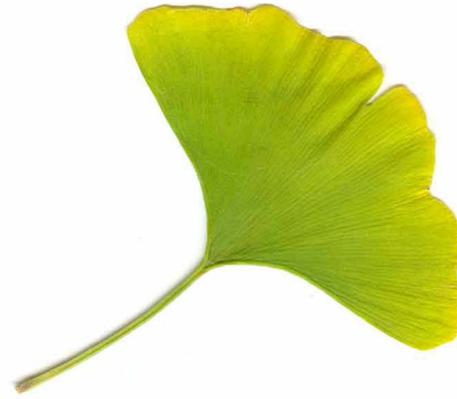


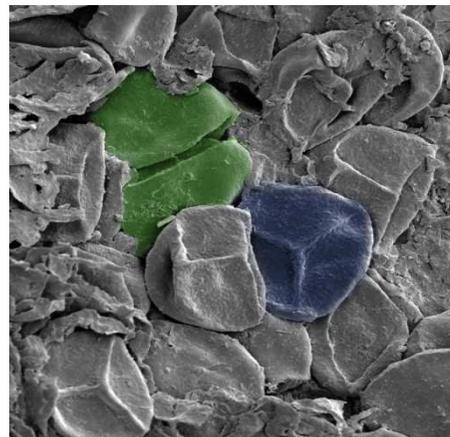
Ces feuilles de ginkgo fossilisées dateraient de l'époque des dinosaures



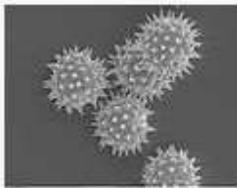
Schiste houiller à Fougères – Carbonifère – (30 – Alès)
(Collection G. Bessonnat)



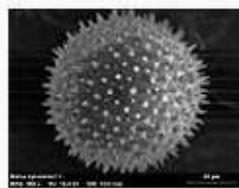
Feuille d'érable dans de la diatomite –
Miocène supérieur – (15 – Carrière de
Foufouilloux)



Spores trilètes du Silurien



Helianthus annuus



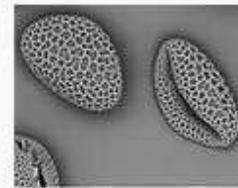
Malva sylvestris



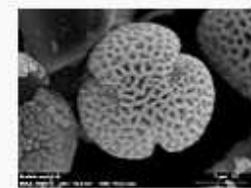
Epilobium angustifolium



Ricinus communis



Lilium auratum



Arabis sp.

On peut identifier un pollen grâce à sa taille,
sa forme et la présence de pores
ou de sillons à la surface de son éxine



INAPERTURÉ
aucun pore



MONOCOLPÉ
un sillon



DICOLPÉ
deux sillons



TRICOLPÉ
trois sillons



STÉPHANOCOLPÉ
sillons réunis dans
le même plan



PÉRICOLPÉ
plusieurs sillons



MONOPORÉ
un seul pore



DIPORÉ
deux pores



TRIPORÉ
trois pores



STÉPHANOPORÉ
pores réunis dans
le même plan



TRICOLPORÉ
trois sillons
percés de pores



STÉPHANOCOLPORÉ
sillons percés de
pores réunis dans
le même plan



PÉRICOLPORÉ
plusieurs sillons
percés de pores



DYADE
les grains sont
groupés par deux



TÉTRADE
groupés par
quatre

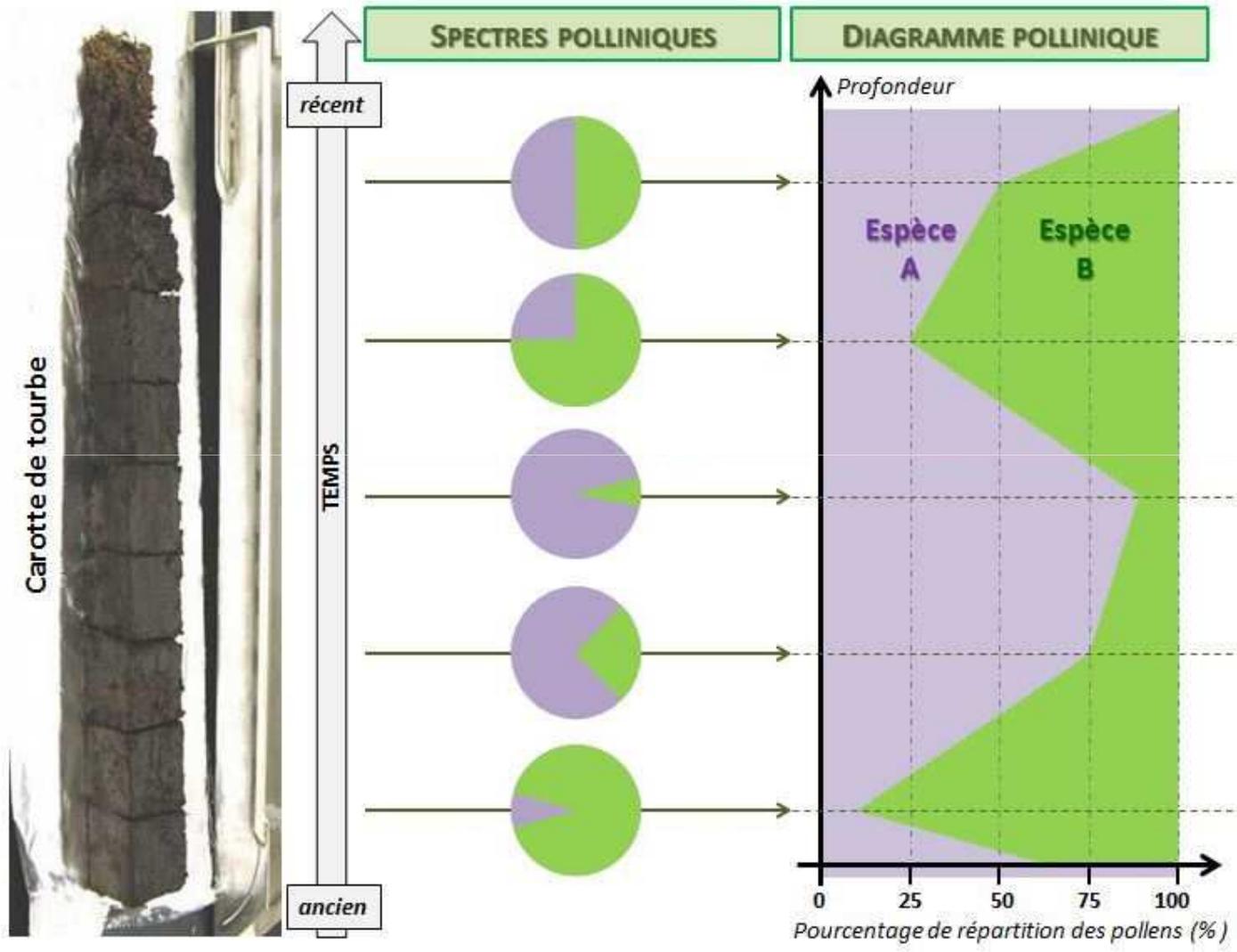


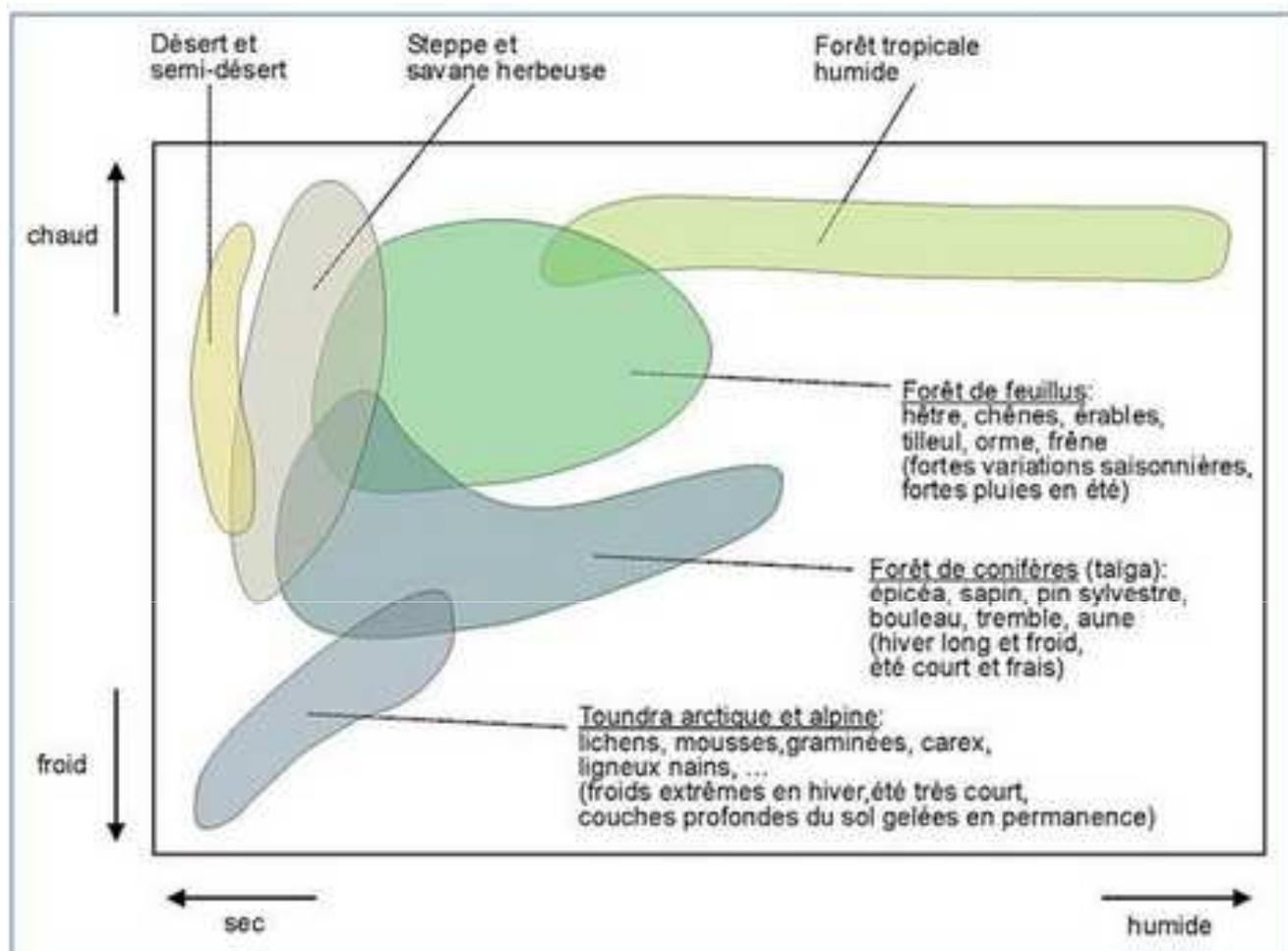
POLYADE
plus de quatre
grains groupés



<http://www.savoirs.essonne.fr/fileadmin/bds/MEDIA/animations/pollen.swf>







Etude appliquée n°1

Review

New
Phytologist



Tansley review

Ancient plant DNA in lake sediments

Authors for correspondence:

Laura Parducci

Tel: +46 18 471 64 14

Email: laura.parducci@ebc.uu.se

Mikkel Winther Pedersen

Tel: +45 29 27 53 42

Email: mwpedersen@snm.ku.dk

Received: 1 October 2016

Accepted: 7 December 2016

**Laura Parducci¹, Keith D. Bennett^{2,3}, Gentile Francesco Ficetola^{4,5},
Inger Greve Alsos⁶, Yoshihisa Suyama⁷, Jamie R. Wood⁸ and
Mikkel Winther Pedersen⁹**

¹Department of Ecology and Genetics, Evolutionary Biology Centre, Uppsala University, Norbyvägen 18D, Uppsala 75236, Sweden;

²Department of Geography & Sustainable Development, School of Geography & Geosciences, University of St Andrews, St Andrews

Fife, KY16 9AL, UK; ³Marine Laboratory, Queen's University Belfast, Portaferry, BT22 1LS, UK; ⁴CNRS, Université Grenoble-Alpes,

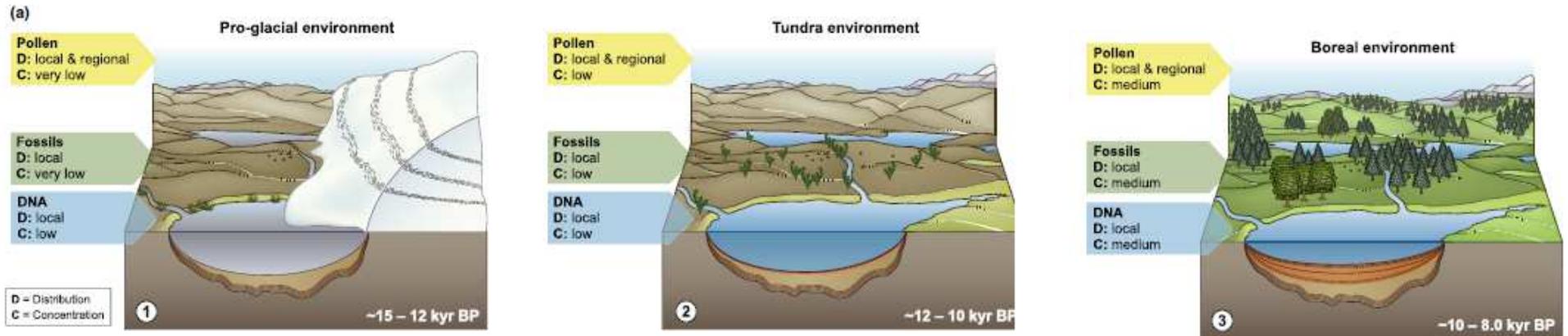
Laboratoire d'Ecologie Alpine (LECA), Grenoble F-38000, France; ⁵Department of Biosciences, Università degli Studi di Milano,

Milan 20133, Italy; ⁶Tromsø Museum, UiT – The Arctic University of Norway, Tromsø NO-9037, Norway; ⁷Field Science Center,

Graduate School of Agricultural Science, Tohoku University, 232-3 Yomogida, Naruko-onsen, Osaki, Miyagi 989-6711, Japan; ⁸Long-

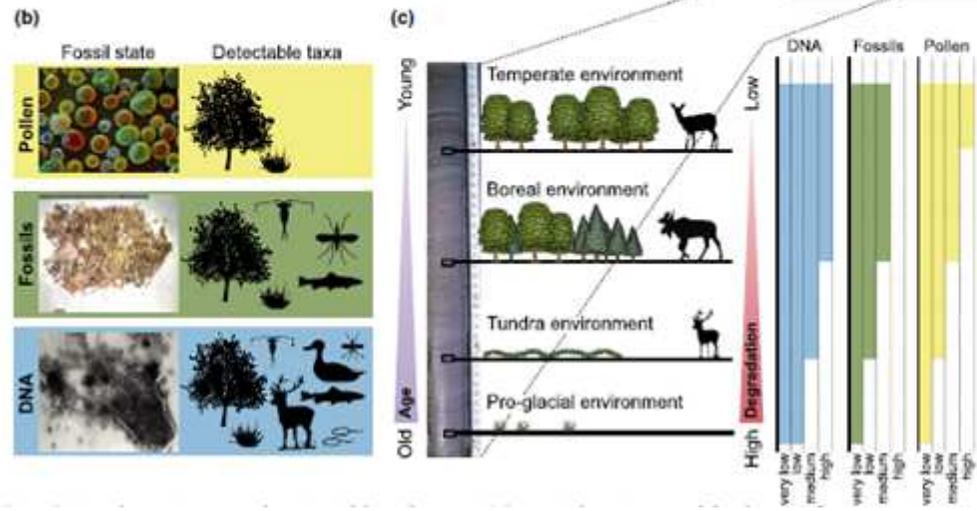
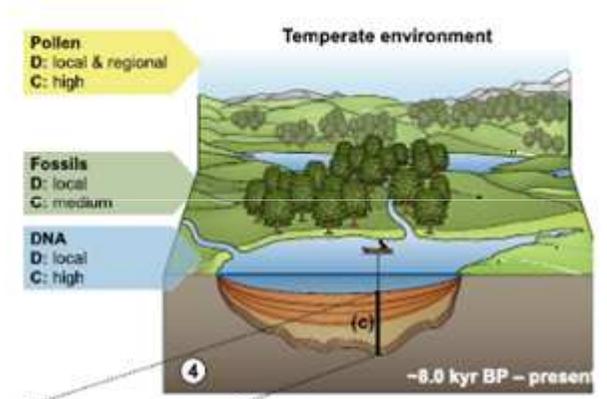
term Ecology Lab, Landcare Research, PO Box 69040, Lincoln Canterbury 7640, New Zealand; ⁹Centre for GeoGenetics, Natural

History Museum of Denmark, University of Copenhagen, Copenhagen 1350, Denmark



(a) Développement environnemental séquentiel pour une région tempérée, où les sédiments lacustres commencent à s'accumuler à mesure que la glace se retire, incorporant des débris érodés et la MO pionnière.

(1) Environnement glaciaire remplacé par une communauté de toundra-steppe (2) puis par la forêt boréale (3) avant d'être finalement remplacée par une forêt tempérée (4). En identifiant les organismes détectables par l'ADN, les macro- et microfossiles accumulés et préservés dans les sédiments lacustres (b), il est possible de reconstruire les environnements à travers le temps (c).



Etude appliquée n°2

RESEARCH ARTICLE

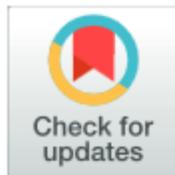
Pollen-based reconstruction of vegetational and climatic change over the past ~30 ka at Shudu Lake in the Hengduan Mountains of Yunnan, southwestern China

Yi-Feng Yao¹*, Xiao-Yan Song²*, Alexandra H. Wortley³, Yu-Fei Wang¹,
Stephen Blackmore³, Cheng-Sen Li¹*

1 State Key Laboratory of Systematic and Evolutionary Botany, Institute of Botany, Chinese Academy of Sciences, Xiangshan, Beijing, China, **2** Shanxi Agricultural University, Taigu, Shanxi, China, **3** Royal Botanic Garden Edinburgh, 20a Inverleith Row, Edinburgh, United Kingdom

* These authors contributed equally to this work.

* yaoyf@ibcas.ac.cn (YFY); lics@ibcas.ac.cn (CSL)



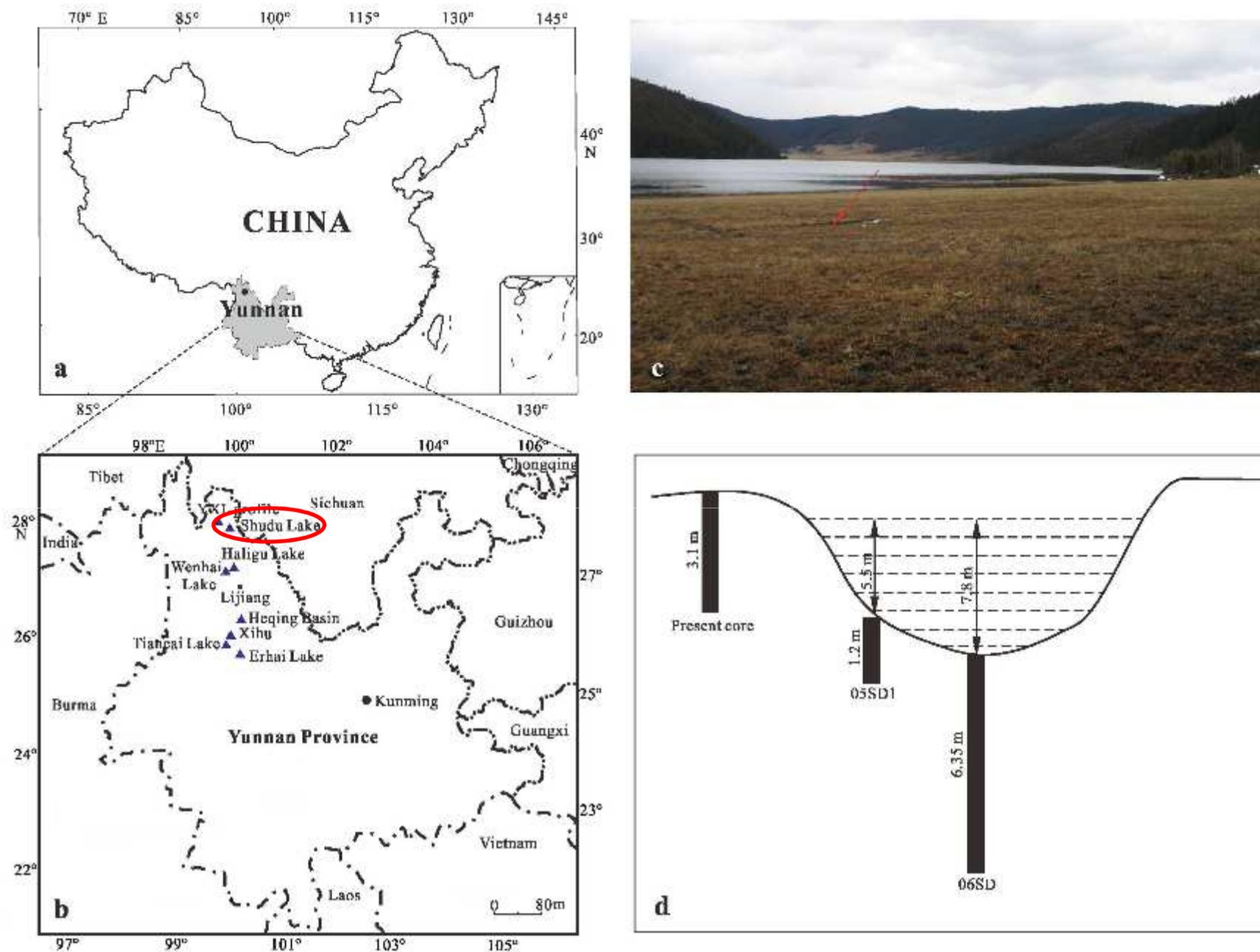
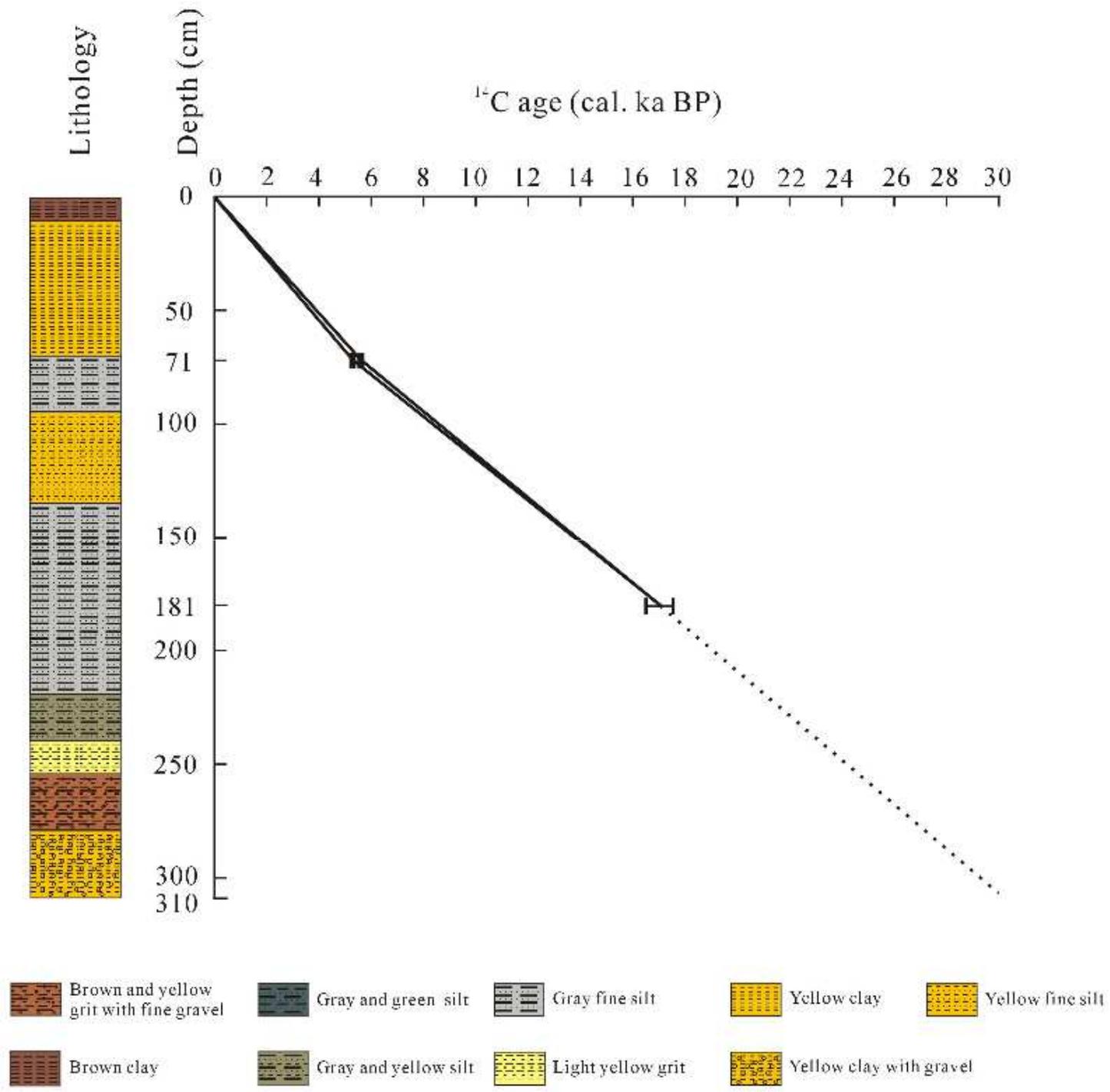
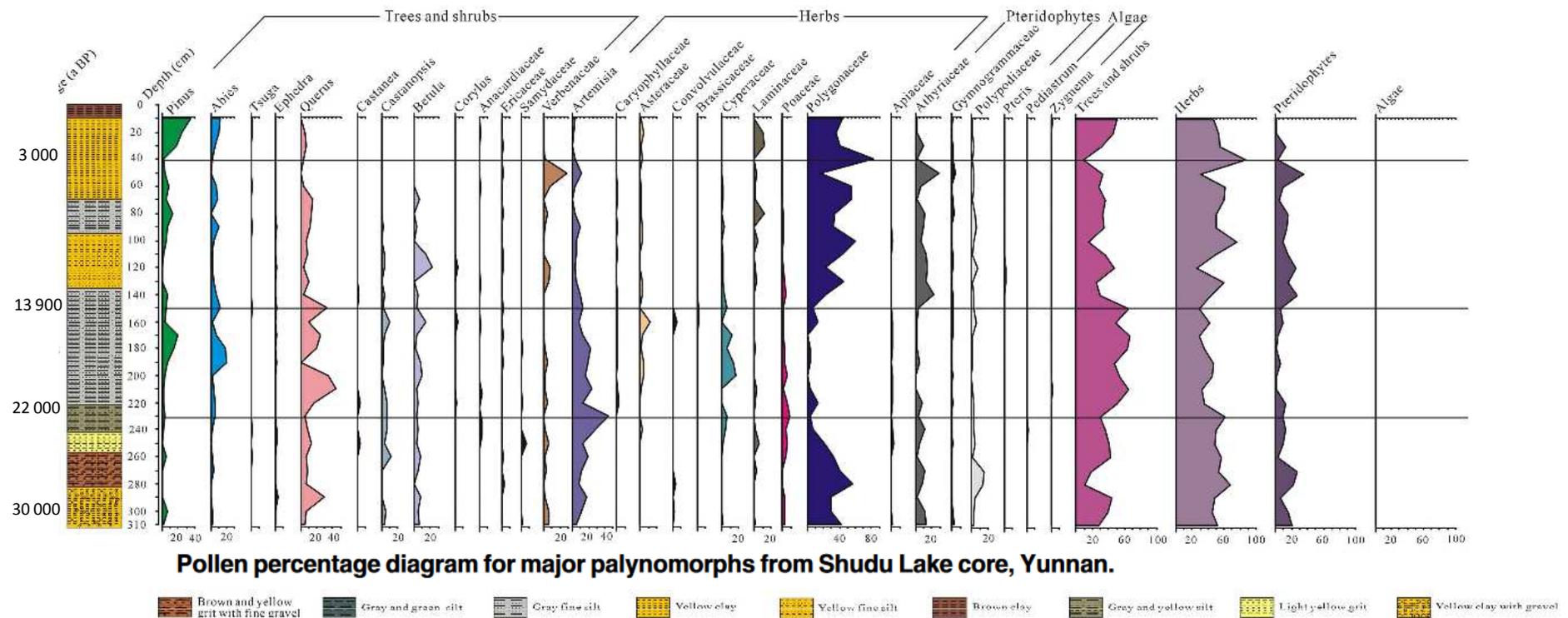


Fig 1. a. Location of Yunnan in China, b. Location of Shudu Lake and other studied sites in northwestern Yunnan, c. Panoramic view of Shudu Lake (red arrow represents position of core), d. Position of present and previous studied cores at Shudu Lake.





De 30 à 22 cal. ka BP, steppes et prairies avec beaucoup de graminées, et **forêts de feuillus** avec (Chêne, Bouleau et Castanopsis) → climat relativement chaud et humide au début de cette phase et conditions légèrement plus chaudes et plus sèches en fin de phase

De 22 à 13,9 cal. ka BP, forêts mixtes (Pin, Sapin et Chêne) [avec diminution de l'étendue des steppes et prairies] → réchauffement et assèchement des conditions climatiques suivies de conditions plus froides et humides

De 13,9 à 3 cal. ka BP, steppes et prairies se redéveloppent alors que la superficie des forêts mixtes est réduite → fluctuation du climat dominé par des conditions chaudes et humides.

Après 3 cal. ka BP, forêt de feuillus en augmentation et réduction de steppes et prairies → suggérant un réchauffement et un assèchement du climat

Etude appliquée n°3

Ambio

DOI 10.1007/s13280-018-1014-2



KUNGL.
VETENSKAPS-
AKADEMIEN
THE ROYAL SWEDISH ACADEMY OF SCIENCES



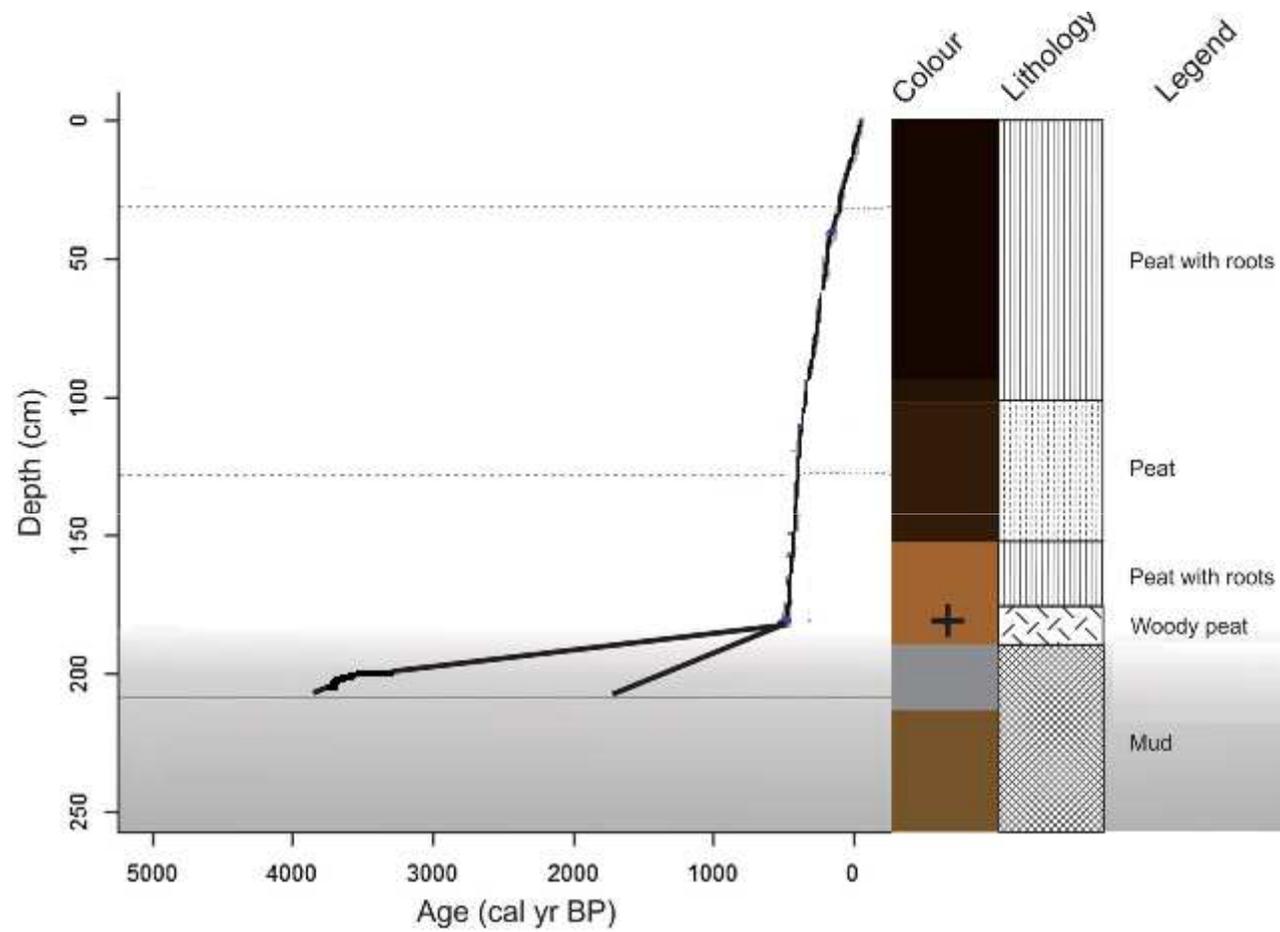
CrossMark

RESEARCH ARTICLE

Late Holocene wetland transgression and 500 years of vegetation and fire variability in the semi-arid Amboseli landscape, southern Kenya

Esther N. Githumbi , Colin J. Courtney Mustaphi, Kevin J. Yun, Veronica Muiruri, Stephen M. Rucina, Rob Marchant

Received: 8 August 2017 / Revised: 1 December 2017 / Accepted: 5 January 2018



Peat = tourbe
 Mud = boue

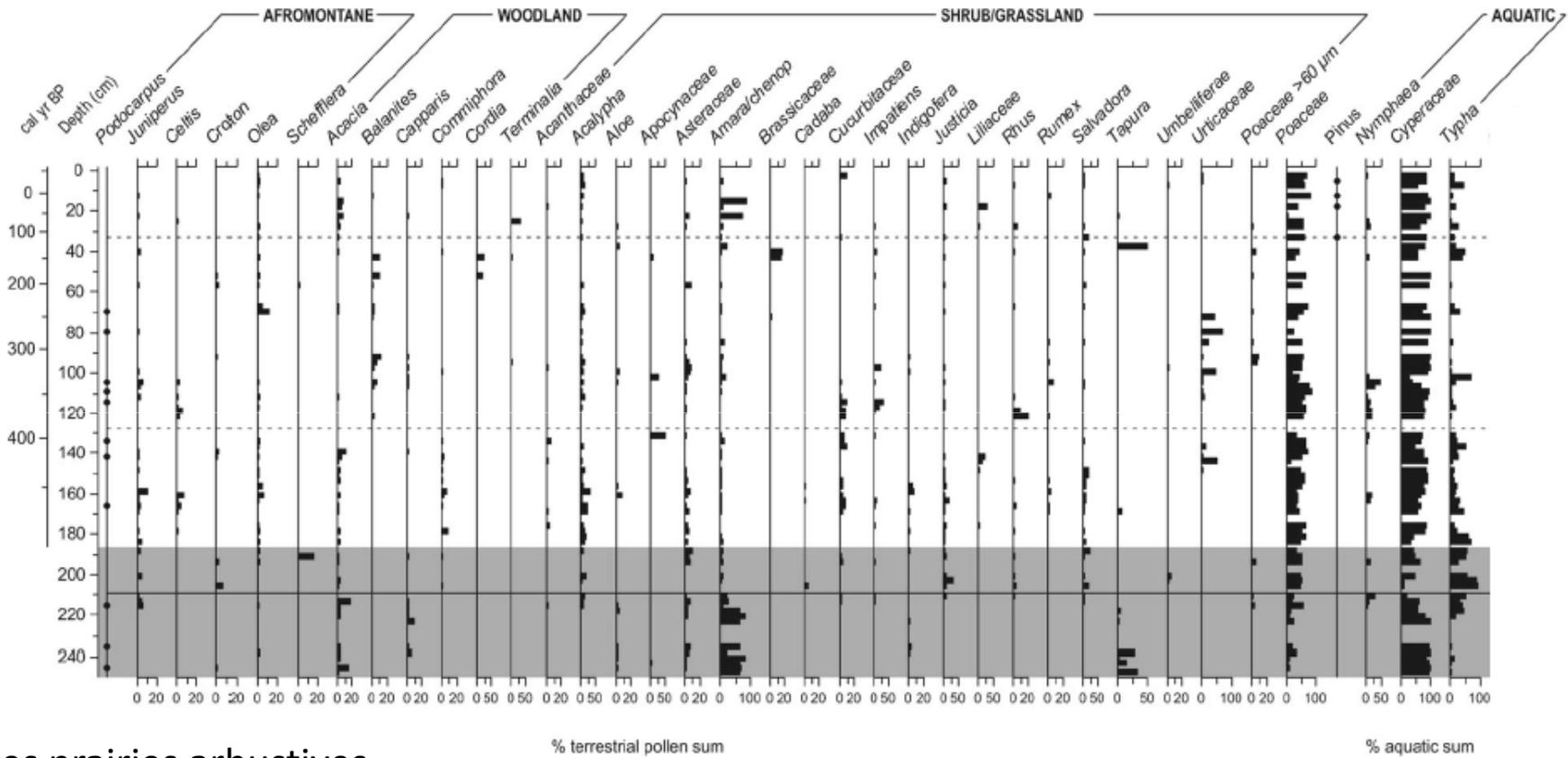
Plantes Afrotropicales

Podocarpus
Celtis = Micocoulier
Croton



Arbres forestiers

Acacias
Commiphora
Terminalia



Plantes prairies arbustives

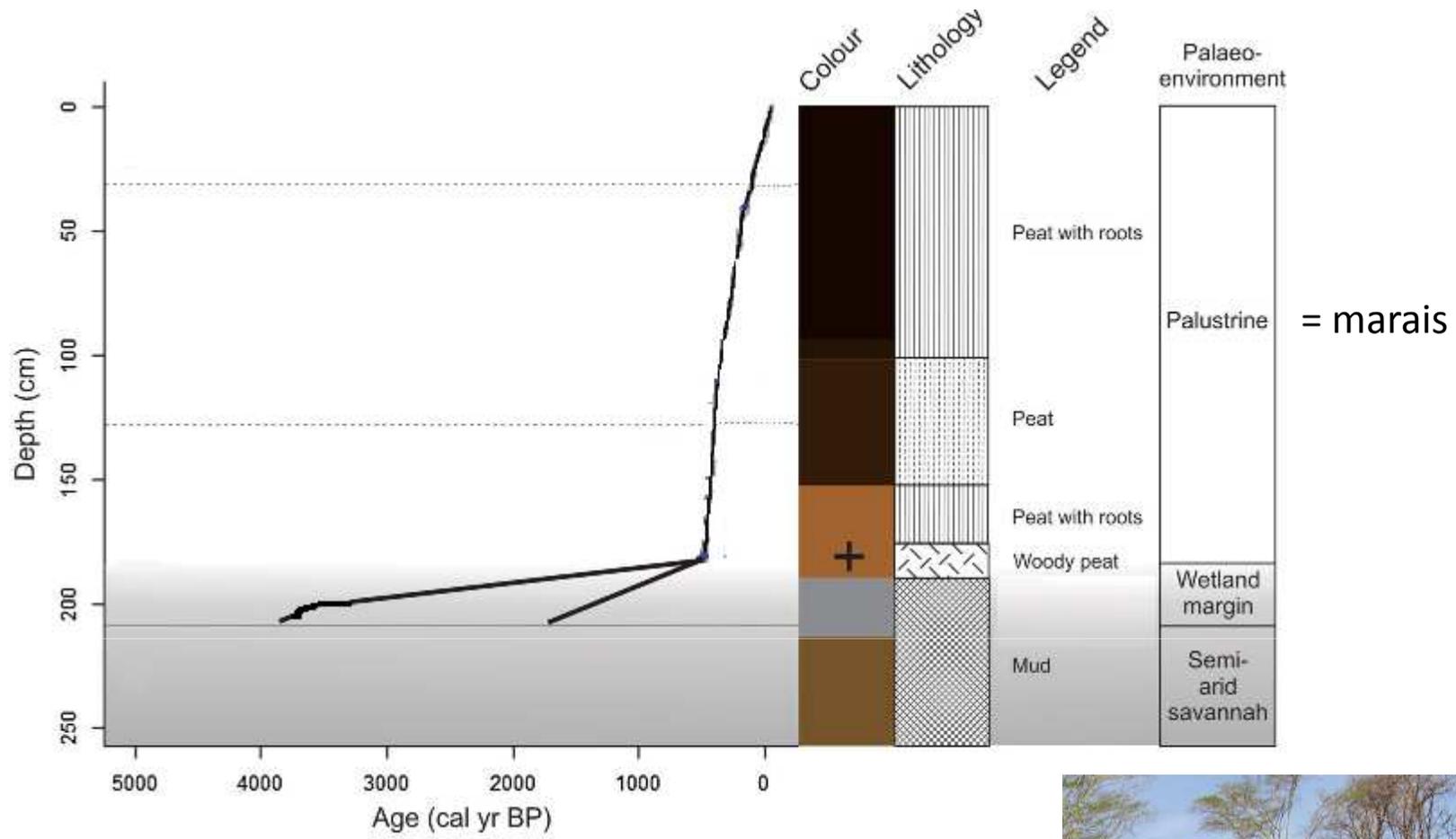
Acalypha
Aloe
Cadaba
Rhus



Plantes aquatiques

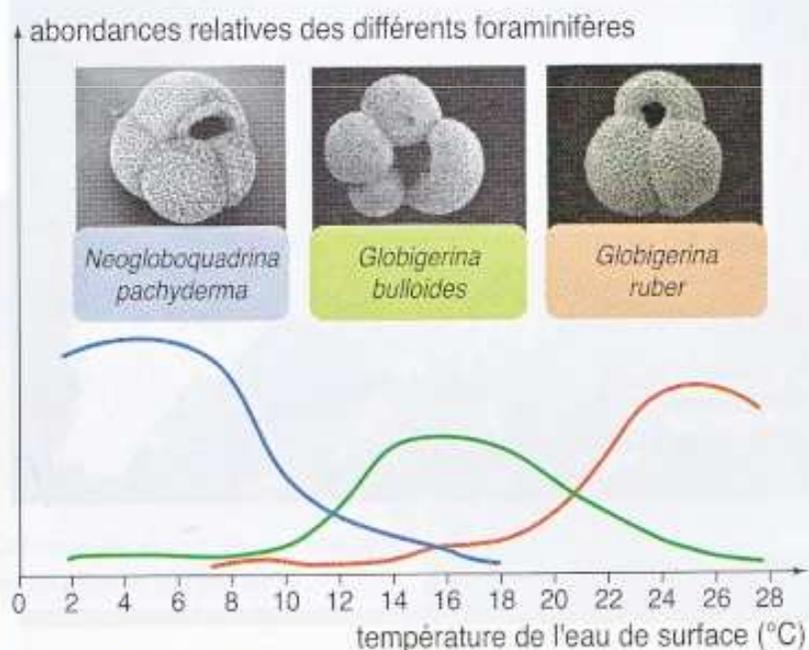
Cyperaceae
Typha





- **Données pour la période actuelle**

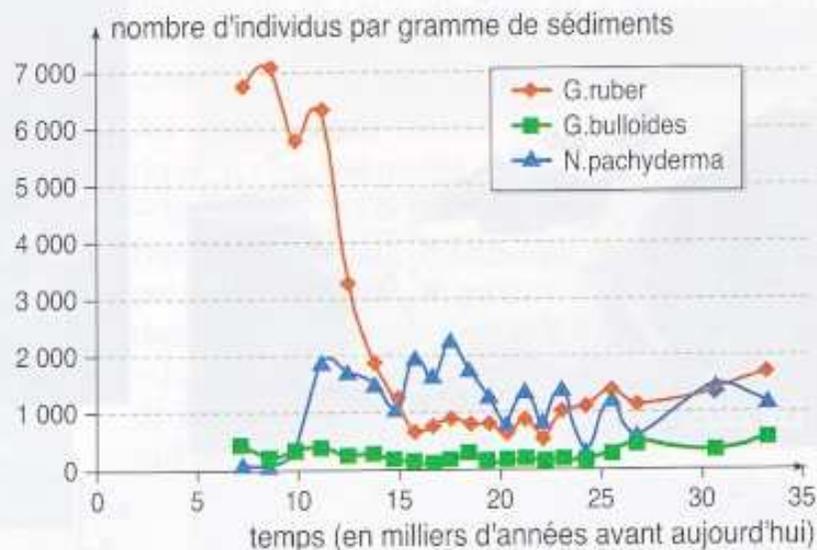
Les échantillons de sédiments marins contenant des foraminifères ont été prélevés par carottage en différents points de l'Atlantique Nord. Dans les sédiments superficiels (donc récents), des comptages ont permis d'estimer l'abondance relative de trois espèces (*graphe ci-dessous*).



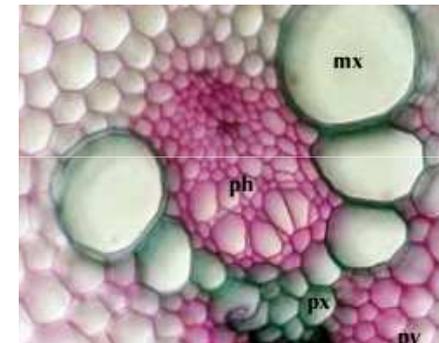
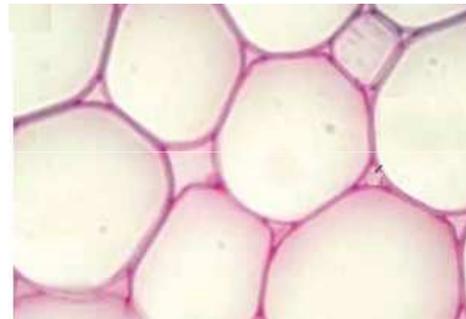
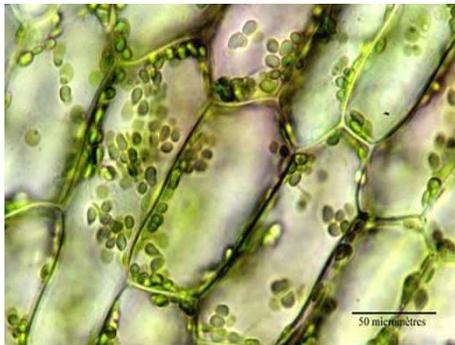
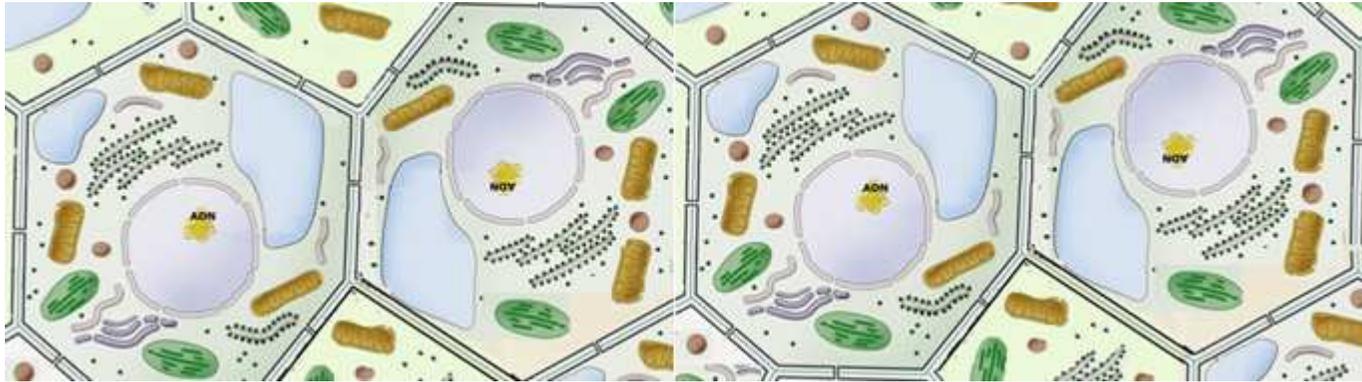
- **Données pour des périodes plus anciennes**

À partir de prélèvements de sédiments plus profonds (plus anciens) effectués dans de nombreux sites océaniques, on peut retracer l'évolution de la température des eaux et en déduire les variations climatiques globales.

Par exemple, le *document ci-dessous* a été obtenu à partir d'échantillons provenant de différents niveaux d'un carottage réalisé par 0° de latitude et 23° de longitude ouest.



Doc. 3 Les foraminifères présents dans les sédiments océaniques fournissent des informations sur l'évolution du climat.

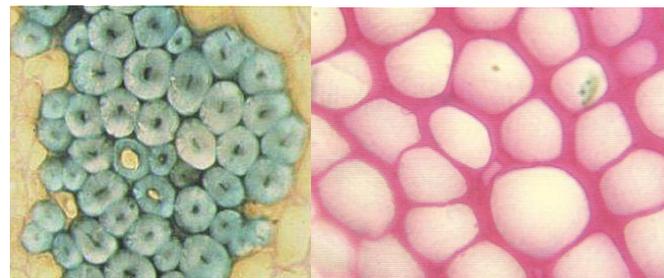


Tissus de réserve
Parenchyme

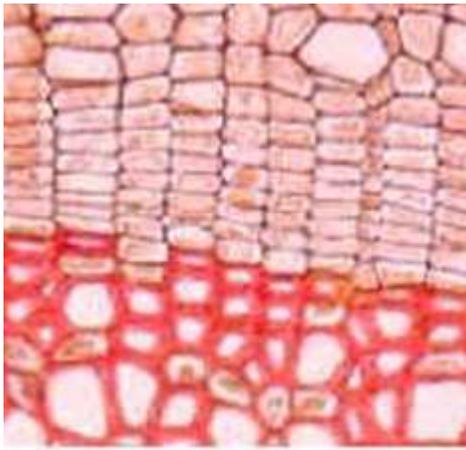
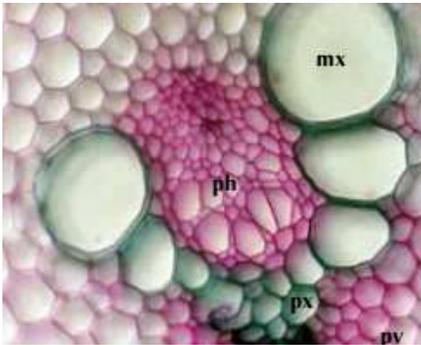
Tissus de conduction
Xylème
Phloème



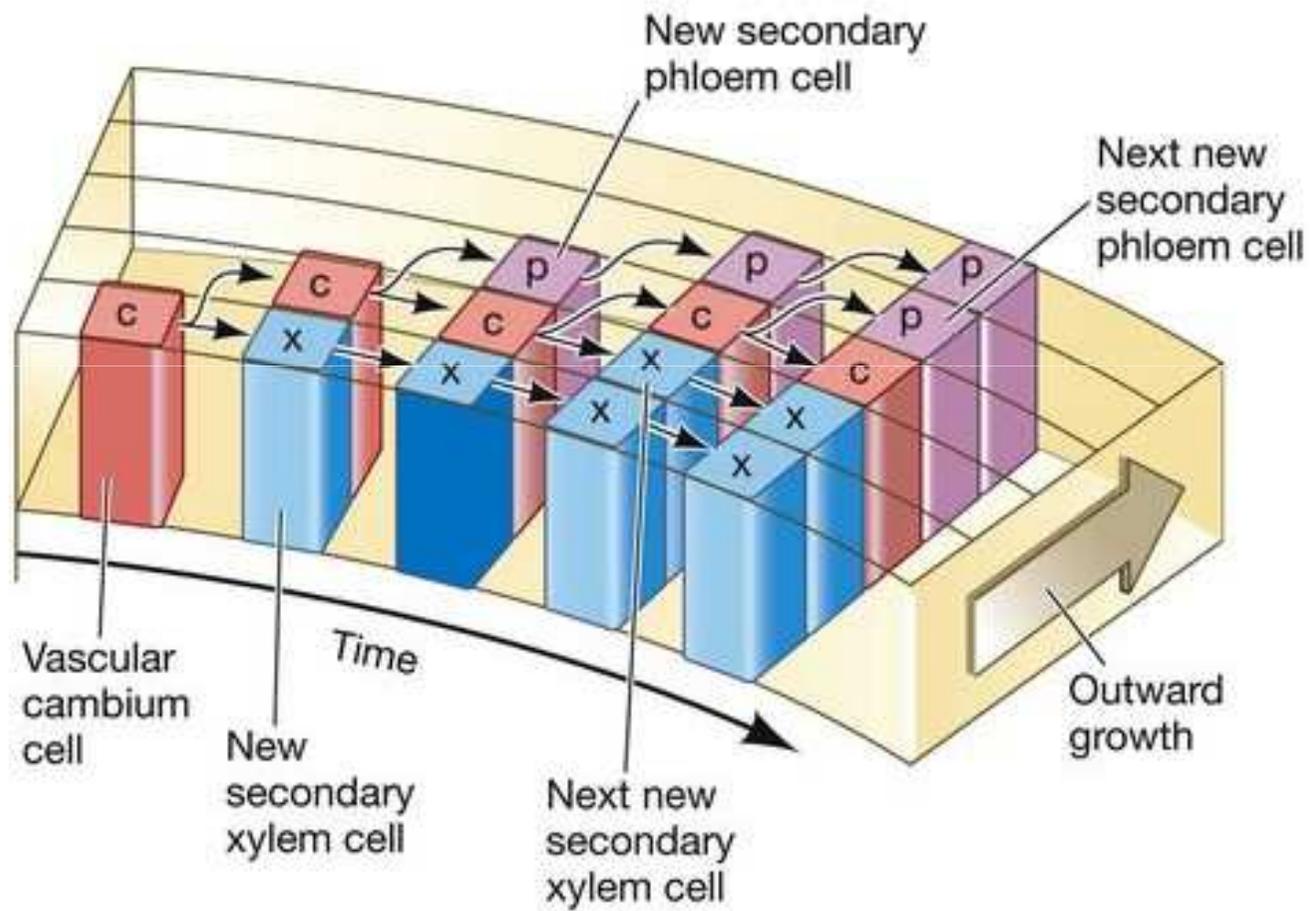
Tissus protecteur
Épiderme foliaire
Périderme (écorce)



Tissus de soutien
Sclérenchyme collenchyme

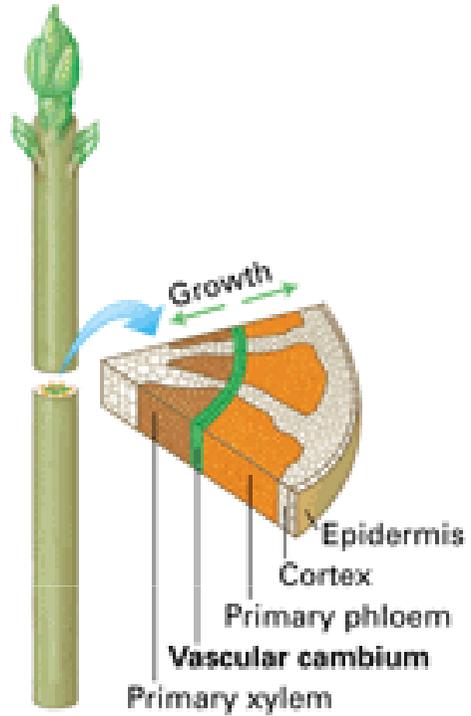


Le méristème secondaire est ici le cambium ou assise libéro ligneuse

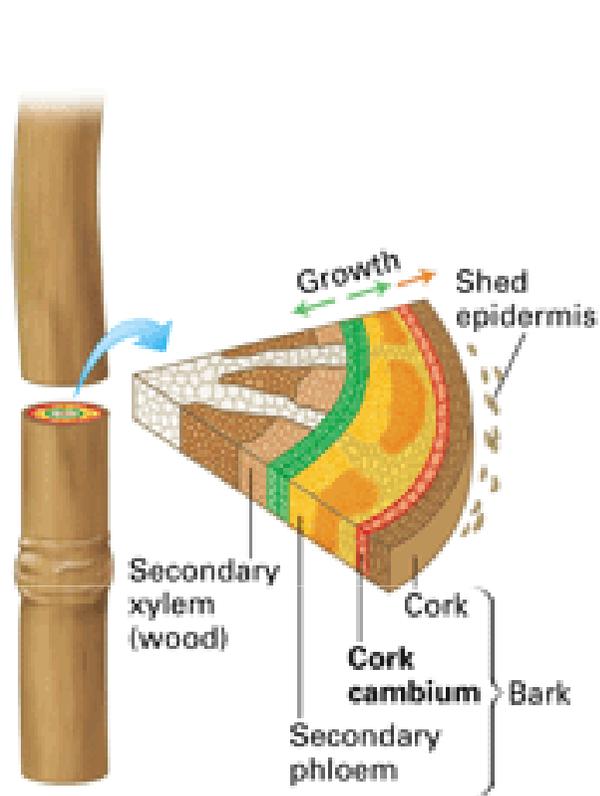


LIFE 9e, Figure 34.17 (Part 2)

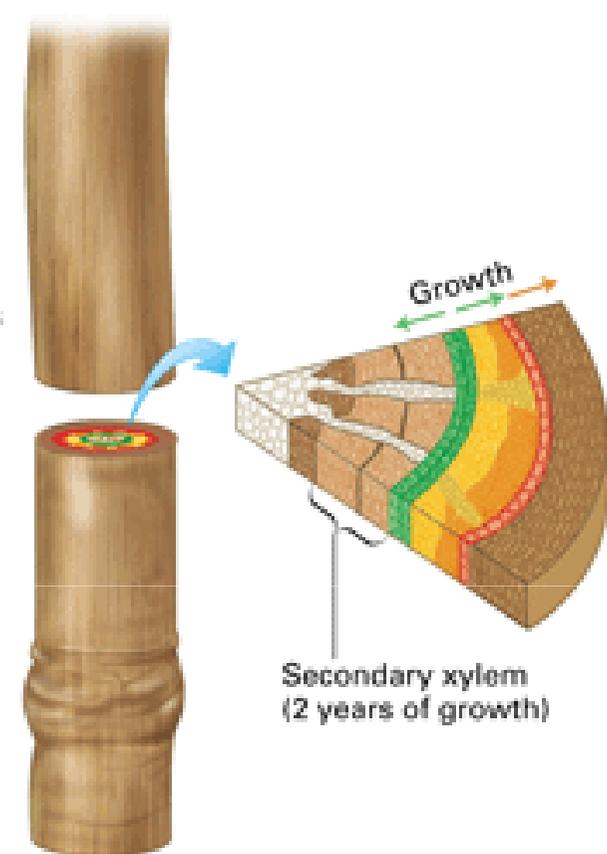
**Year 1
Early Spring**

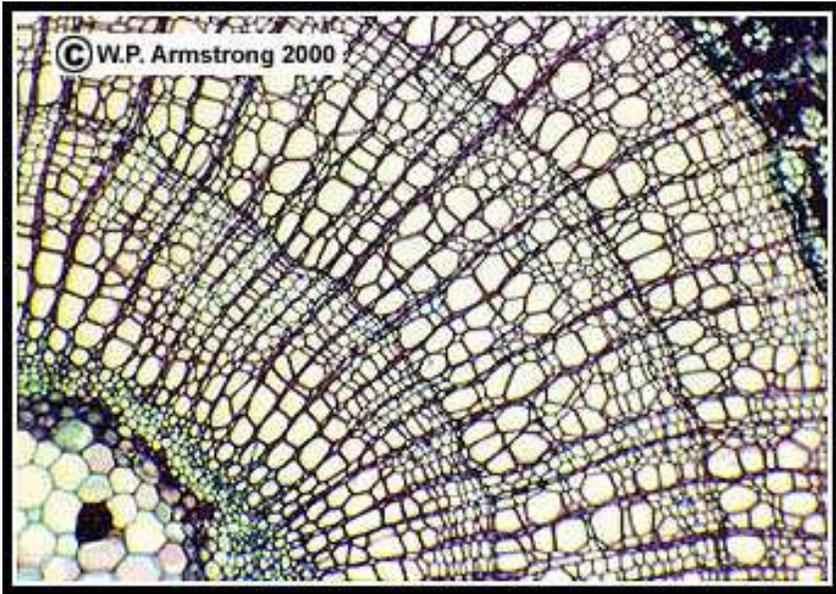


**Year 1
Late Summer**



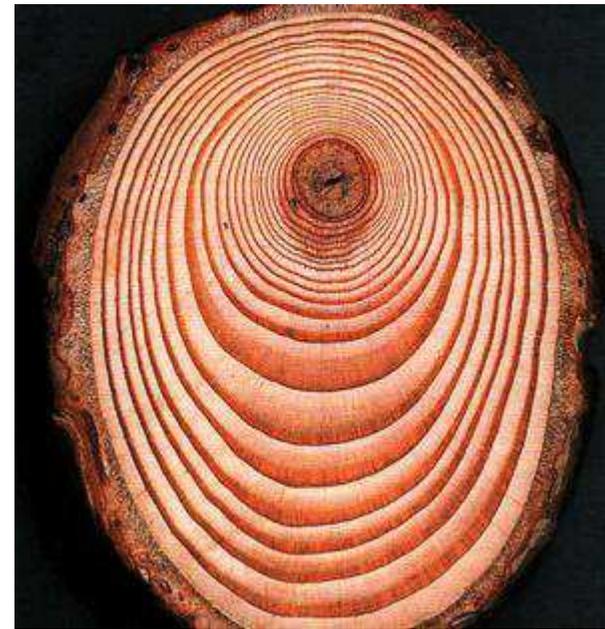
**Year 2
Late Summer**



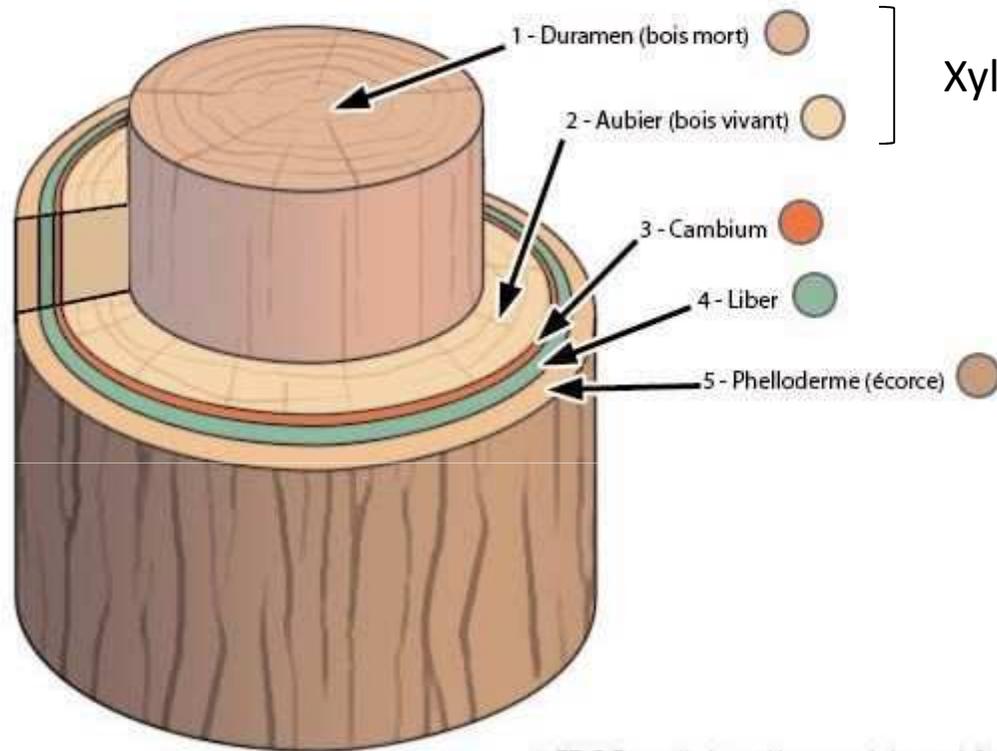


Bois de printemps - Bois d'été

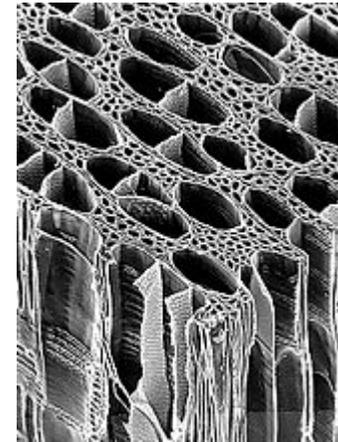
Xylème secondaire
(3 cernes)



Constitution d'une branche



Xylème secondaire

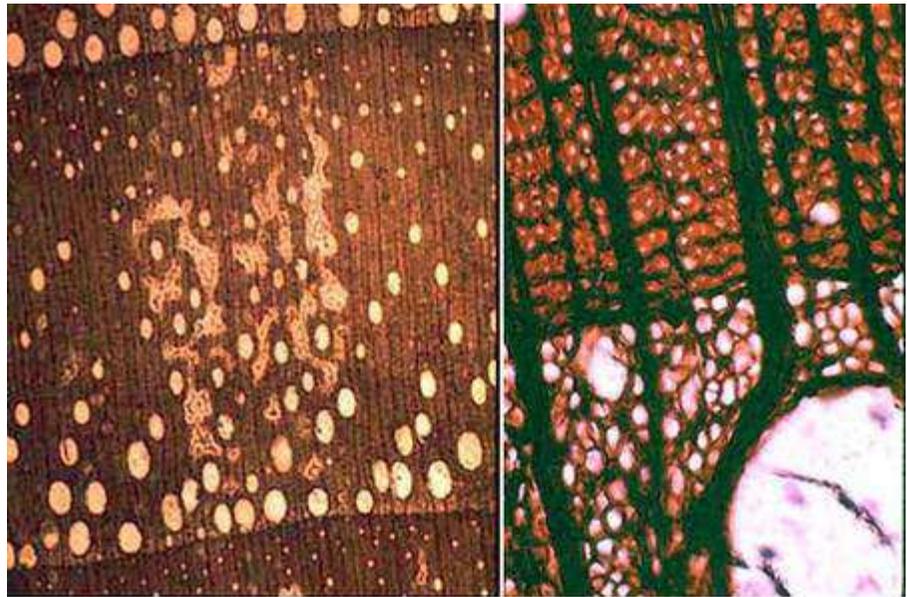








Coupe d'un tronc pétrifié. © Daniel Schwen - Petrified Forest National Park en Arizona, États-Unis



Petrified dicot wood cross section



ELSEVIER

Review of Palaeobotany and Palynology 113 (2001) 261–272

**Review of
Palaeobotany
& Palynology**

www.elsevier.nl/locate/revpalbo

Glutoxylon Chowdhury (Anacardiaceae): the first record of fossil
wood from Bangladesh

I. Poole^{a,*}, C. Davies^b

^aWood Anatomy Section, Nationaal Herbarium Nederland, University of Utrecht Branch, P.O. Box 80102, 3585 CS Utrecht, The Netherlands

^bSchool of Earth Sciences, University of Leeds, Leeds, LS2 9JT, UK

Received 23 February 2000; accepted for publication 6 July 2000

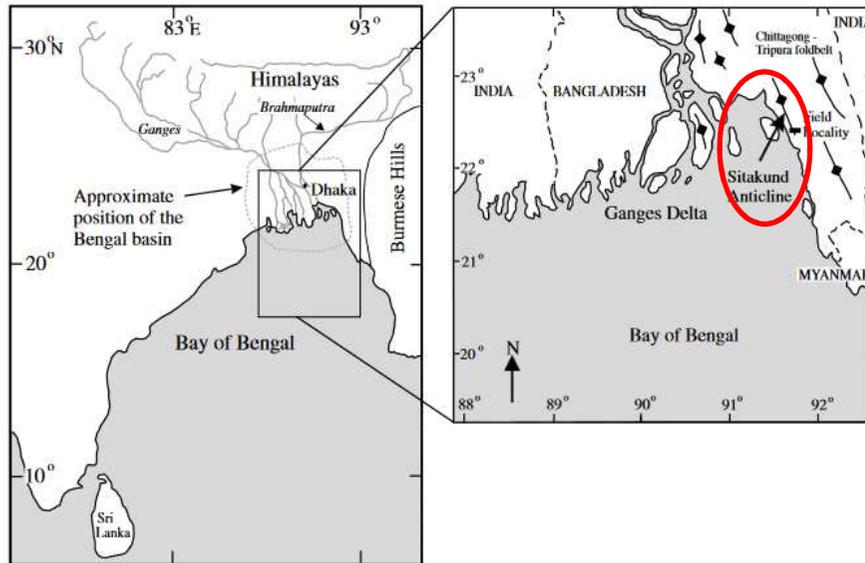
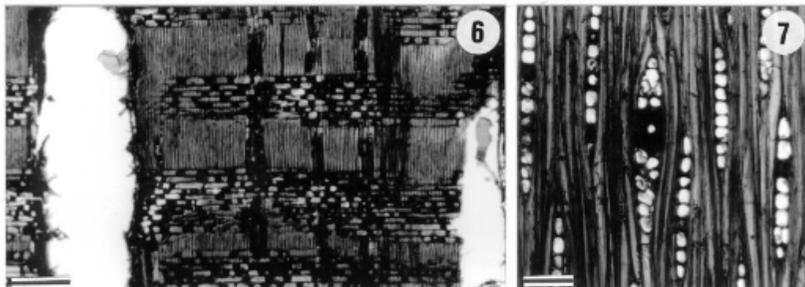
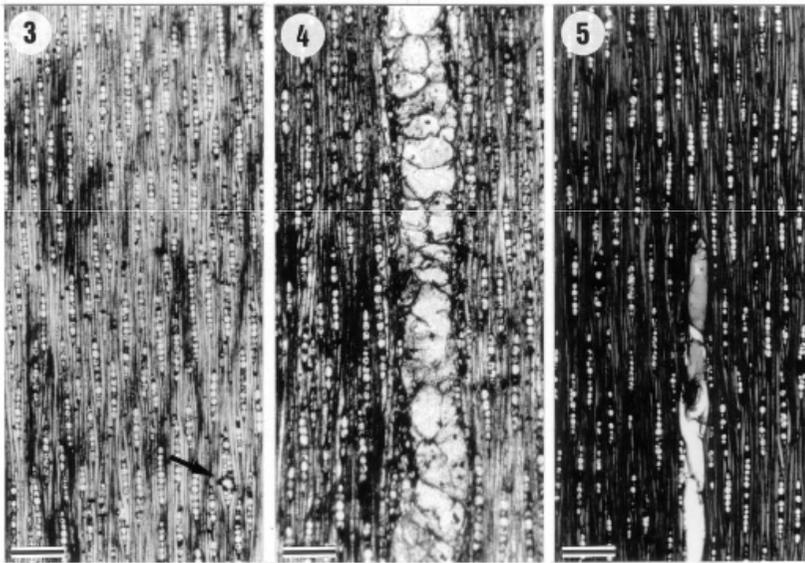
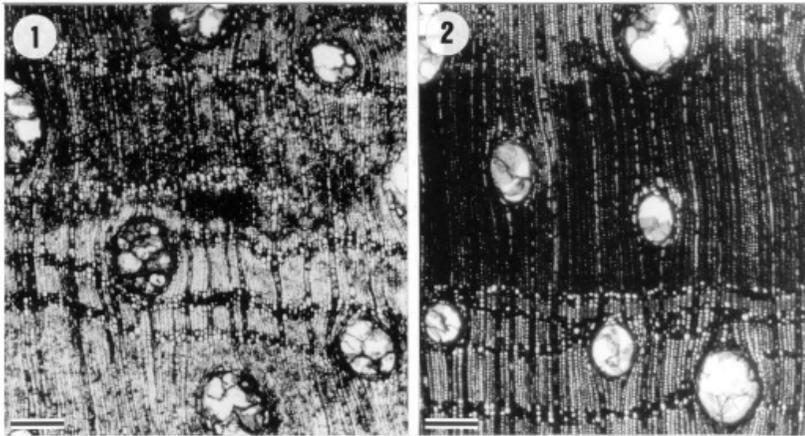


Fig. 1. Schematic maps to show the location of the Bengal Basin, which contains the present day Ganges Delta, and the location of the wood-rich field locality in the Sitakund Anticline.



Formation « herringbones » ou arêtes de poisson ou chevrons

Photographie : Pierre Thomas



Light micrographs of fossil *Glutoxylon sitakundensis* (1, 3–4) modern *Gluta reghans* (RHBw 7707) (2, 5–7) housed in the Federal Institute of Wood Biology and Wood Protection.

1. Transverse section (TS) of showing large, solitary vessels with tyloses and parenchyma bands; scale bar = 200 μm .
2. TS showing the large solitary vessels and parenchyma bands, note the fewer tyloses in the vessels; scale bar = 200 μm .
3. Tangential longitudinal section (TLS) showing uniseriate rays and a multiseriate ray (arrowed) with one radial canal; scale bar = 200 μm .
4. TLS showing tyloses within the vessel obscuring the perforation plates; scale bar = 200 μm .
5. TLS showing uniseriate rays and relatively few multiseriate rays with one radial canal per ray; scale bar = 200 μm .
6. Radial longitudinal section (RLS) showing the procumbent cells forming the body of the ray with the occasional more square cells forming a marginal row in some rays; scale bar = 175 μm .
7. TLS showing the structure of the multiseriate ray with radial canal; scale bar = 150 μm .



Available online at www.sciencedirect.com



Micron 39 (2008) 825–831

micron

www.elsevier.com/locate/micron

Anatomical descriptions of silicified woods from Madagascar and Indonesia by scanning electron microscopy

Chul Jong Yoon^a, Ki Woo Kim^{b,*}

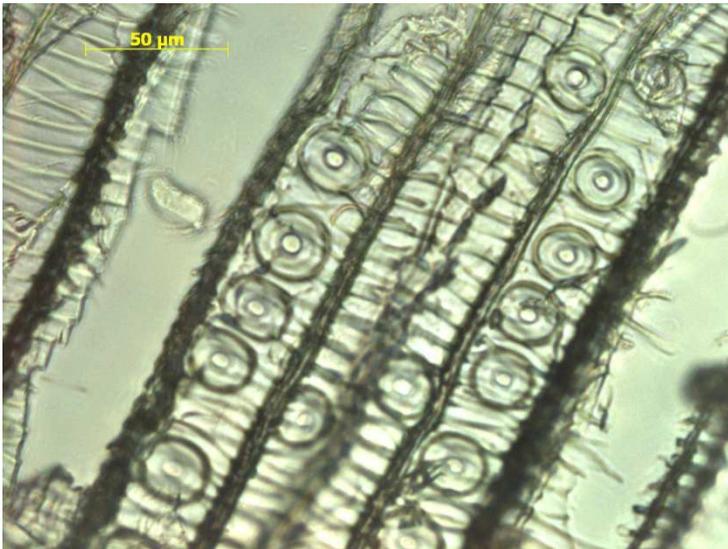
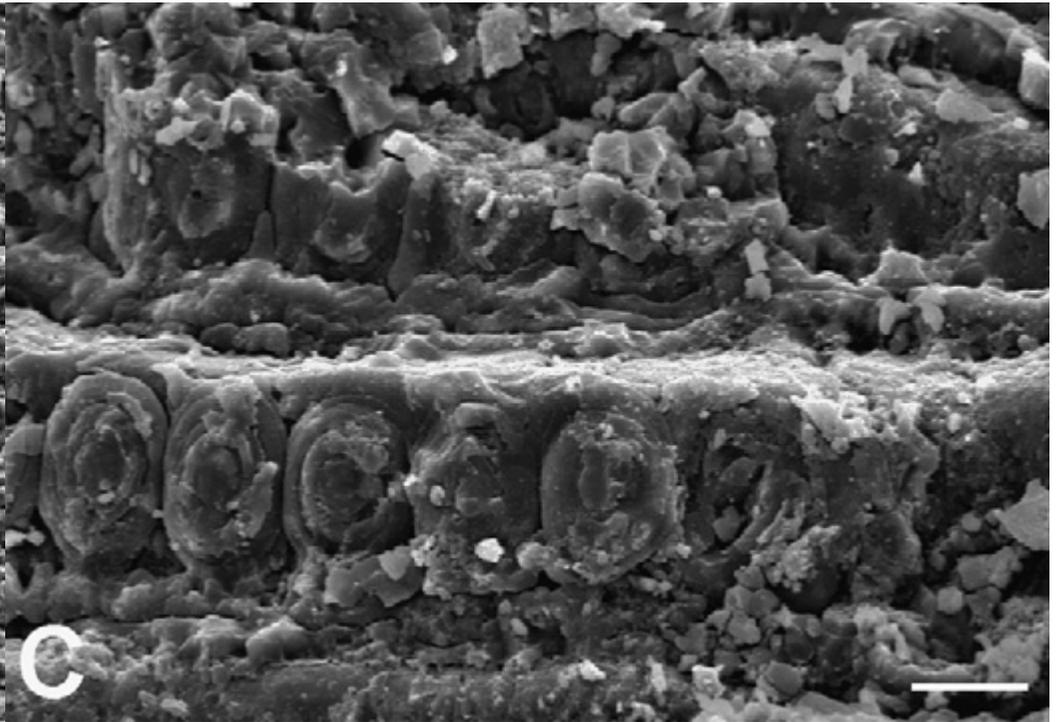
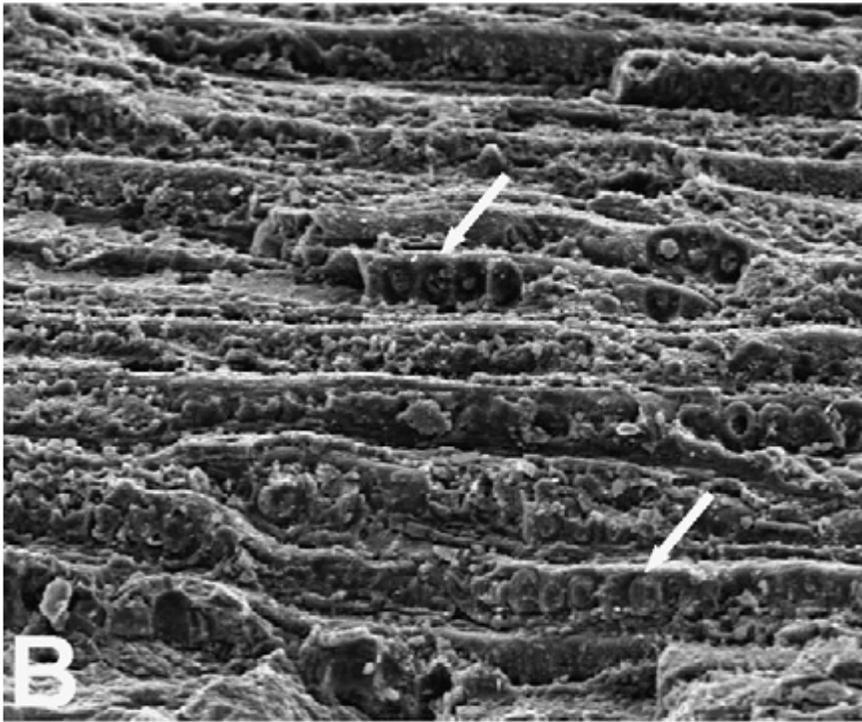
^aCell Morphology Institute, Seoul 157-790, Republic of Korea

^bNational Instrumentation Center for Environmental Management, Seoul National University,
Seoul 151-921, Republic of Korea

Received 30 November 2007; received in revised form 28 December 2007; accepted 29 December 2007



Fig. 1. Silicified woods from Madagascar. They retained the exterior morphology of once grown trees.



Trachéides de Pin

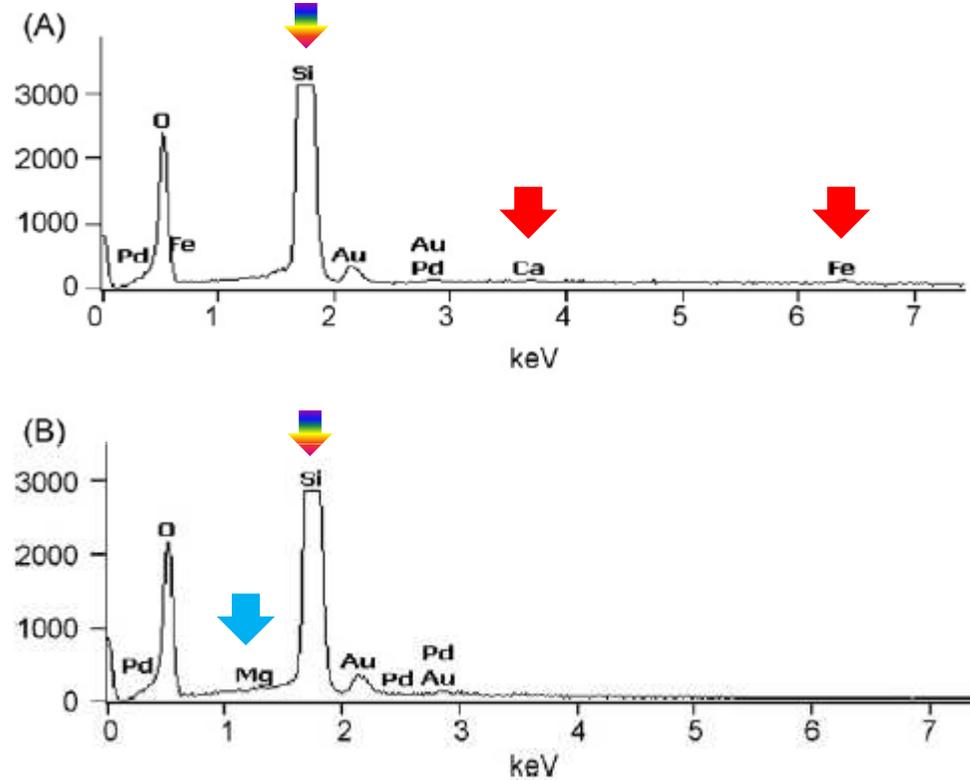


Fig. 8. X-ray spectra of the silicified wood from Indonesia. (A) Spectrum from a red-colored region. Silicon (Si) was present as a basic component of the silicified wood, whereas gold (Au) and palladium (Pd) were derived from the coating material. Calcium and iron were characteristically detected from the region. (B) Spectrum from a blue-colored region. The presence of magnesium was observed at the position of 1.25 keV.