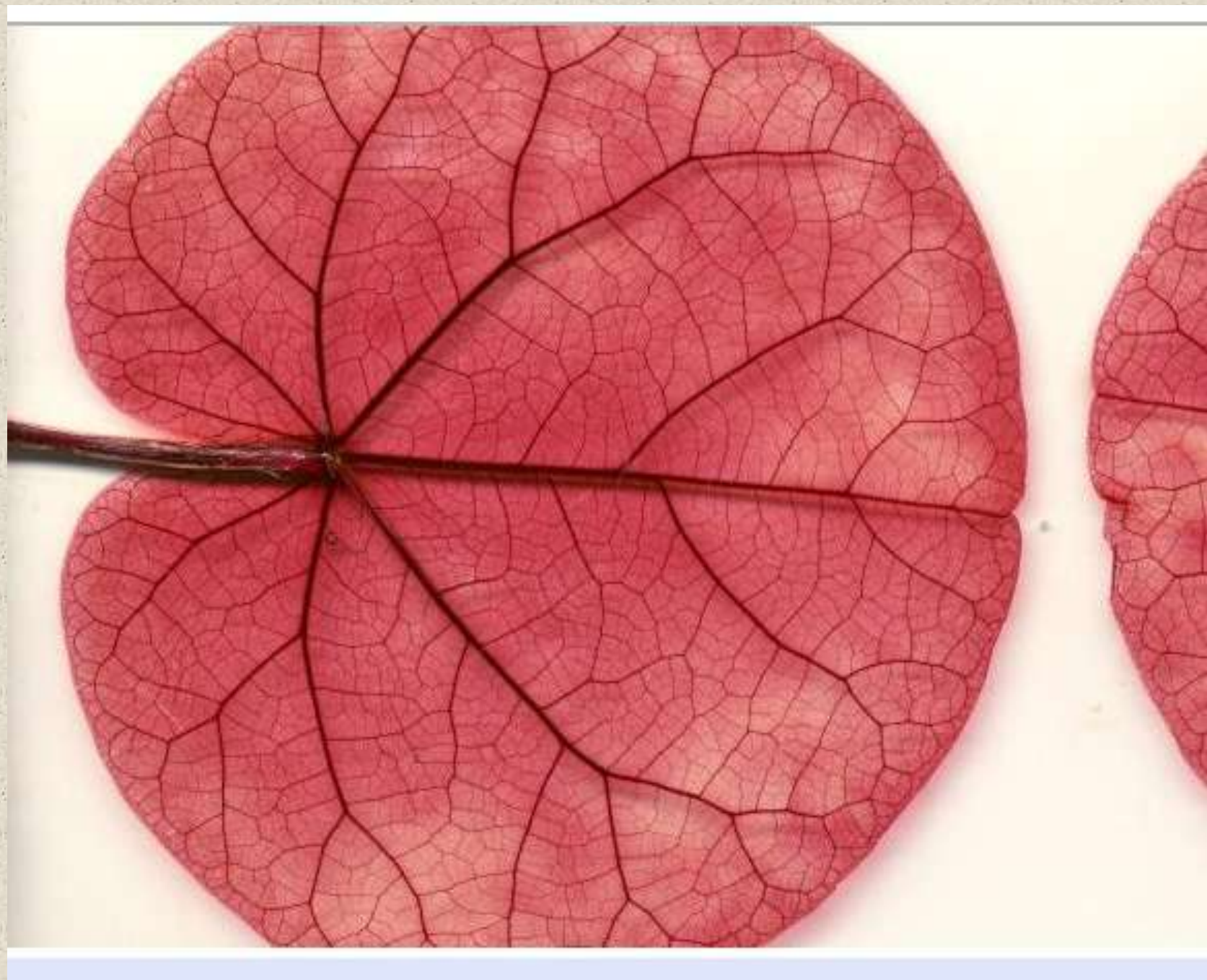


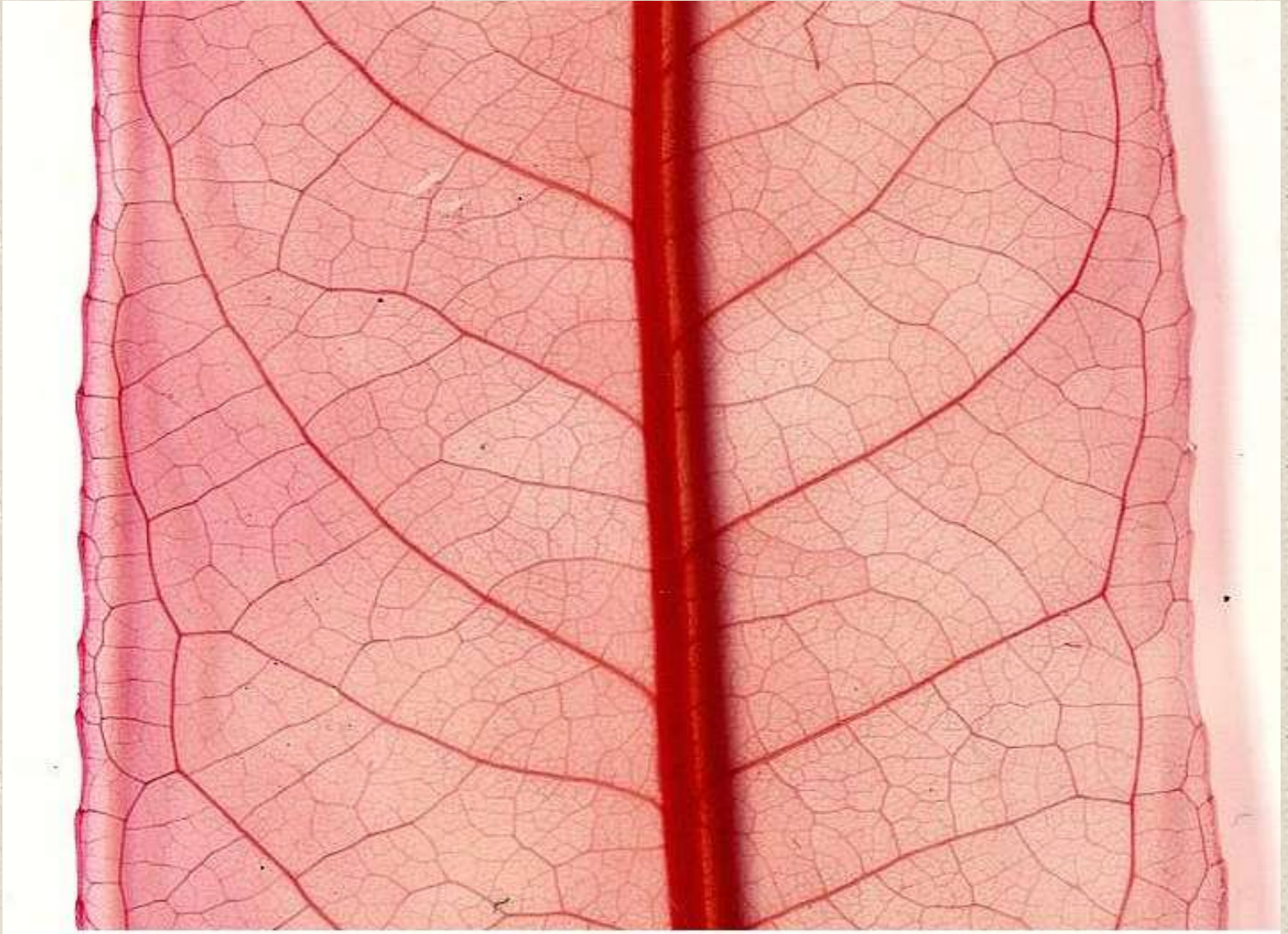
Dicot



Monocot









Yale Peabody Museum of Natural History

Paleobotany

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- [Search the Collections](#)
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THE NATIONAL CLEARED LEAF COLLECTION

[SEARCH THE COLLECTIONS](#)

This reference collection consists of over 6,500 cleared, stained and mounted extant leaves. While at the Smithsonian Institution Curator [Leo Hickey](#) began this collection in 1967 as part of his research on the systematic distribution of the leaf characters of the flowering plants in relation to the evolution of a group.

This collection was transferred with Hickey when he came to the Yale Peabody Museum as Director in 1982. The National Cleared Leaf Collection remains an integral part of research not only for Hickey and his students, but also for national and international scientists.

The Yale Peabody Museum's collections are available to legitimate researchers for scholarly use. Loans are issued to responsible individuals at established institutions. Loans and access to the collection can be arranged through the [Collections Manager](#).



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Yale Peabody Museum – National Cleared Leaf Collection Started by Leo Hickey



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California
Museum of
Paleontology



See the world (and its fossils) with UCMP's field notes.

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Collections : [Paleobotany collection](#)

UCMP cleared leaf collection

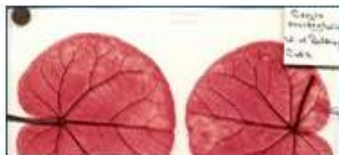
Cleared leaves are modern leaves that have been bleached and stained to make their venation patterns more visible. Leaf shape, venation, and features of the margin, base and apex constitute important taxonomic and physiognomic characters. For more information on leaf terminology, download the [Manual of Leaf Architecture](#). For the paleobotanist, cleared leaves aid in identifying fossil leaf compressions. To learn more about the use of fossil leaves in inferring paleoclimate, visit the [Climate Leaf Analysis Multivariate Program \(CLAMP\)](#) website.

UCMP houses the *Daniel I. Axelrod* and the *Berkeley* collections, comprising over 2000 slides of modern leaf taxa. Leaves of the Axelrod collection are mounted in plexiglass and are in good archival condition. However, the Berkeley collection is mounted between glass with the mounting medium Permunt and is unfortunately deteriorating due to oxidation of this medium. Therefore, putting the cleared leaf images online is in part a conservation measure, with the ultimate goal of having the entire cleared leaf collection available online and CD to serve as teaching and research tools.

Data records for both collections are now available in the online database. JPEG images are being incorporated with the specimen records, beginning with the Axelrod collection. Some images are also available in higher resolution "Zoom and pan" mode (all eventually will be), which gives finer detail of the venation, epidermis and margin areas and in many cases insect and fungal damage, information vital for paleoecological studies.

You can search the collection from the [Paleontology Collections Photos](#) page or browse the collection at the [Modern Cleared Leaf Photos](#) page.

Locality information: For leaves in the Axelrod collection, the locality data, if any, appear directly on the slide label. The Berkeley collection generally has good locality information, since many of the cleared leaves are from herbarium specimens housed at UC Berkeley's [University and Jepson Herbaria](#).



Additional information: The Berkeley cleared leaves are linked directly to their UC Berkeley Herbarium online records using the UC Herbarium Accession ID number. Clicking on this number will bring up all information the herbaria have for a particular specimen, but please note that only the herbaria's California collection is currently web accessible.

In addition, cleared leaf specimen images are linked to the [ITIS report](#), the [USDA plants database](#), [CalPhotos database](#), and [Google image search](#), providing additional images, taxonomic and geographic information for the taxon of interest.

CalPhotos: photo details

click photo for enlargement or ZOOM (java required)



Photographer: M
Organization: UC
Collection: UCMP
ID: 0000 0000 1002
Copyright © 2002 U

Berberis aquifolium
Mountaingrape

INFORMATION PROVIDED WITH THE PHOTO

- date of photo Sep 30, 2002
- location Grass Valley (Nevada County, Calif)
- notes Modern cleared leaf. [View more](#)
- camera scanned
- View UCMP specimen record [BCL10](#)
- [View all photos](#) for this specimen

MORE INFORMATION ABOUT THIS PLANT

- common names Mountaingrape, Oregon Grape
- [Look for Jepson Manual treatments, maps \(USDA\)](#)
- [Plants Database record \(USDA\)](#)
- [ITIS record](#) (Integrated Taxonomic Information System)
- [View all photos in CalPhotos](#) of Berberis aquifolium
- [Look for google images](#) of Berberis aquifolium

Some of the information available on a cleared leaf in CalPhotos.

Internet

75%

start



Inbox - M...

UCMP cle...

GNU Ima...

Microsoft...

Clearing

2 Micro...

9:59 PM



10. Mahonia punila (Greene) Fedde

10. Mahonia punila (Greene) Fedde



CalPhotos: photo details

Photo 1

click photo for enlargement
or [ZOOM](#) (java required)



Photographer: [M...](#)
Organization: [Un...](#)
Collection: [UCM...](#)

ID: 0000 0000 1002

Copyright © 2002 U

Berberis aquifolium
Mountaingrape

INFORMATION PROVIDED WITH THE PHOTO

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- **location** Grass Valley (Nevada County, Calif)
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- [ITIS record](#) (Integrated Taxonomic Information Syst
- [View all photos in CalPhotos](#) of Berberis aquif
- [Look for google images](#) of Berberis aquifolium

Acer
Tubrum
Rock Creek,
Wash., D.C.
2-68



Fischer

CENTIMETERS

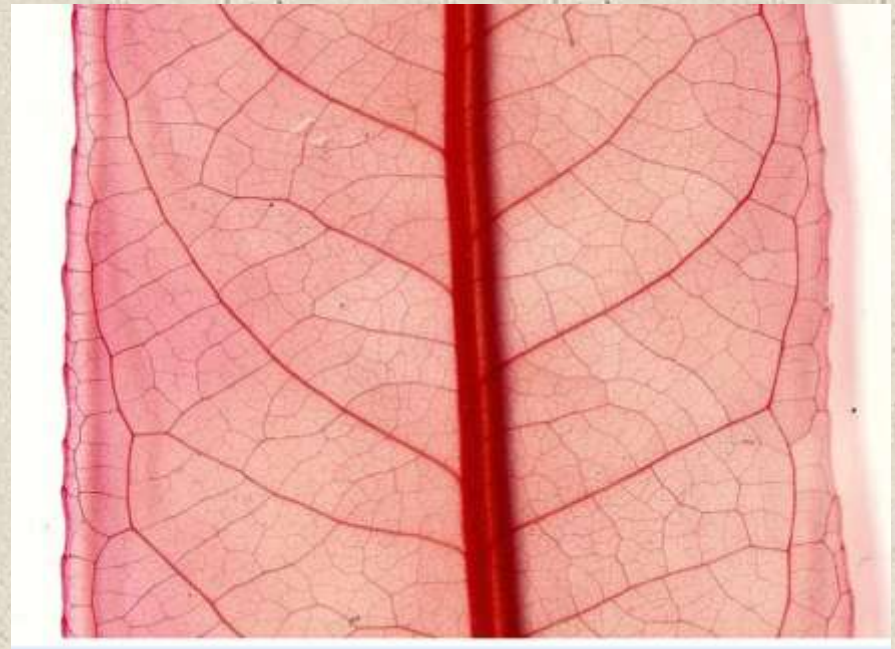


Liquidambar
styraciflua
H. S. Gentry
Rock Creek
Wash. D.C.



CENTIMETERS

Salix
laevigata
3-68





CLAMP online

Climate Leaf Analysis Multivariate Program

SITE INDEX

- Home
- CLAMP Updates
- Background
- What is CLAMP?
- CLAMP Sampling
- CLAMP 'Classic'
- CLAMP Analysis Online
- CLAMP Uncertainties
- Acknowledgements

Contact

- Bob Spicer

Downloads

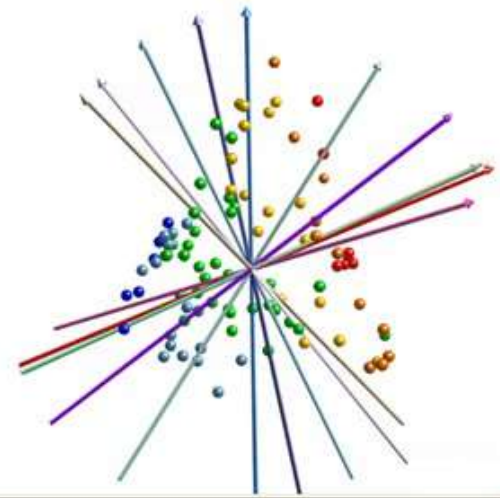
- Character Definitions
- Leaf Size Template
- Scoring and Scoresheets
- Physg3br/ar Scoresheets
- PhysgAsia1 Files



CLAMP is a method of obtaining ancient climate information from the architecture (physiognomy) of fossil leaves of woody dicot flowering plants.

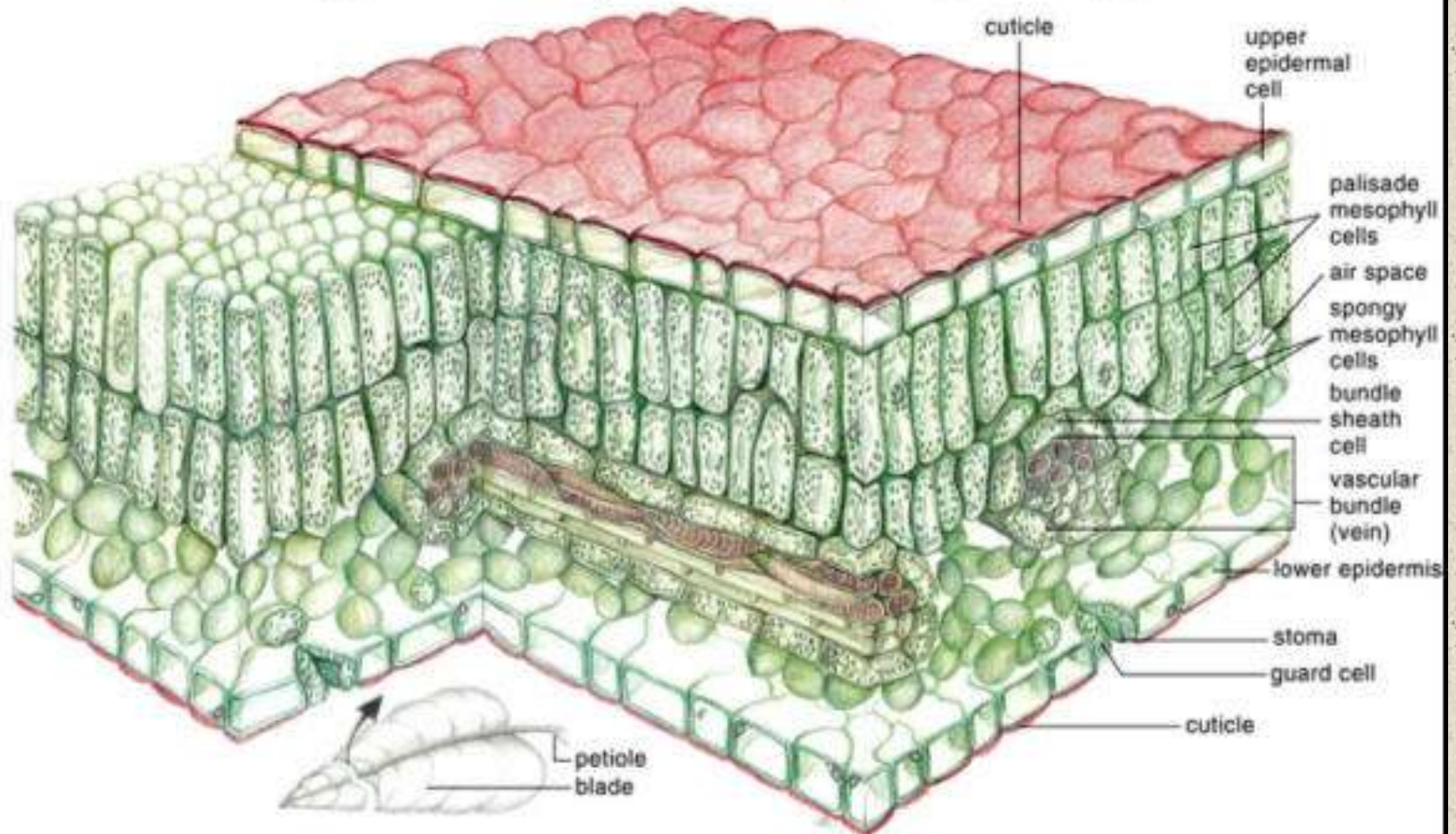
It can be applied to any fossil assemblage up to almost 100 million years old where there are at least twenty different morphotypes (species) preserved, and where evidence suggests that the assemblage is likely to be a fair representation of the leaves present in the ancient source vegetation.

Such palaeoclimate proxies are important in quantifying past climate change in order to predict and plan our future better.

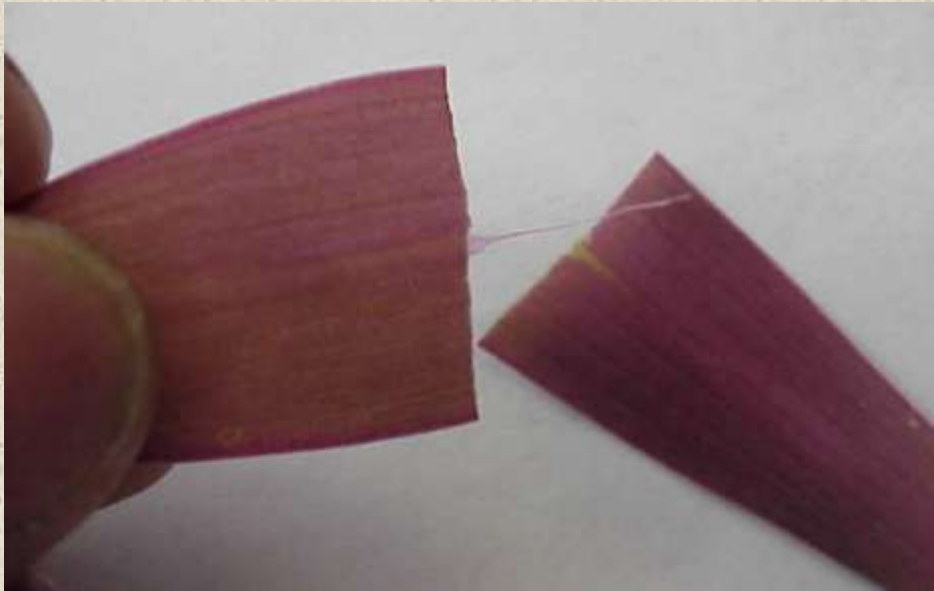


Epidermal Peels

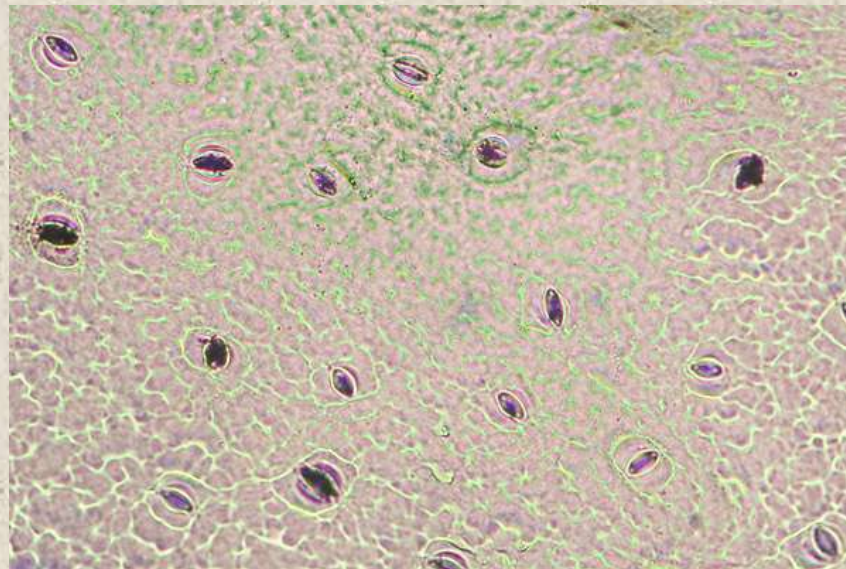
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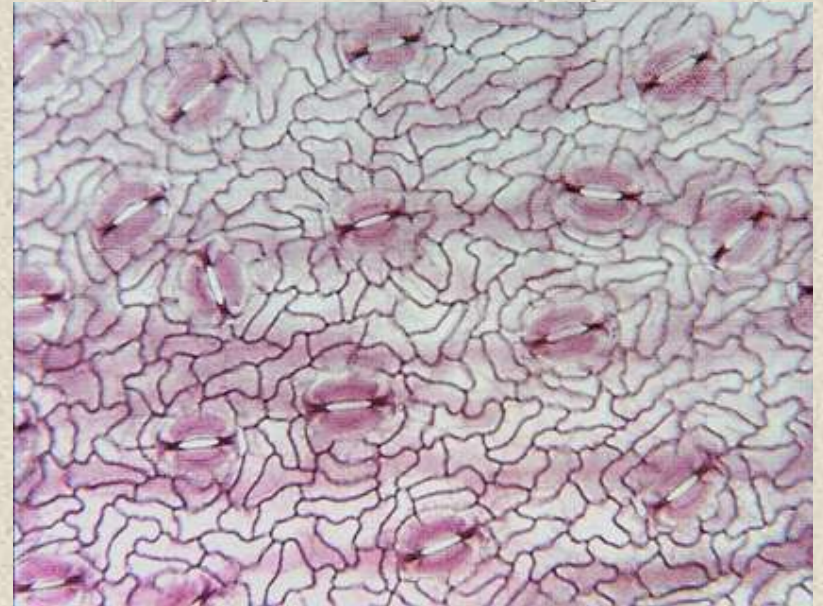
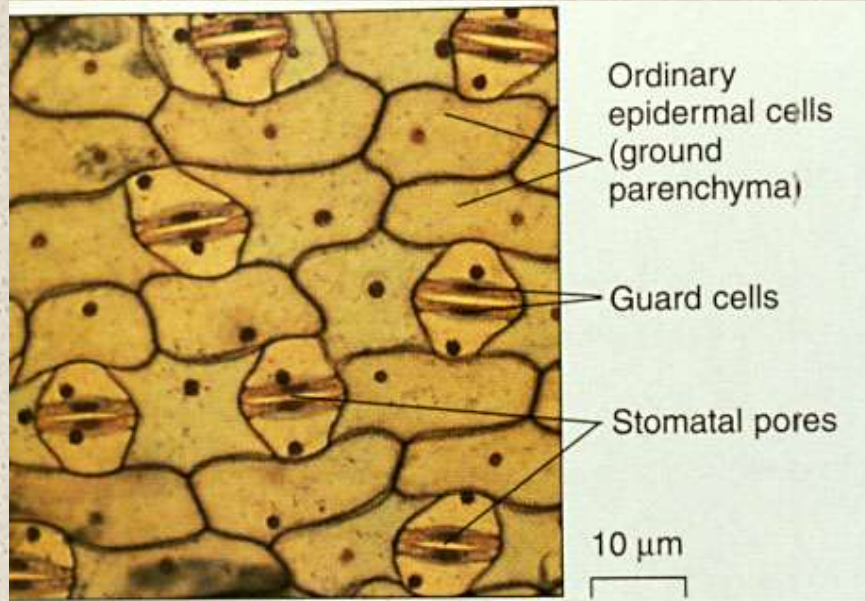
Epidermal Peels – snap and peel



Epidermal Peels – using glue or plastic

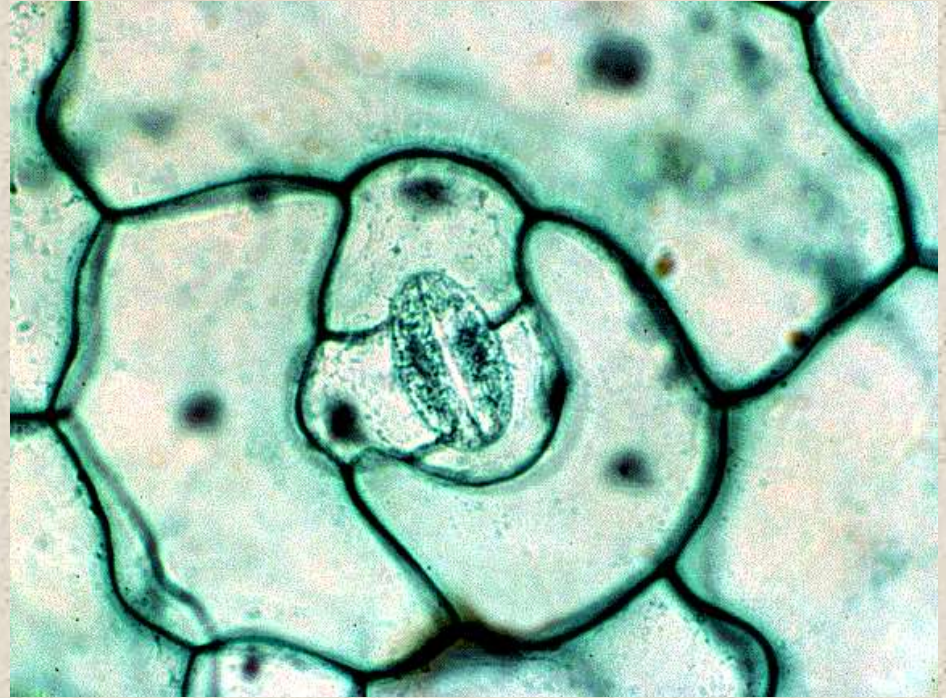


Epidermal Peels



Cycas rumphii

Epidermal Peels

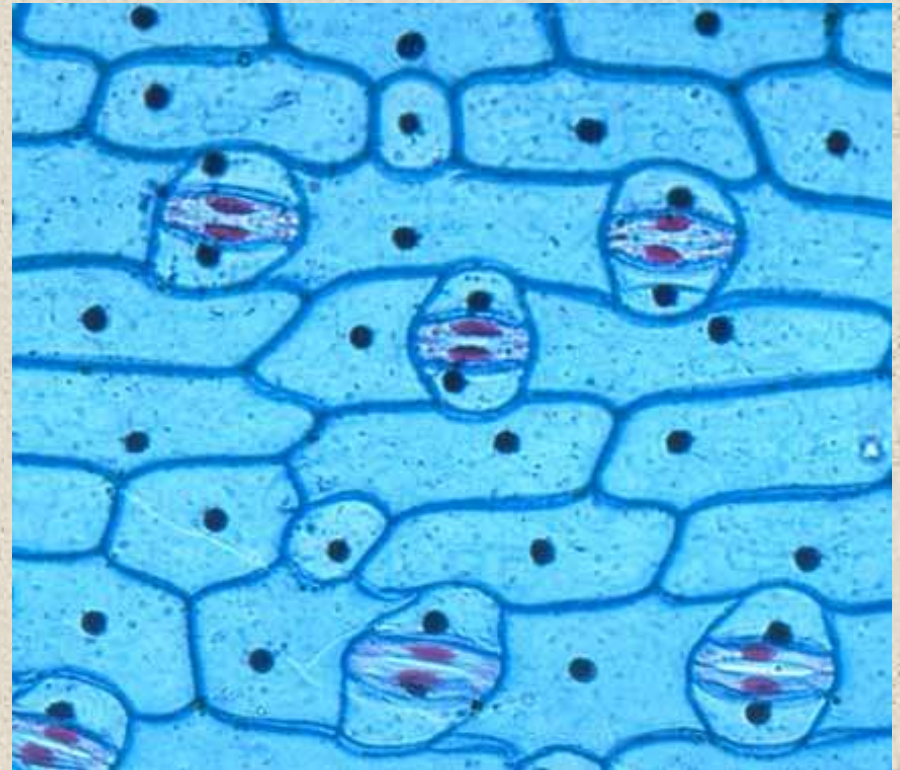


Echeveria

Epidermal Peels



Zea mays



Lilium

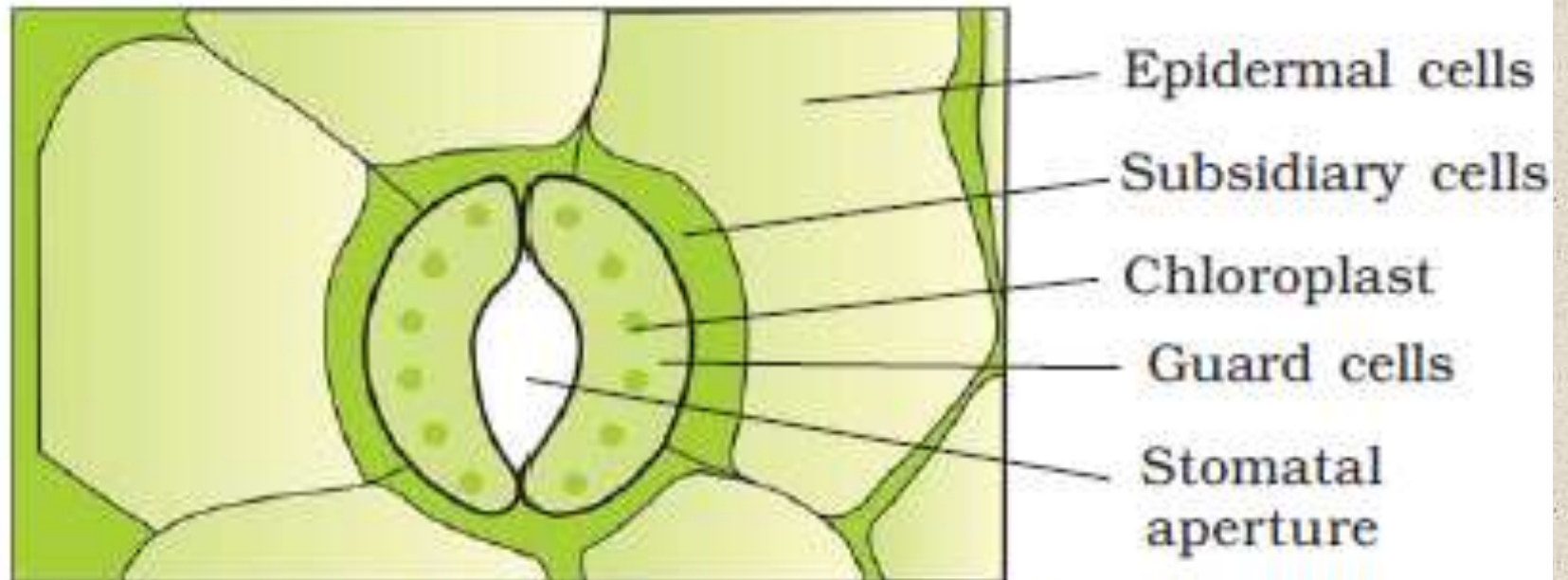
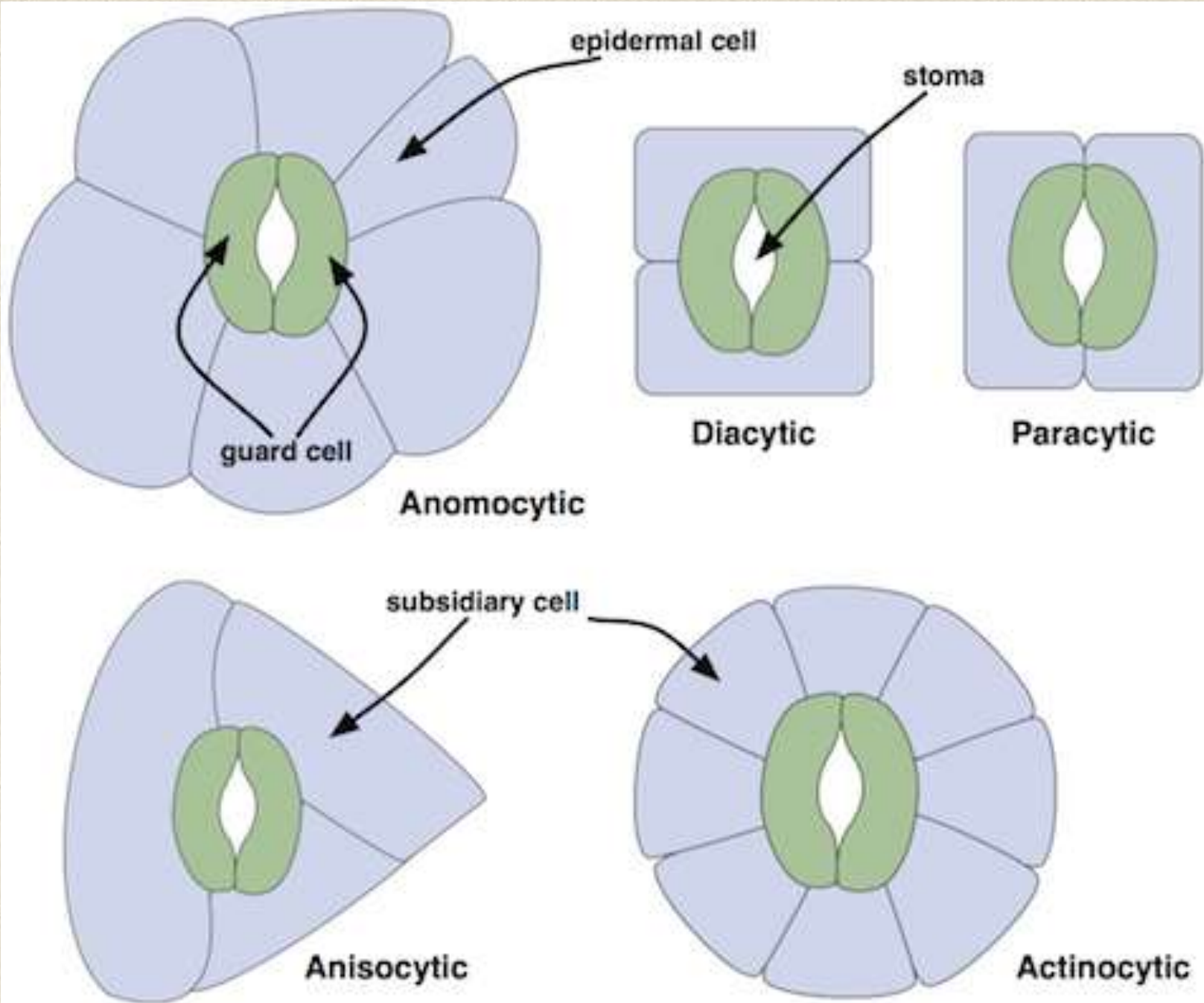


Figure 6.4 Diagrammatic representation:
(a) stomata with bean-shaped guard cells



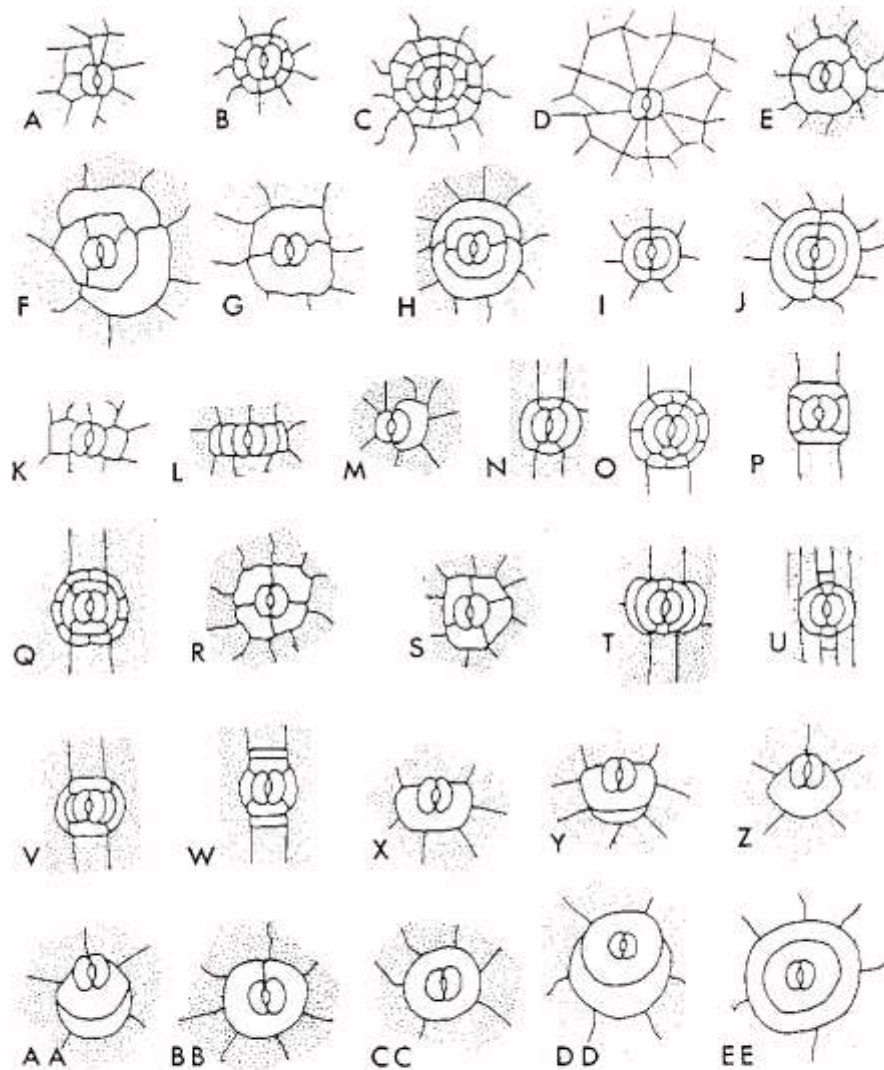


Fig. 3.7 Thirty-one types of arrangement of subsidiary cells in the mature stomatal complex of vascular plants, adapted from Dilcher:¹⁰¹ A, anomocytic; B, cyclocytic; C, amphicyclocytic; D, actinocytic; E, anisocytic; F, amphianisocytic; G, diacytic; H, amphidiacytic; I, paracytic; J, amphiparacytic; K, brachyparacytic; L, amphibrachyparacytic; M, hemiparacytic; N, paratetracytic; O, amphiparatetracytic; P, brachyparatetracytic; Q, amphibrachyparatetracytic; R, staurocytic; S, anomotetracytic; T, parahexacytic-monopolar; U, parahexacytic-dipolar; V, brachyparahexacytic-monopolar; W, brachyparahexacytic-dipolar; X, polocytic; Y, copolocytic; Z, axillocytic; AA, coaxillocytic; BB, desmocytic; CC, pericytic; DD, copericytic; EE, amphipericytic. Four other types now recognized were not known to Dilcher.

Macerations

Methods:

KOH/Chromic Acid

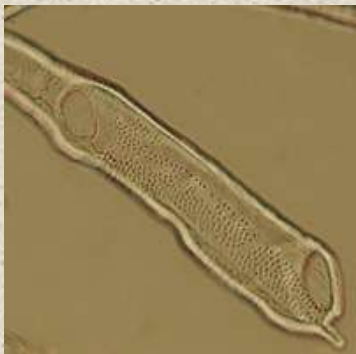
Jeffrey's Method

10% chromic acid and 10% nitric acid

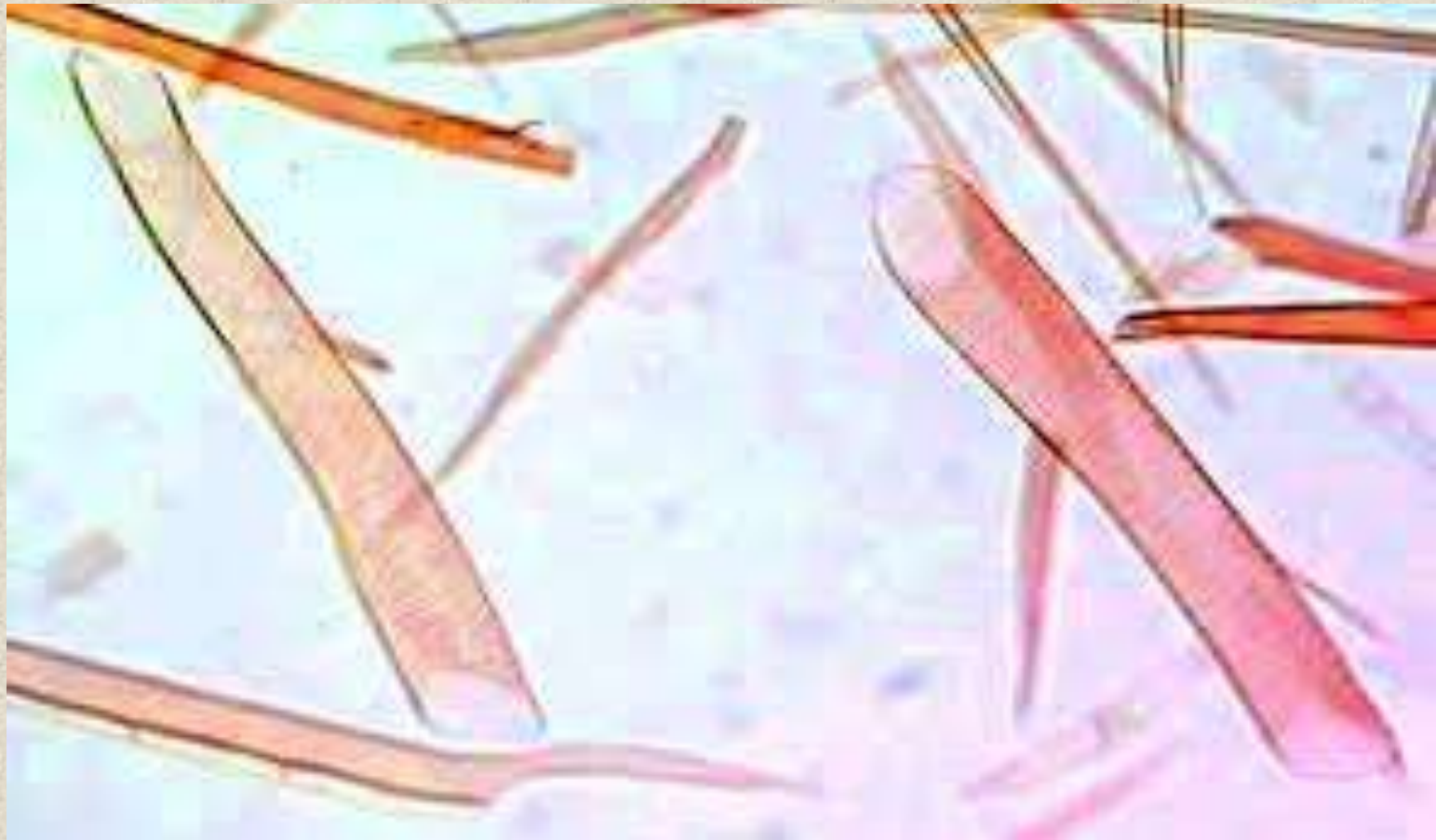
Gifford's Method

Glacial Acetic Acid

30% Hydrogen Peroxide



Macerations



Maceration of *Tilia*

