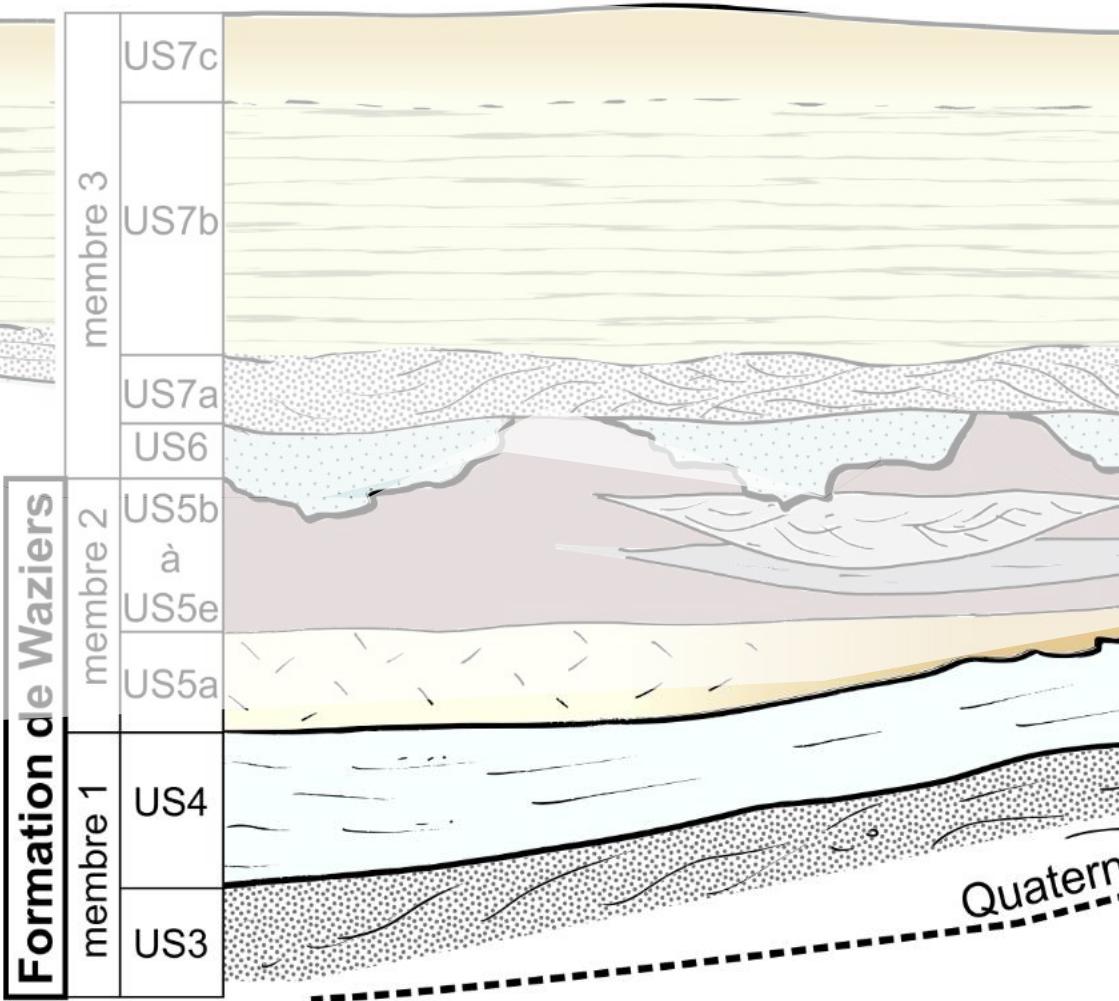


18 mètres IGN 69



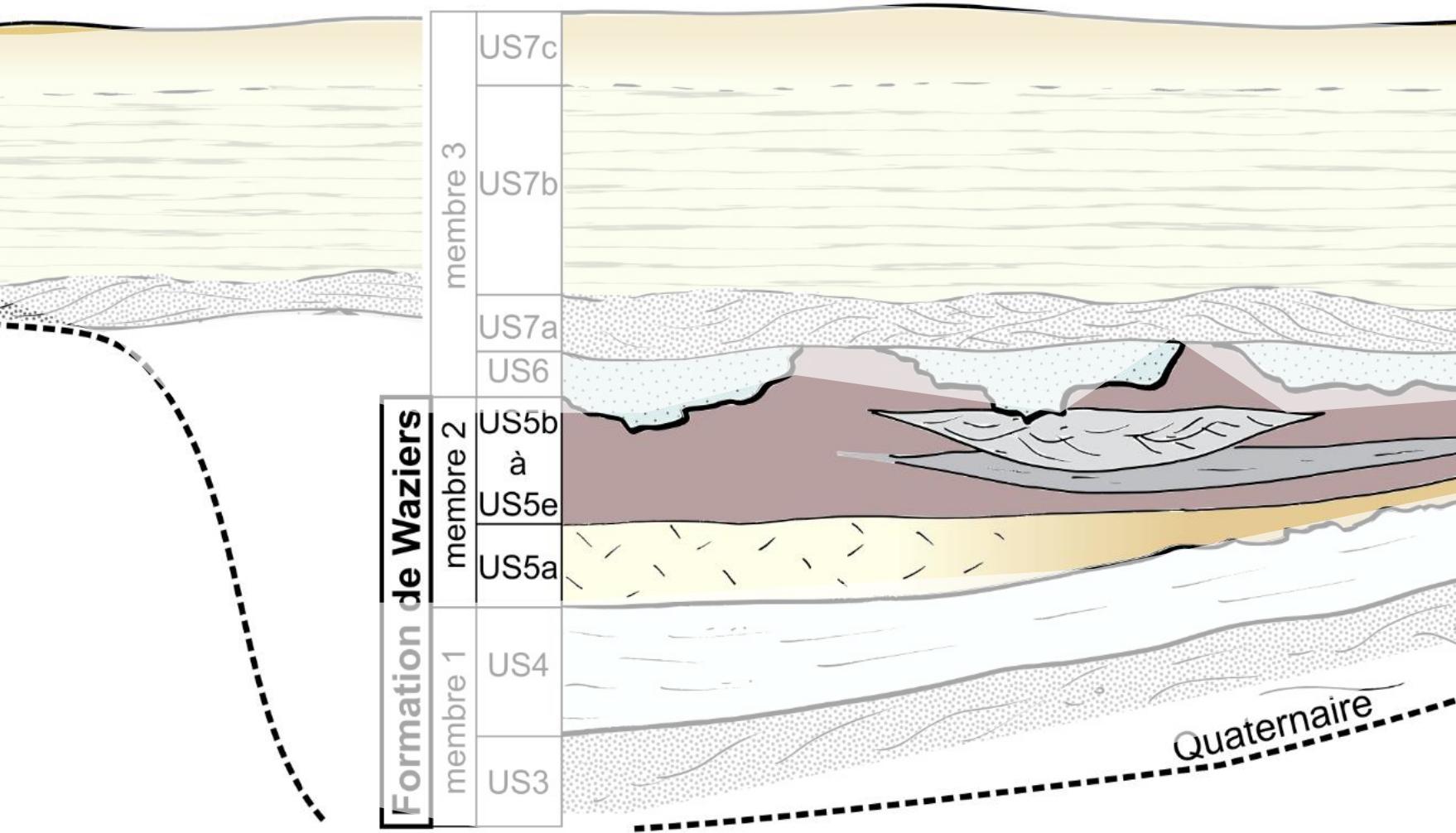
from the detailed cross-section...





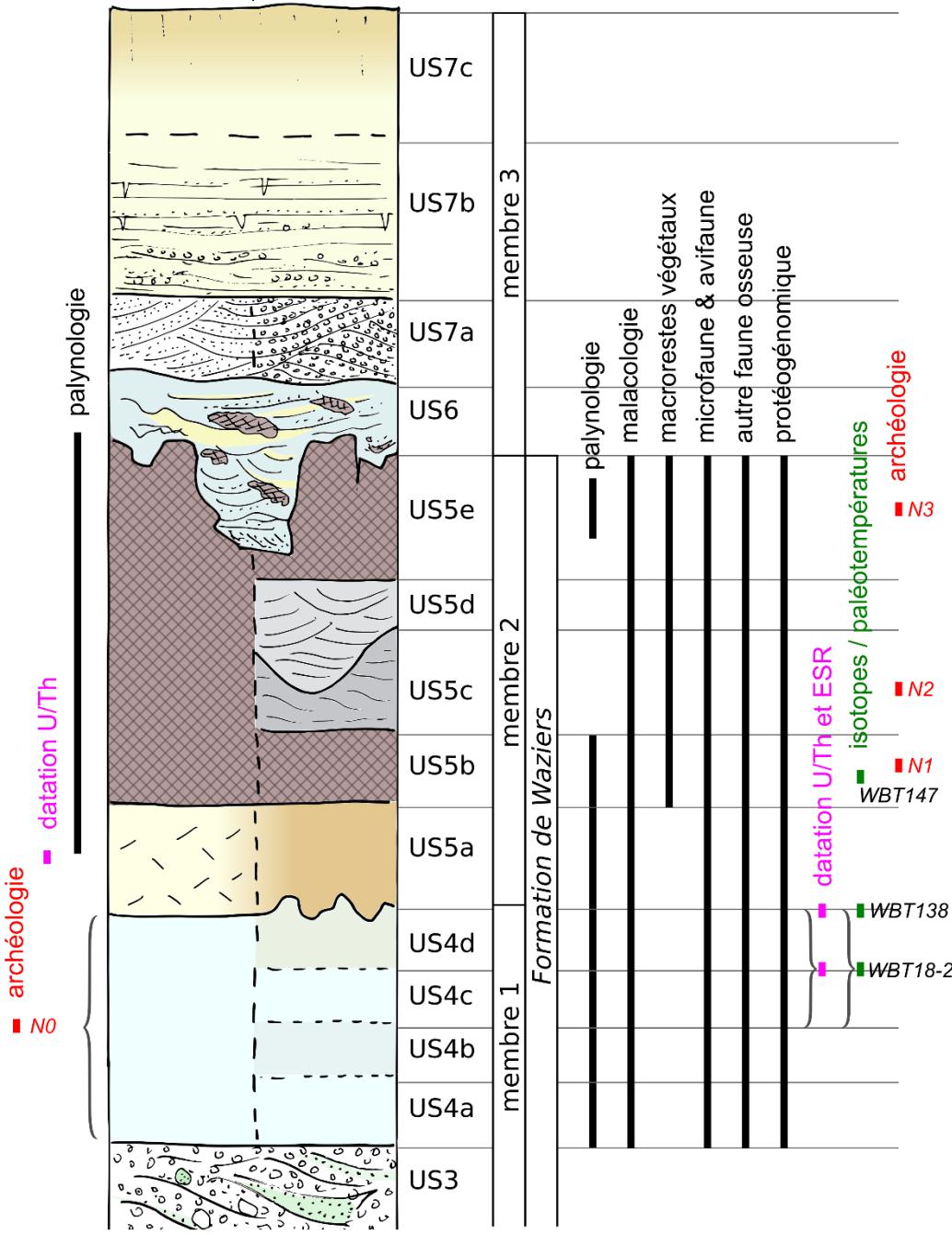
M1 = gravelly alluvium and clastic silts





M2 = tuff, peat with passages of clastic silt

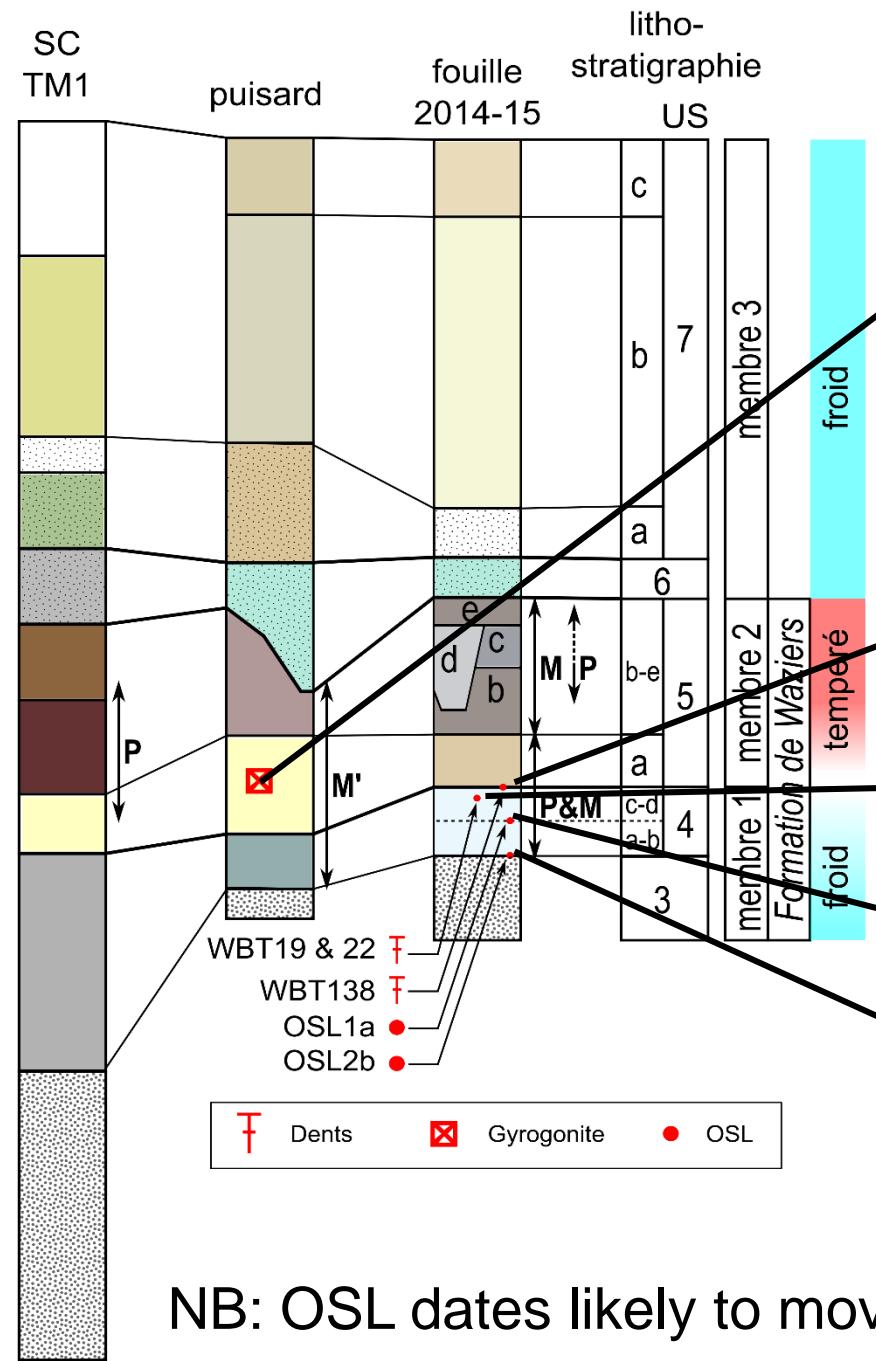
SC5 et
"puisard"
fouilles
2014-2015



Confrontation of variables

- palynology
- malacology
- macro plant remains
- microfauna
- bone fauna
- geochronology
- archaeology
- paleotemperature reconstruction
- (...)

m IGN69



103 +3,5/-3,4 ka
âge minimum

132 ± 8 ka

125 ± 8 ka

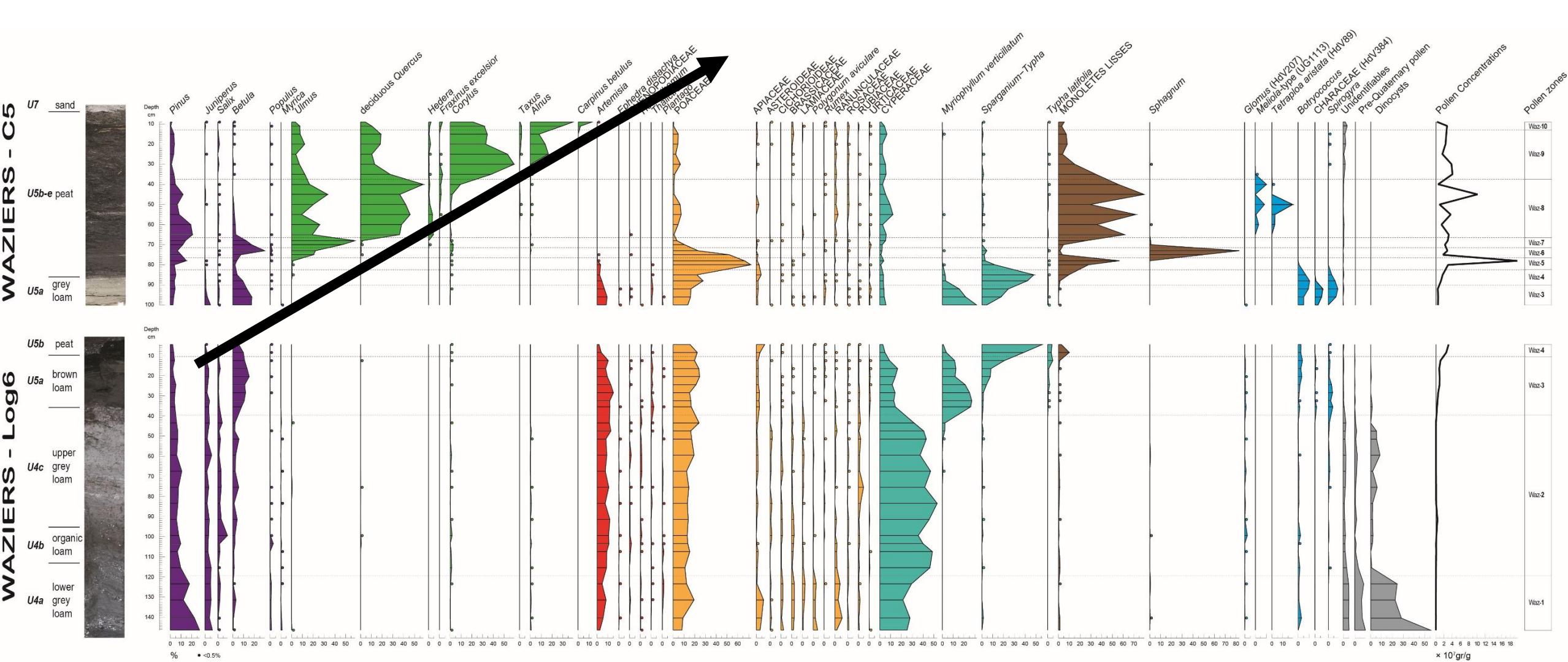
138 ± 8 ka

123 ± 8 ka

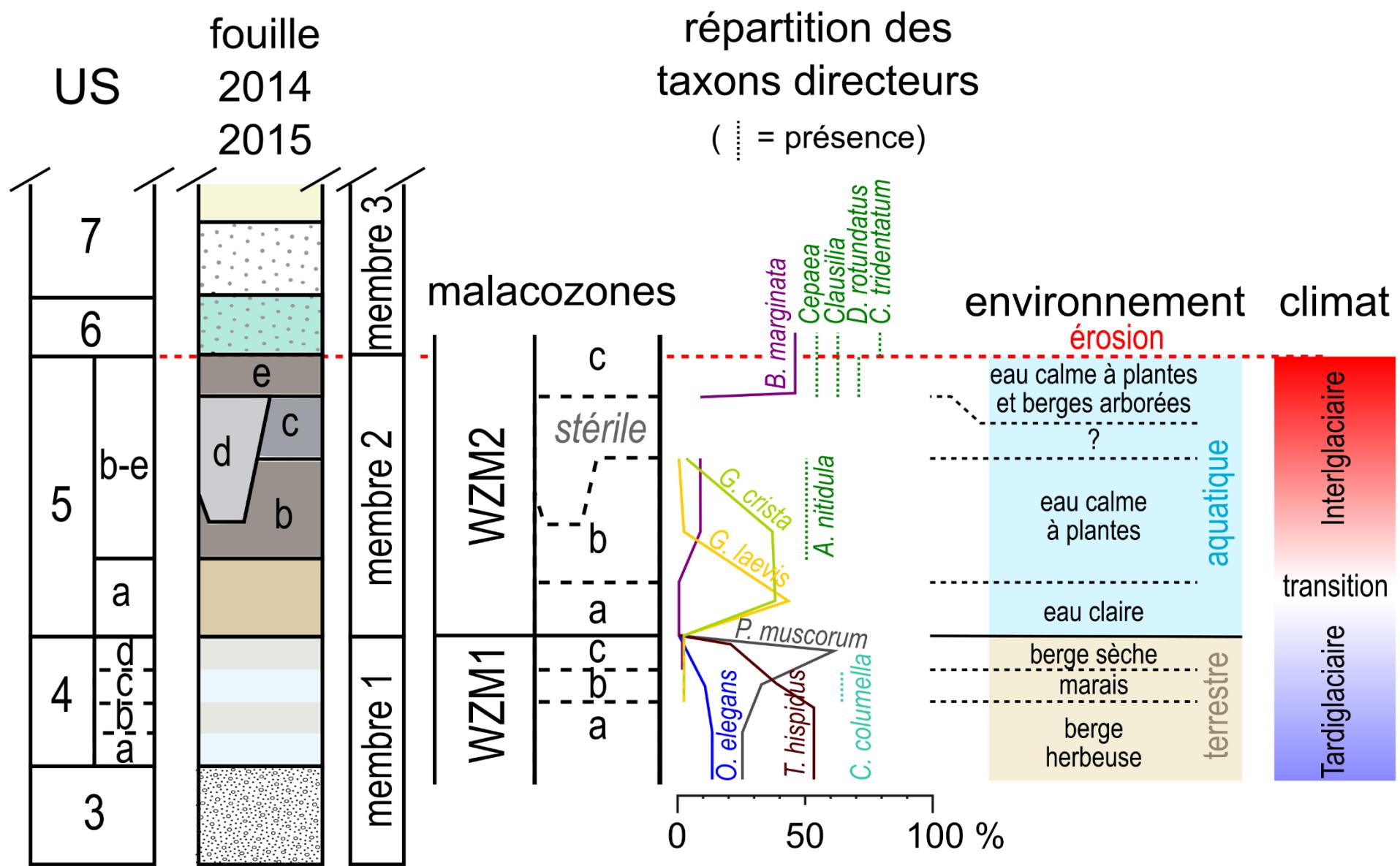
115,89 ± 5,2 ka

125,41 ± 6,1 ka

NB: OSL dates likely to move again depending on radiometric palaeodose



Transition from a **tundra-steppe** in Member 1
to a **wetland with pioneer trees** at the base of Member 2
and then **forest** towards a **climatic optimum** at the top of Member 2



Change from **cold and dry bank climate** in M1 to a wetland at the base of M2, then **wetland and interglacial species** in the upper part of M2

Waziers, un riche spectre faunique exploité par...

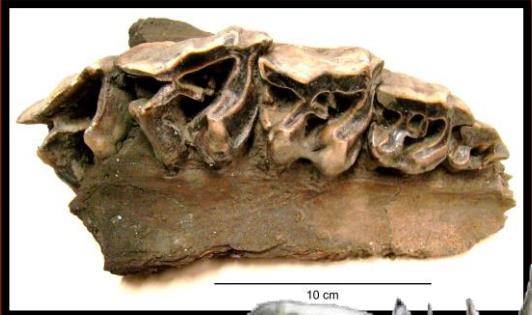
Tortue



Oiseaux
(canards, cygnes...)



Rhinocéros de prairie
(*Stephanorhinus cf hemitoechus*)



Castor (*Castor fiber*)

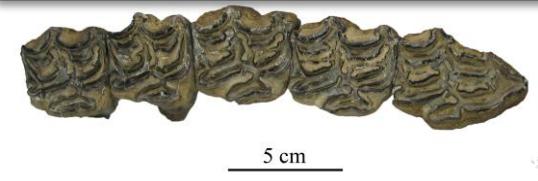


Ours brun (*Ursus arctos*)



© B. Clarys

Cheval (*Equus sp.*)



© B. Clarys

Chevreuil



Aurochs

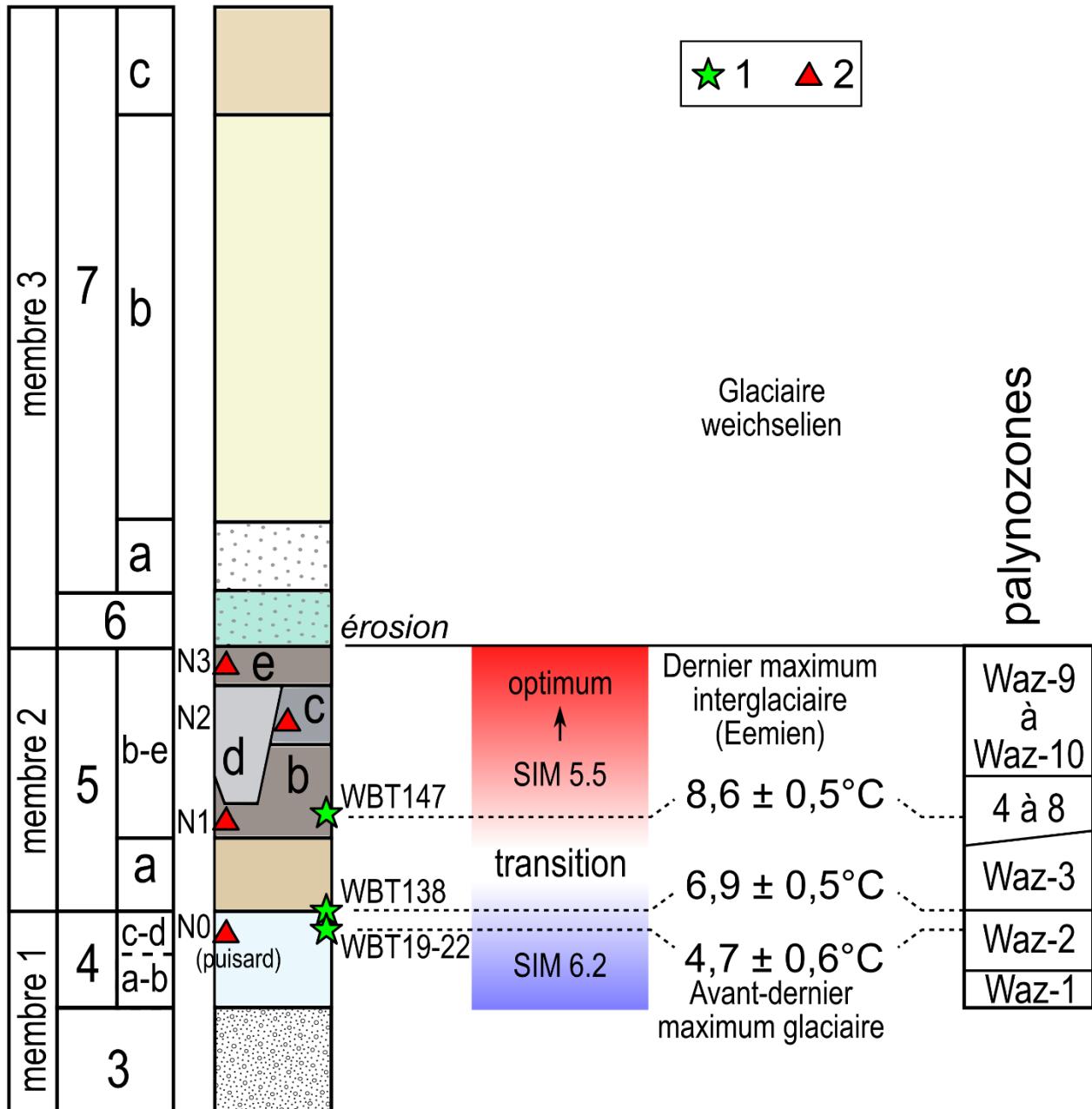


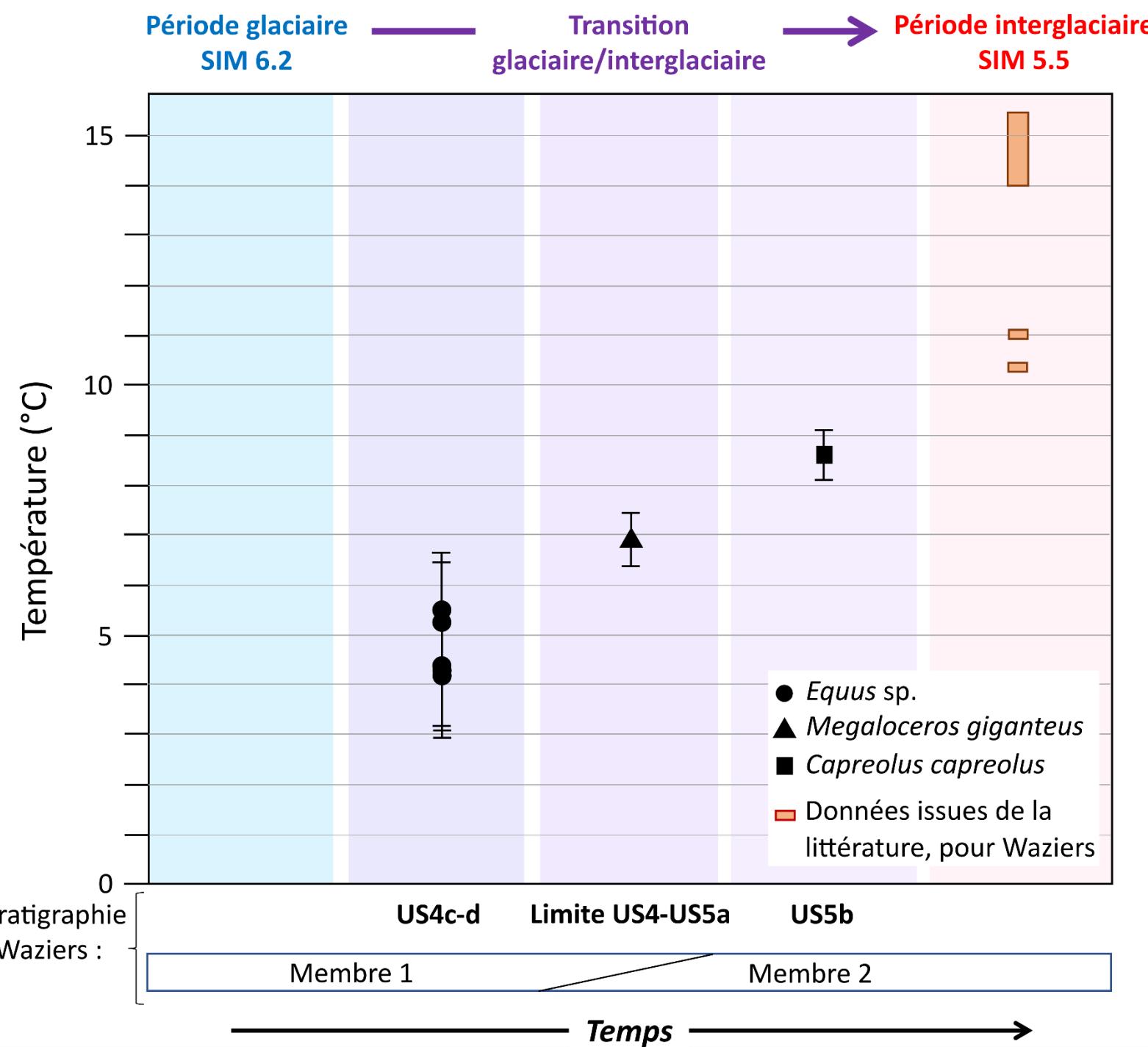
Cerf



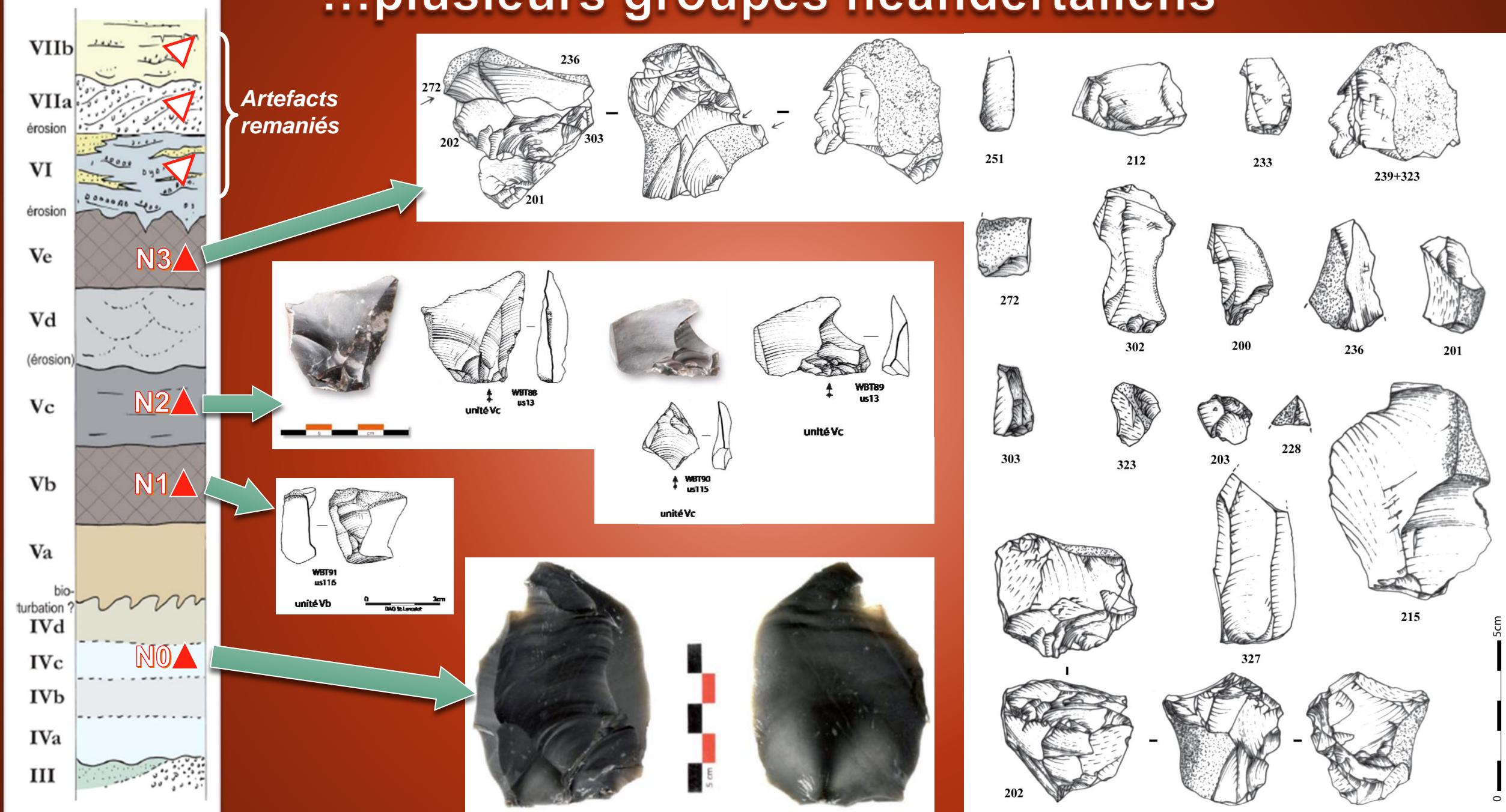
© B. Clarys

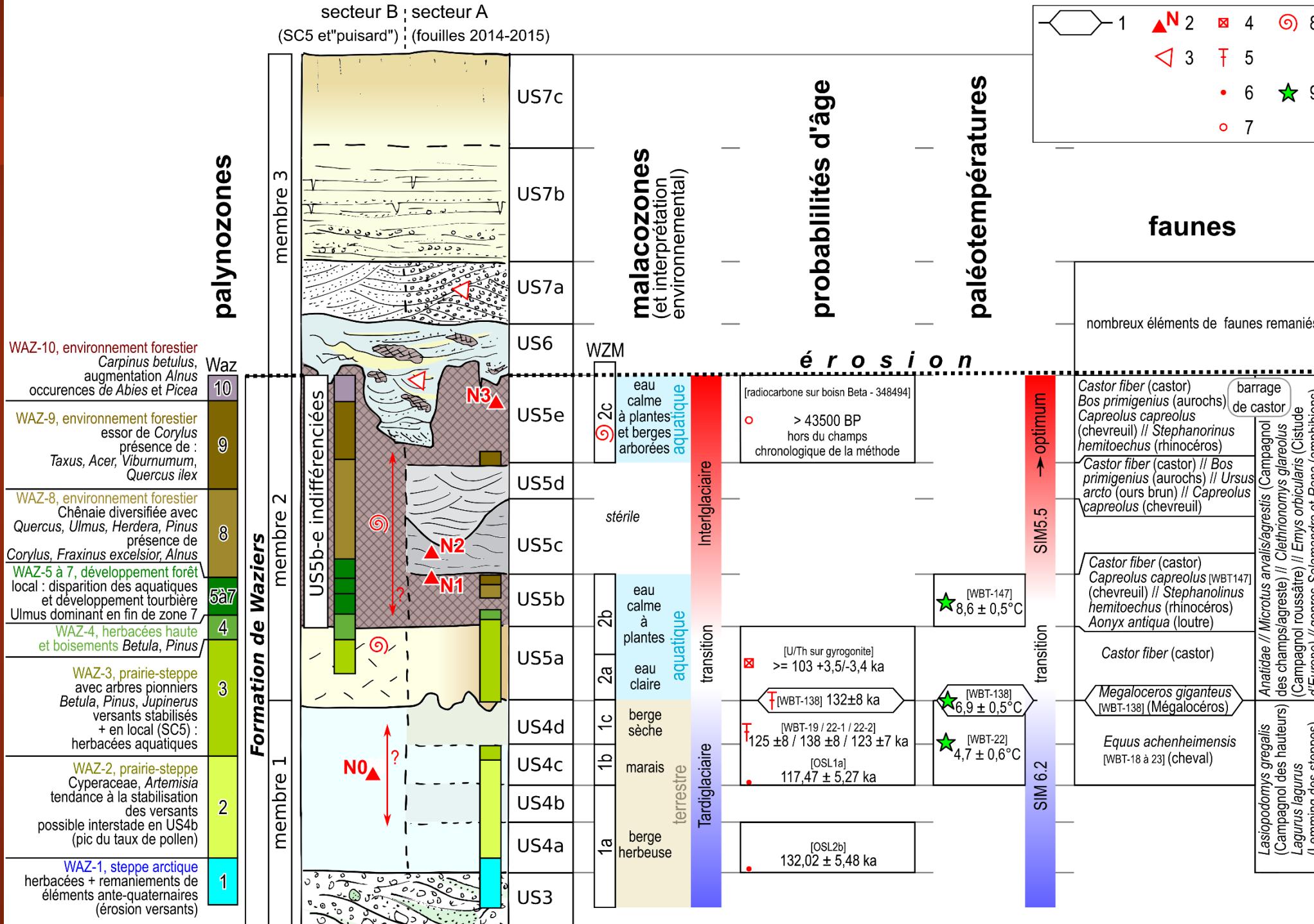
US fouilles
2014-15

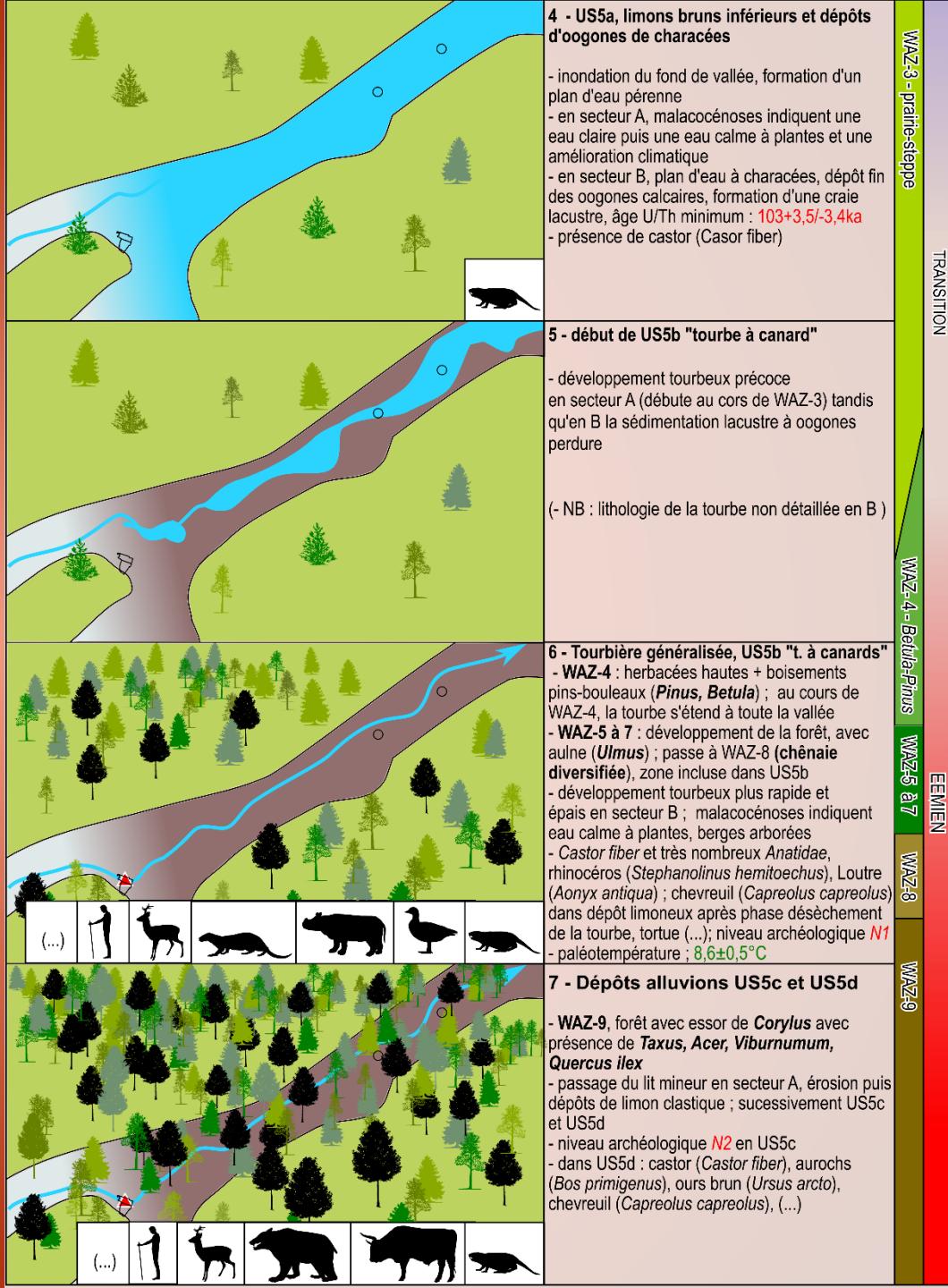
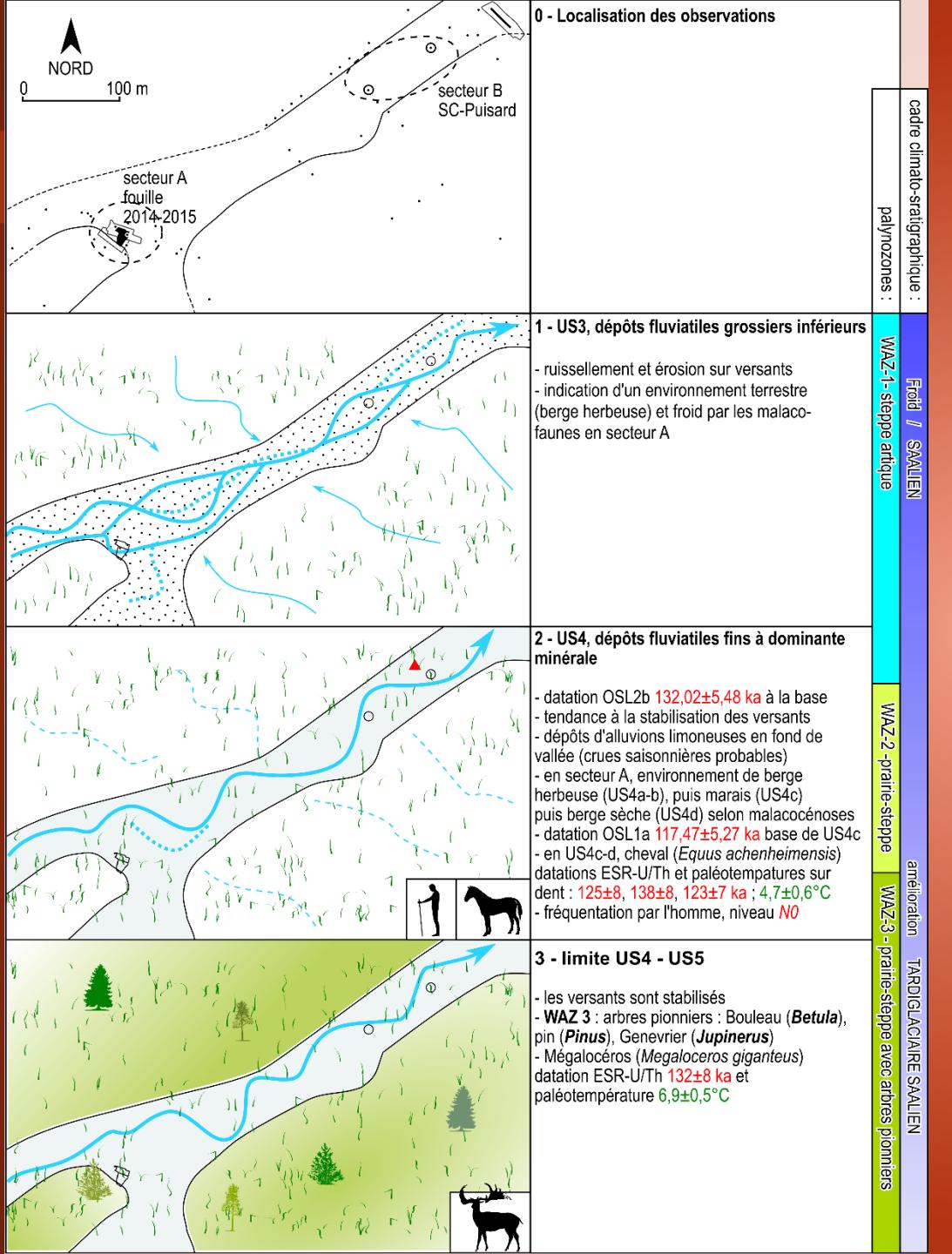


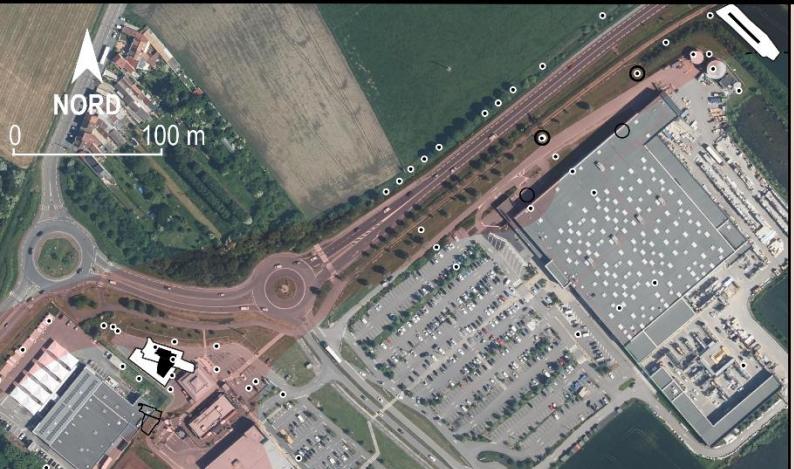
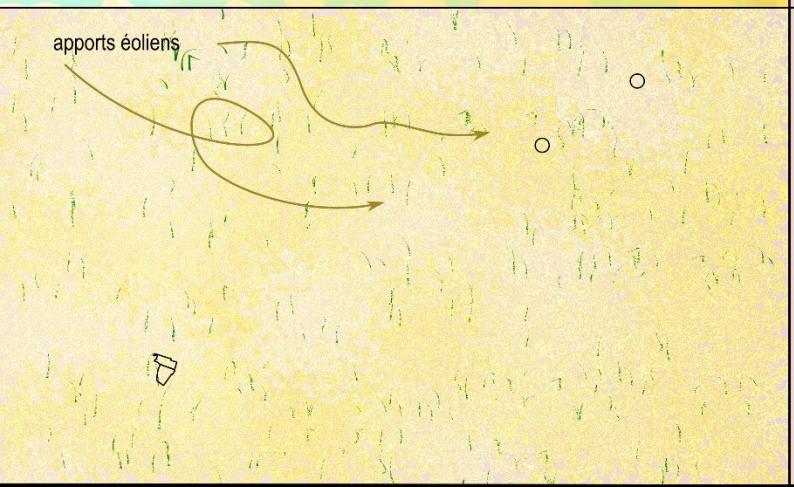
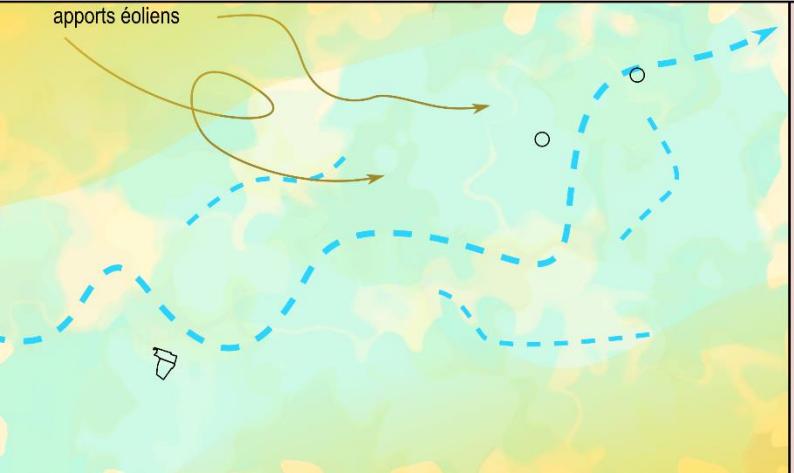
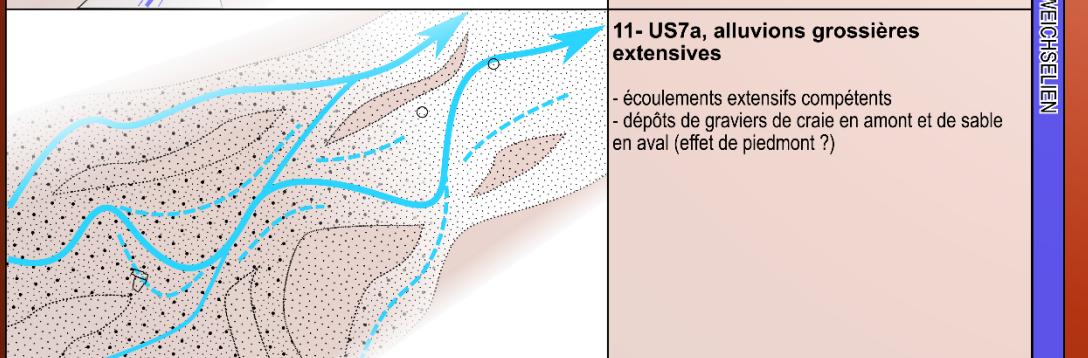
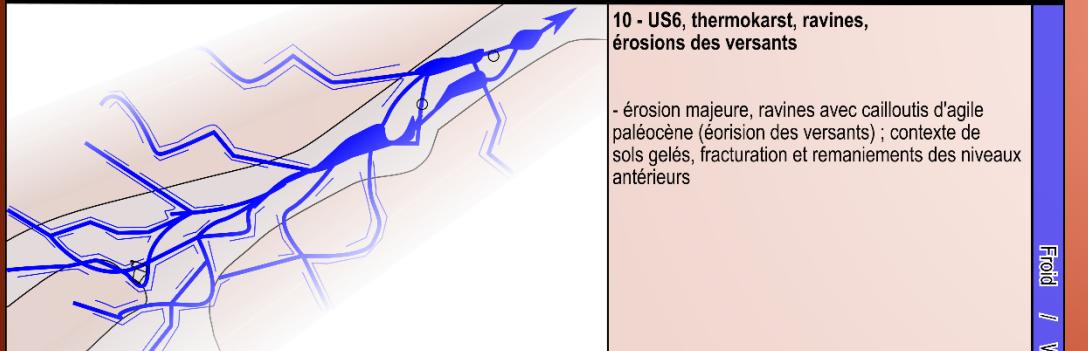
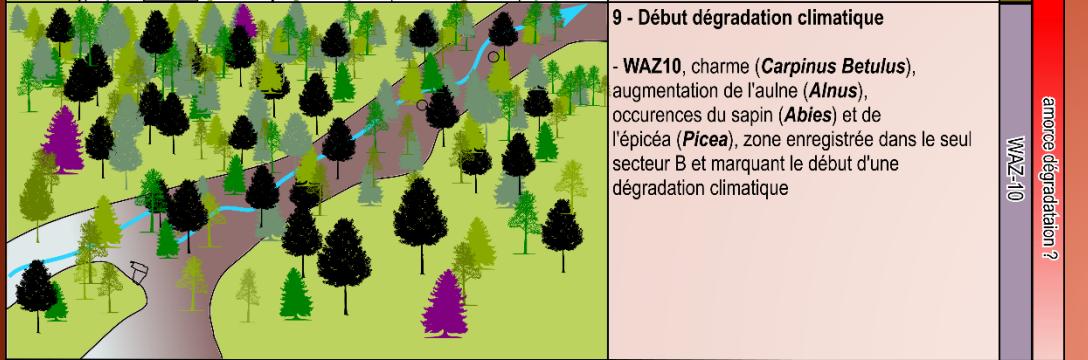
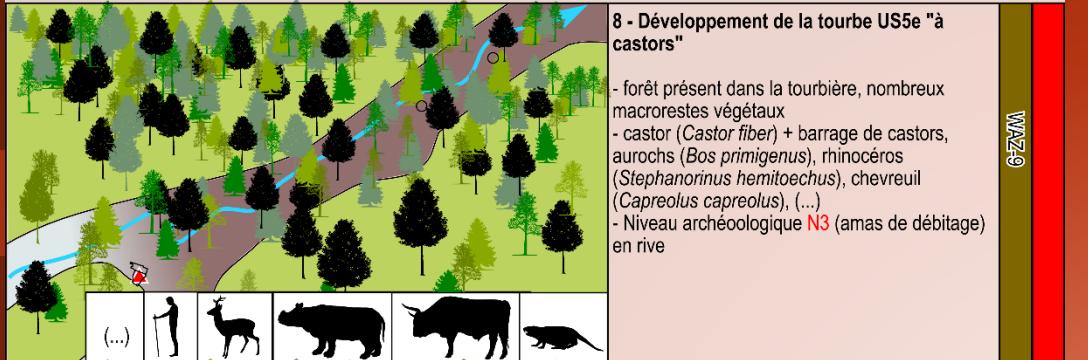


...plusieurs groupes néandertaliens









12 - US7b, dépôts fluvio-éoliens

- dépôts réguliers de limon loessique et de sable par des inondations saisonnières régulières
- exhaussement de l'ensemble de la plaine (scellement du fond de la vallée par les apports ; l'axe hydrographique disparaît)

13 - US7c, couverture loessique

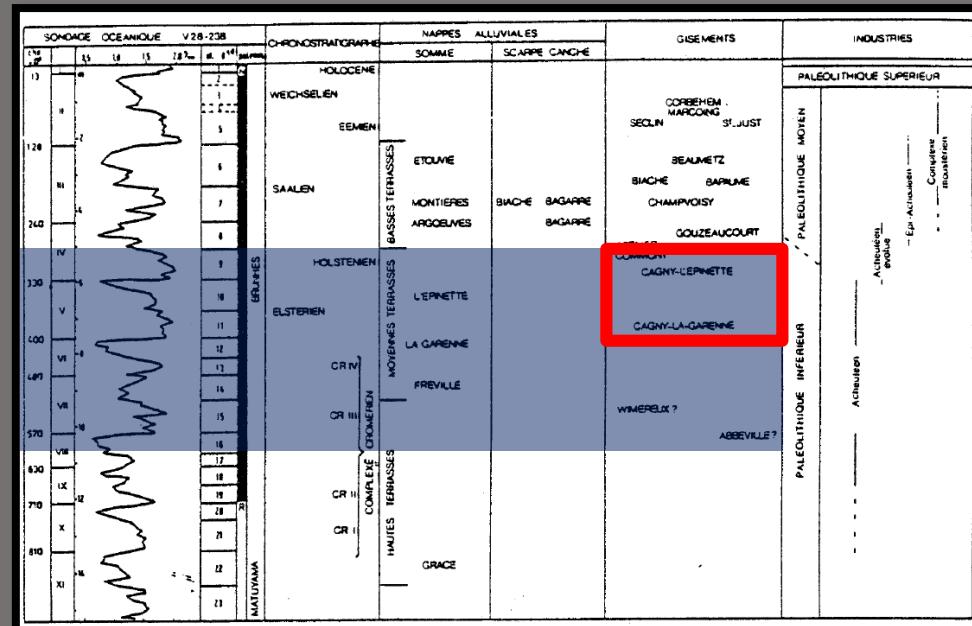
- fin de tout écoulement dans la zone investigée
- une légère dépression topographique subsiste

14 - Pédogenèse holocène, mise en culture puis construction de la ZAC

Evocation du niveau N3 de Waziers



Flash back : état des recherches 1984-1987 vs 2022



1987

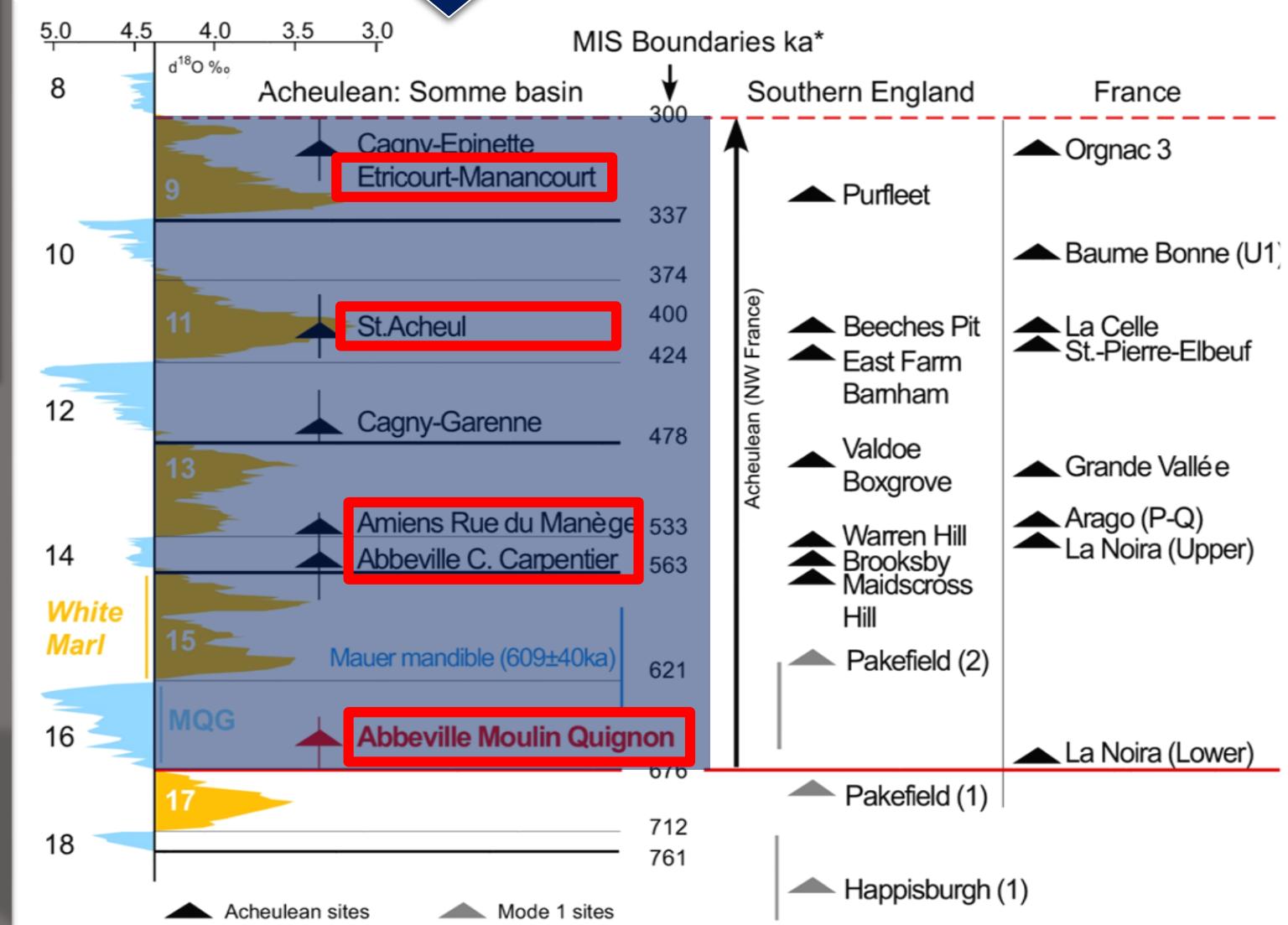
2 sites sûrs
MIS 9 – 11

2022

7 sites sûrs
MIS 9 – 16

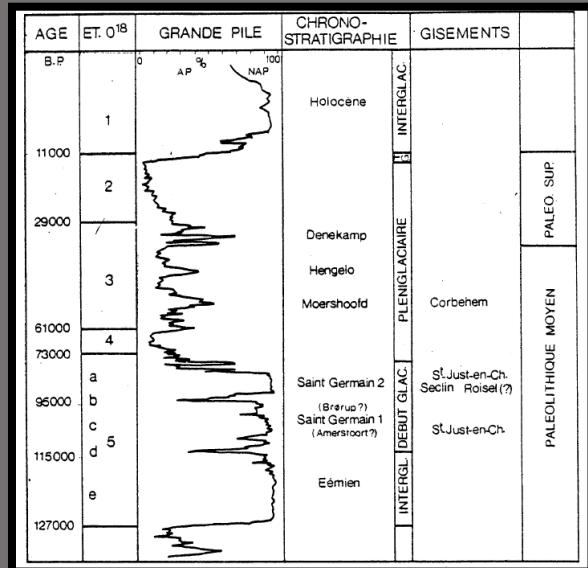
A. Tuffreau, 1987
d'après P. Haesaerts,
1984.

Antoine et al., 2019 NSR



Flash back : état des recherches en 1987 vs 2021

Locht et al., 2021 RAP



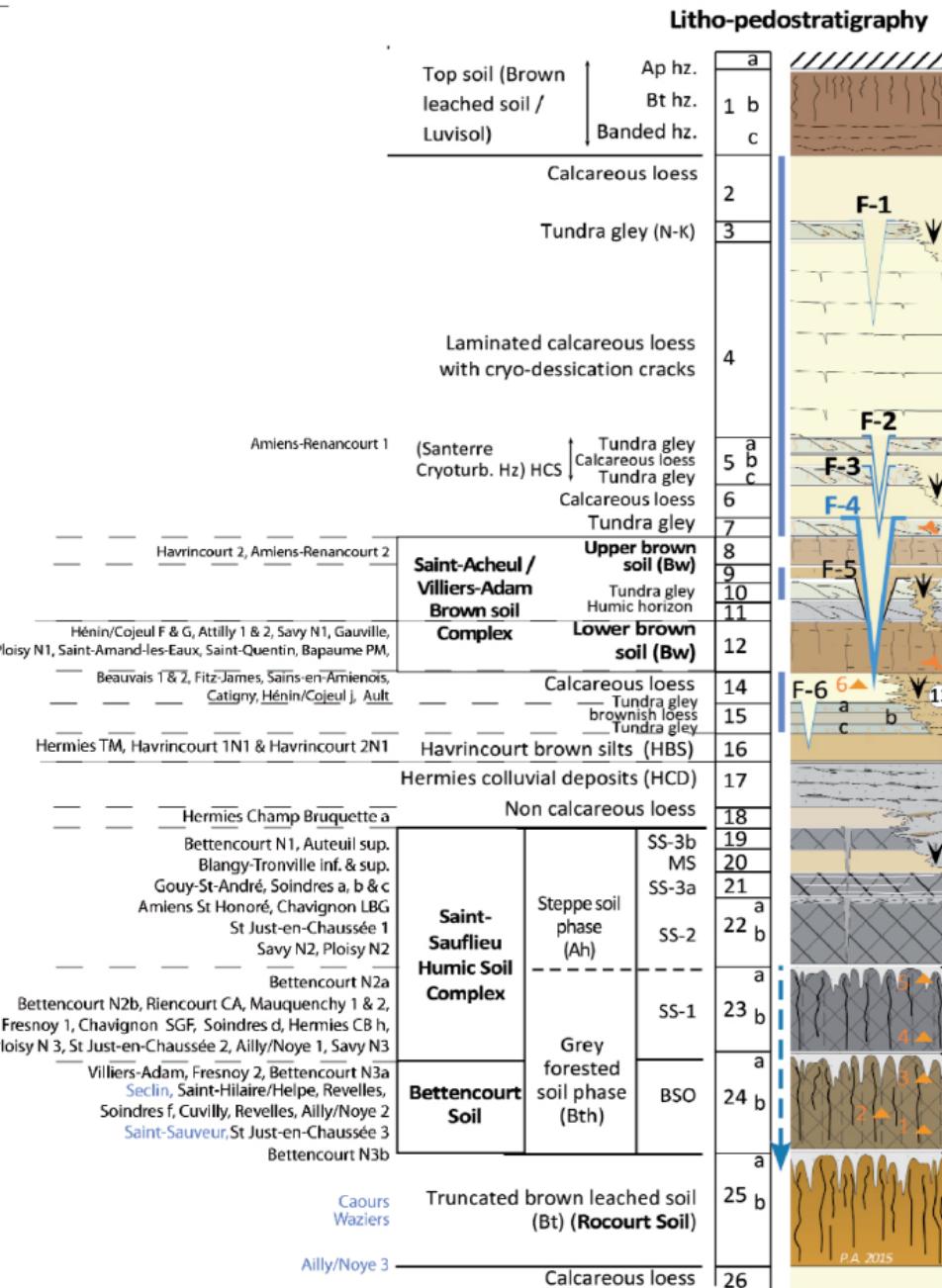
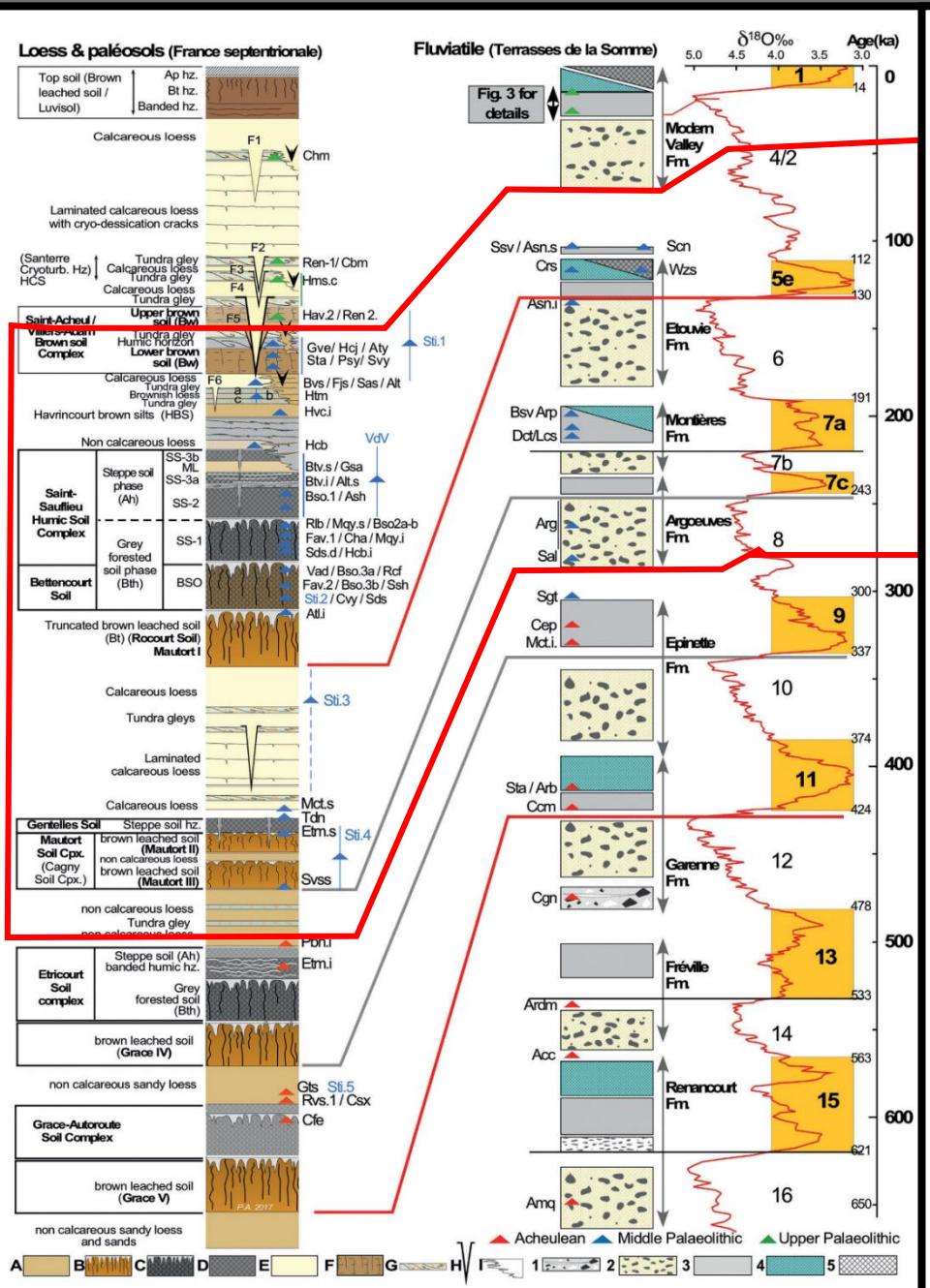
A. Tuffreau, 1987.

1987

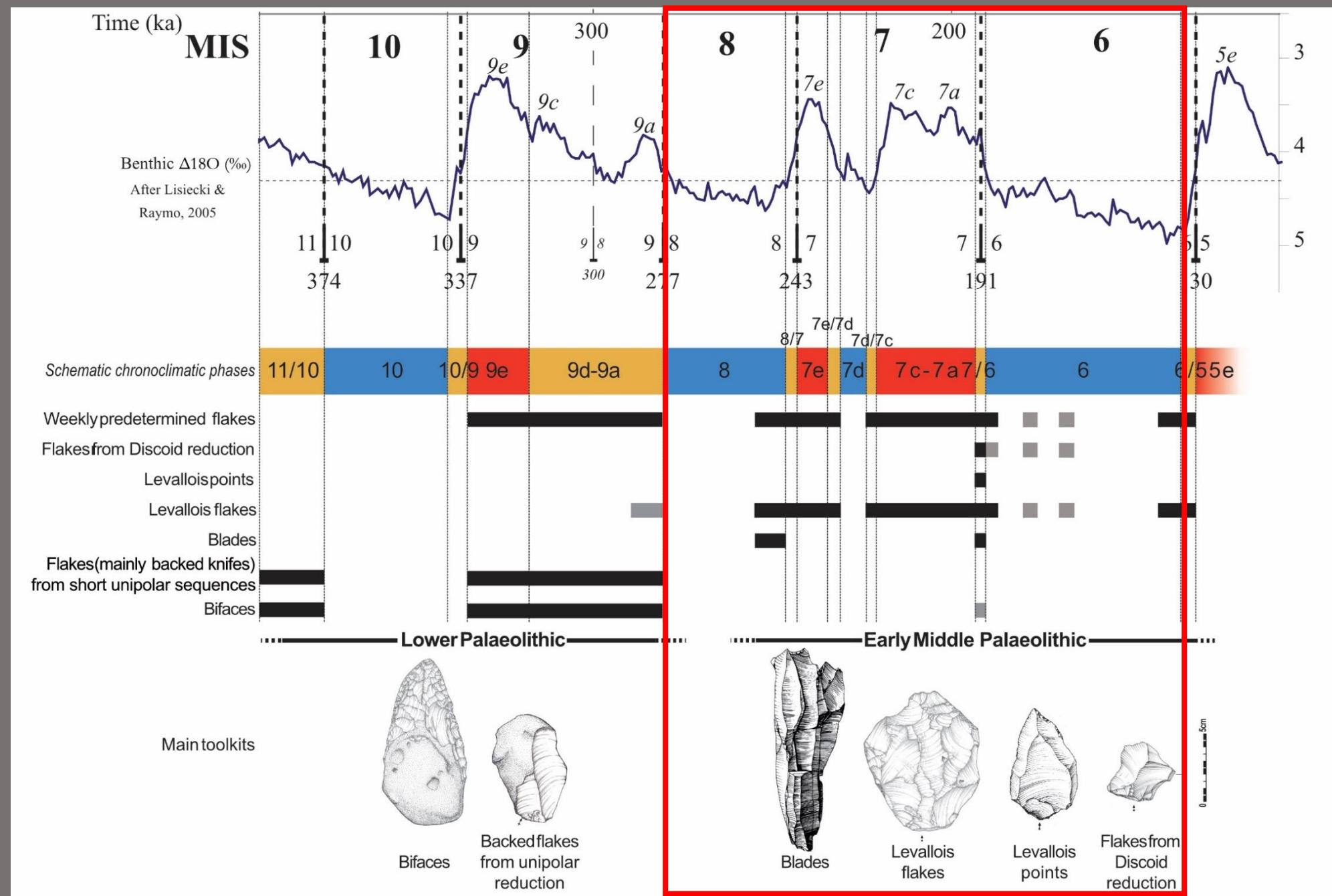
1? site sûr
MIS 8 – 3

2021

16-18 sites
sûrs
MIS 8 – 3



A mi-pente de la Somme MIS 8-6

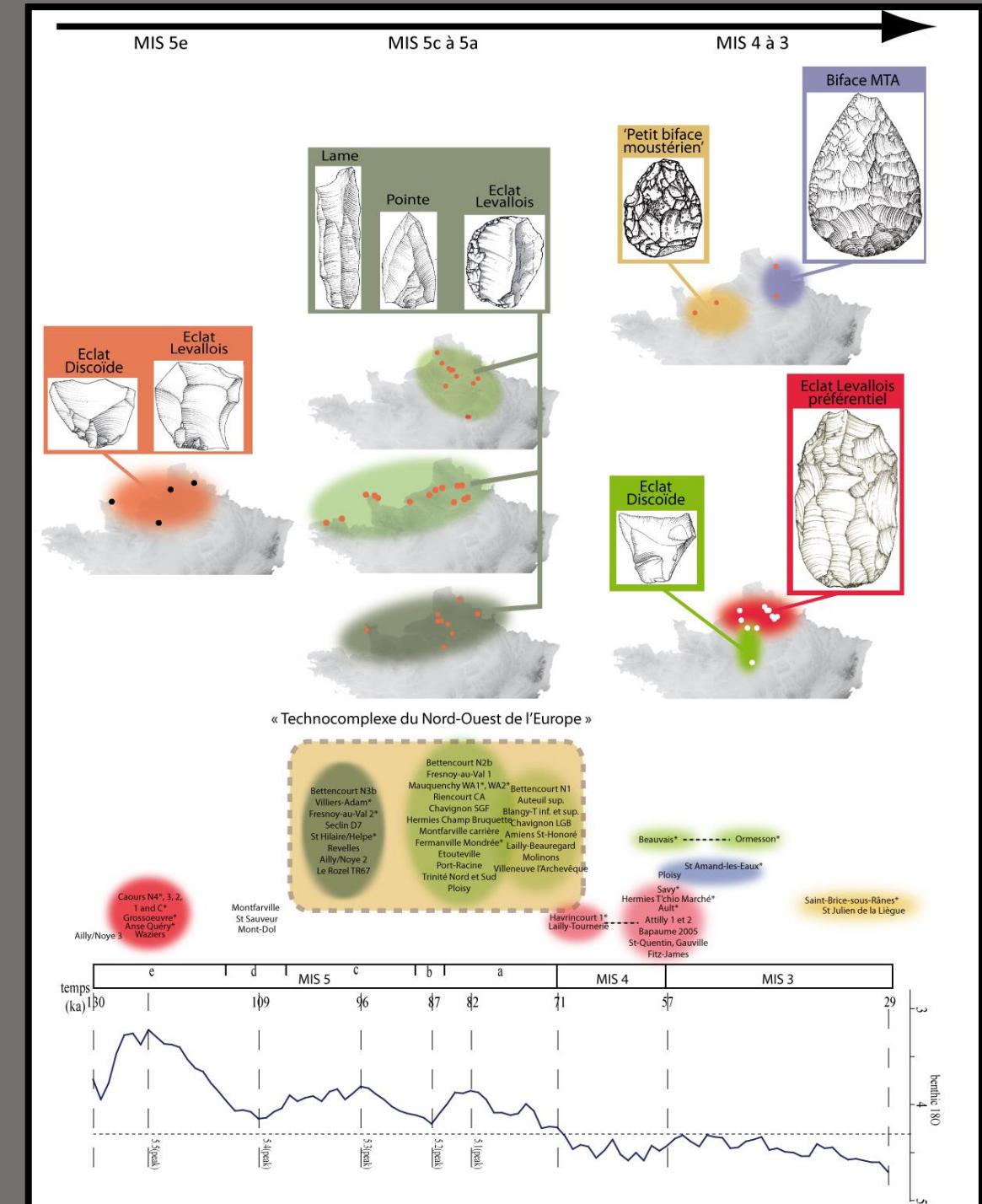


Presque les pieds dans l'eau de la Somme MIS 5^e-3

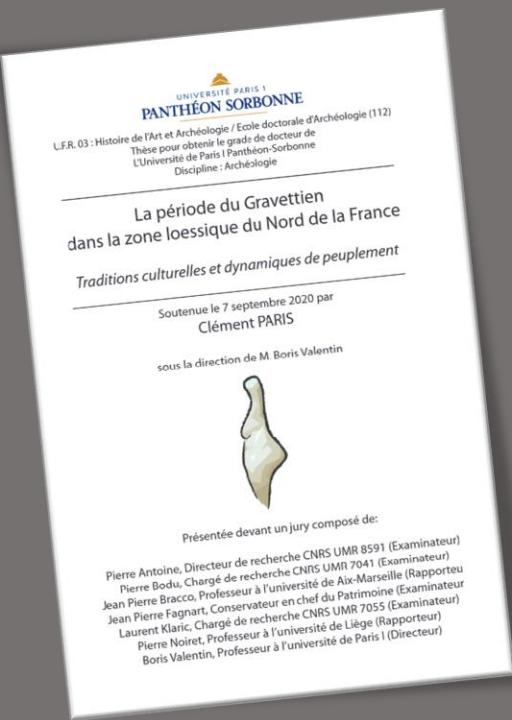
Technocomplexes et groupes culturels du Paléolithique moyen récent

- ✓ Groupes homogènes porteurs de technologies similaires
- ✓ Multiplication de groupes réduits à la fin du Paléolithique moyen
- ✓ Discontinuité du peuplement en lien avec les fluctuations climatiques confirmée MAIS à tempérer (Havrincourt)

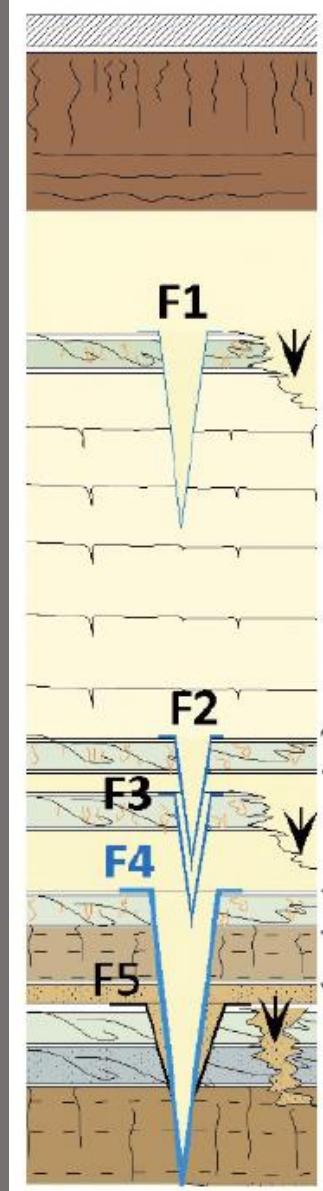
Locht, Hérisson *et al.*,
2016 *Quat. Int.*



Le Paléolithique supérieur ancien renouvelé



Paris (2020)



Rapprochement
stratigraphique
et chronologique

Rapprochement
stratigraphique
probable et technologique

Rapprochement
chronologique
et/ou technologique

Chronologie

Amiens-Renancourt 1

Elnes

Hallines
Catigny

23500 BP
27000 cal. BP

Hermies-Cimetière

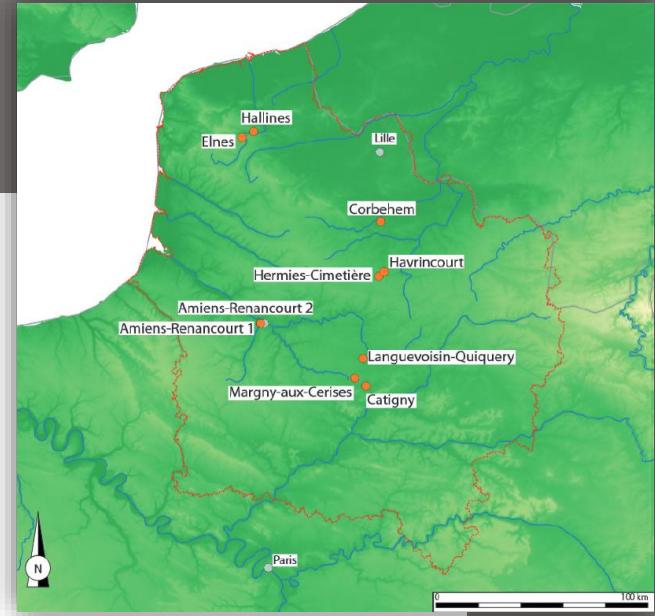
Corbehem

Margny-aux-Cerises

26500 BP
31000 cal. BP

Havrincourt N2
Amiens-Renancourt 2
Languevoisin-Quiquery

28500 BP
33000 cal. BP



Le Paléolithique supérieur ancien renouvelé

UNIVERSITÉ PARIS 1
PANTHÉON SORBONNE
L.F.R. 03 : Histoire de l'Art et Archéologie / Ecole doctorale d'Archéologie (112)
Thèse pour obtenir le grade de docteur de
l'Université de Paris I Panthéon-Sorbonne
Discipline : Archéologie

La période du Gravettien
dans la zone loessique du Nord de la France
Traditions culturelles et dynamiques de peuplement

Soutenue le 7 septembre 2020 par
Clément PARIS

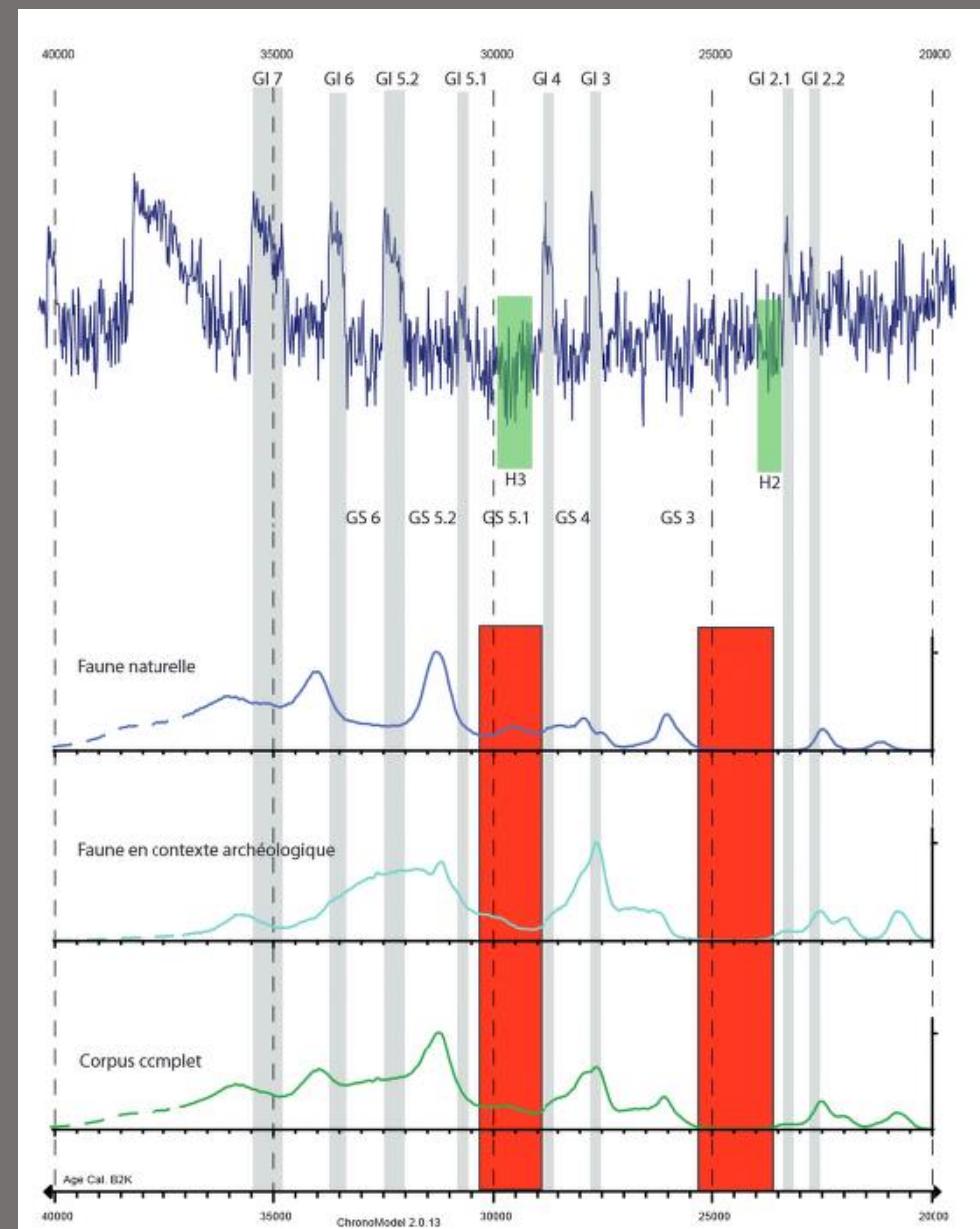
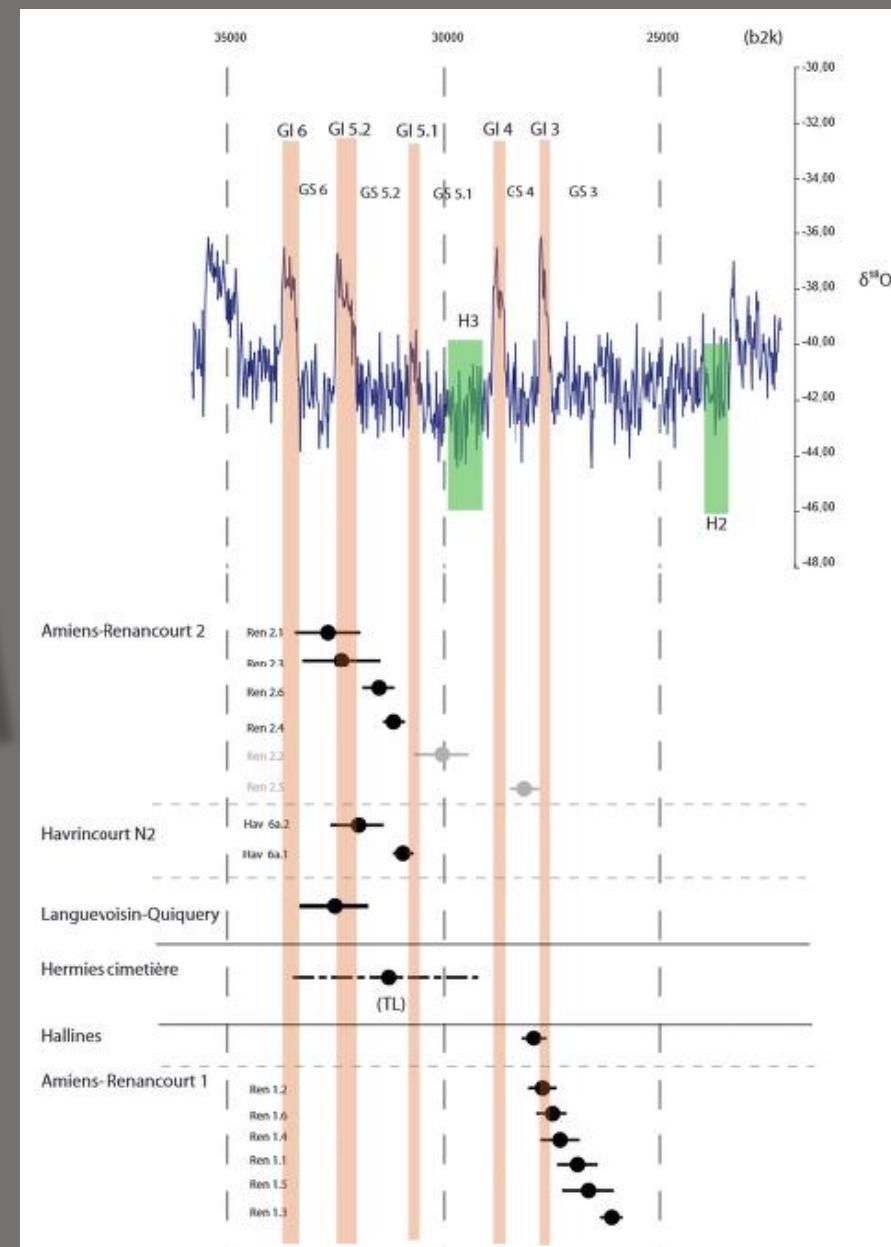
sous la direction de M. Boris Valentin



Présentée devant un jury composé de :

Pierre Antoine, Directeur de recherche CNRS UMR 8591 (Examinateur)
Pierre Bodu, Chargé de recherche CNRS UMR 7041 (Examinateur)
Jean Pierre Bracco, Professeur à l'université de Aix-Marseille (Rapporteur)
Jean Pierre Fagnart, Conservateur en chef du Patrimoine (Examinateur)
Laurent Klaric, Chargé de recherche CNRS UMR 7055 (Examinateur)
Pierre Noiret, Professeur à l'université de Liège (Rapporteur)
Boris Valentin, Professeur à l'université de Paris I (Directeur)

Paris (2020)



Reconstruire le cadre chrono-climatique et paléoenvironnemental des occupations humaines paléolithiques : le cas d'école et d'**équipe** du Nord de la France



Merci pour votre attention



@david_herisson

