Tiempo y árboles

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MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD

INSTITUTO PIRENAICO DE ECOLOGÍA IPE CSIC

"10 AÑOS DE LA LEY DE PATRIMONIO ARBÓREO MONUMENTAL EN LA COMUNITAT VALENCIANA"

Jornada sobre Árboles Monumentales

10 mayo 2016

Banc de Llavors Forestals (GV)-Jardí Botànic (UV) Valencia

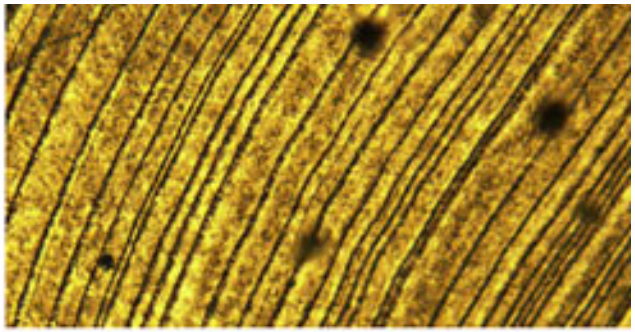
Anillos por doquier

Summer Science Exhibition

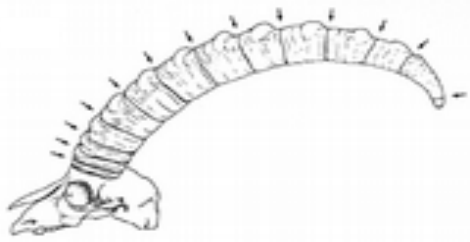
Arctica islandica, the longest-lived animal on Earth

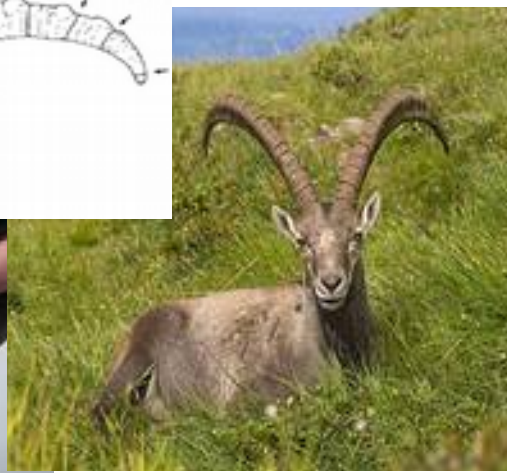
Theme zone: Explore
Tags: Biology, Environment
Twitter hash: #SFSSE

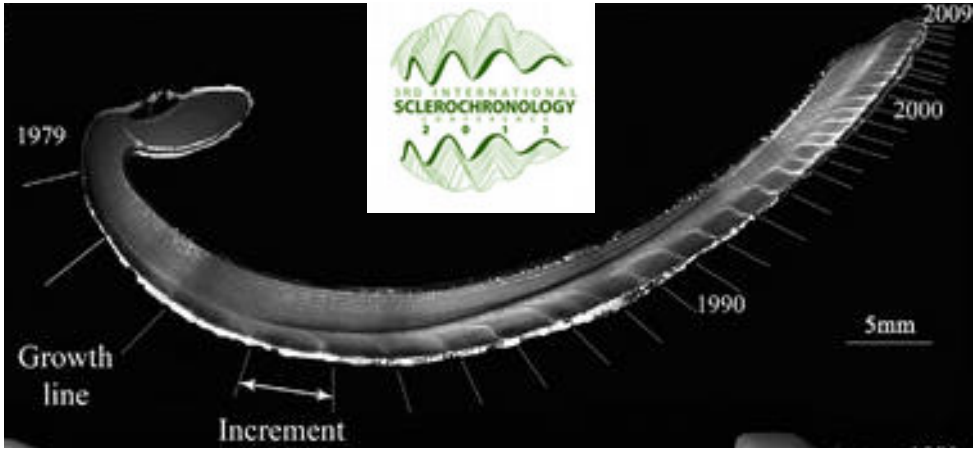
Esclerocronología



Magnified image of Arctica islandica growth increments







Imágenes de Miguel Ortega

Las especies de crecimiento rápido tienen los anillos de crecimiento anchos

Las especies de crecimiento lento y longevas tiene los anillos estrechos

Imágenes de Miguel Ortega

Pino carrasco de 31 años
de dimensiones semejantes a un
tejo de 350 años

Imágenes de Miguel Ortega

Los ejemplares longevos que viven en lugares límite, pino negro de 600 años

Imágenes de Miguel Ortega

Pinos negros viejos (800-1000 años), Pirineos

Árboles más viejos

Nombre	Edad (años)	Especie	Lugar
Old Hara	**5065**	   *Pinus longaeva*	Sierra Nevada-White Mountains, California, Nevada USA
Methuselah	**4847**		
Prometheus (WPN-114)	**4844**		
Gran Abuelo	**3645**	*Fitzroya cupressoides*	Cordiller Pelada, S. Chile
The President	**3200**	*Sequoiadendron giganteum*	Sierra Nevada, California, USA

Especie	Edad (años)	Lugar
Pinus longaeva	5062	White Mountains, California
Pinus longaeva	4845	White Mountains, California
Fitzroya cupressoides	3622	Chile
Sequoiadendron giganteum	3266✞ (muerto)	Sierra Nevada, California, USA

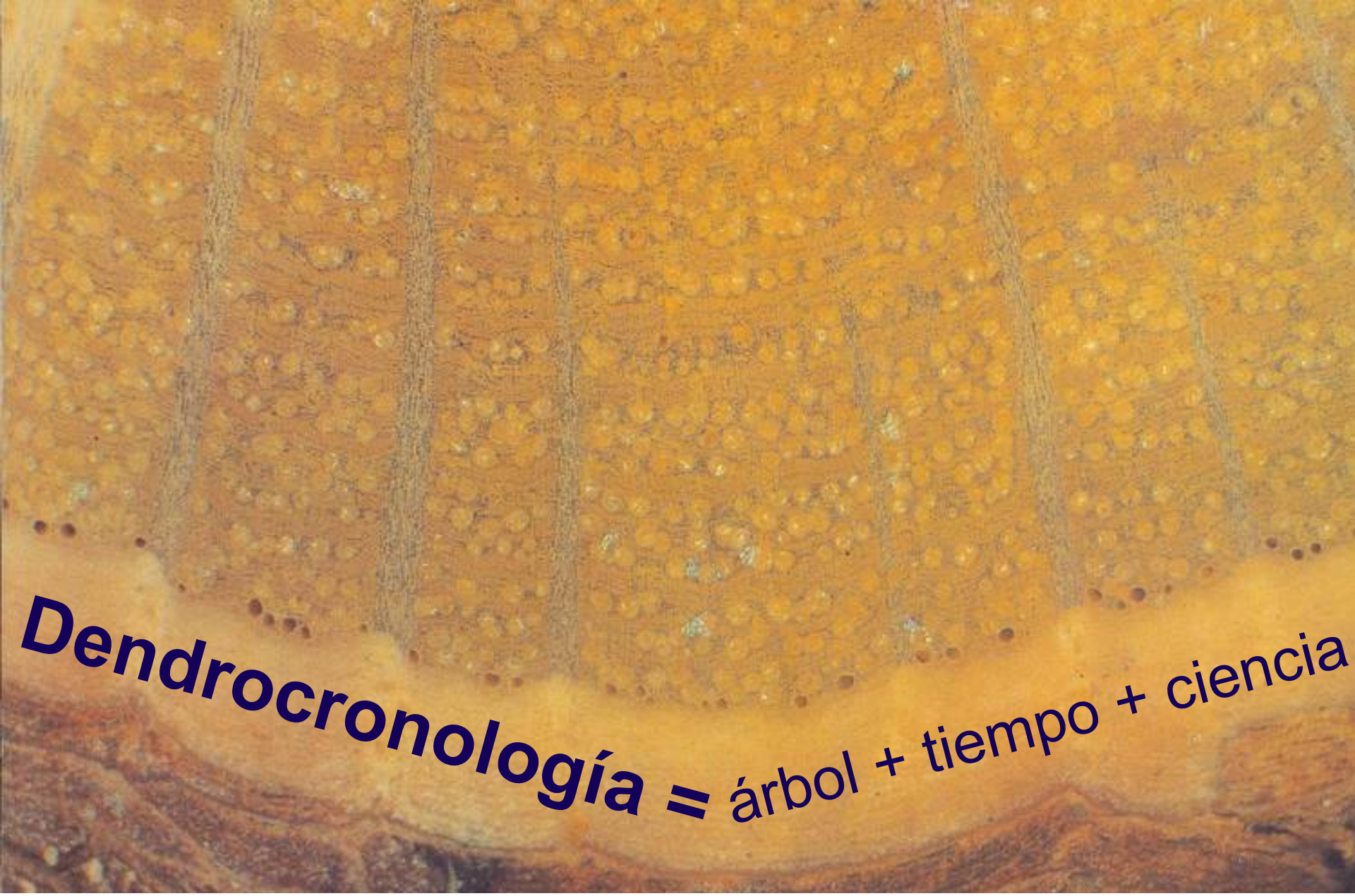
Fuentes: Wikipedia, http://www.rmtrr.org/oldlist.htm

✓ En España: pino laricio de Cazorla (1080 años).

✓ Pinos negros de Pirineos (800-1000 años).

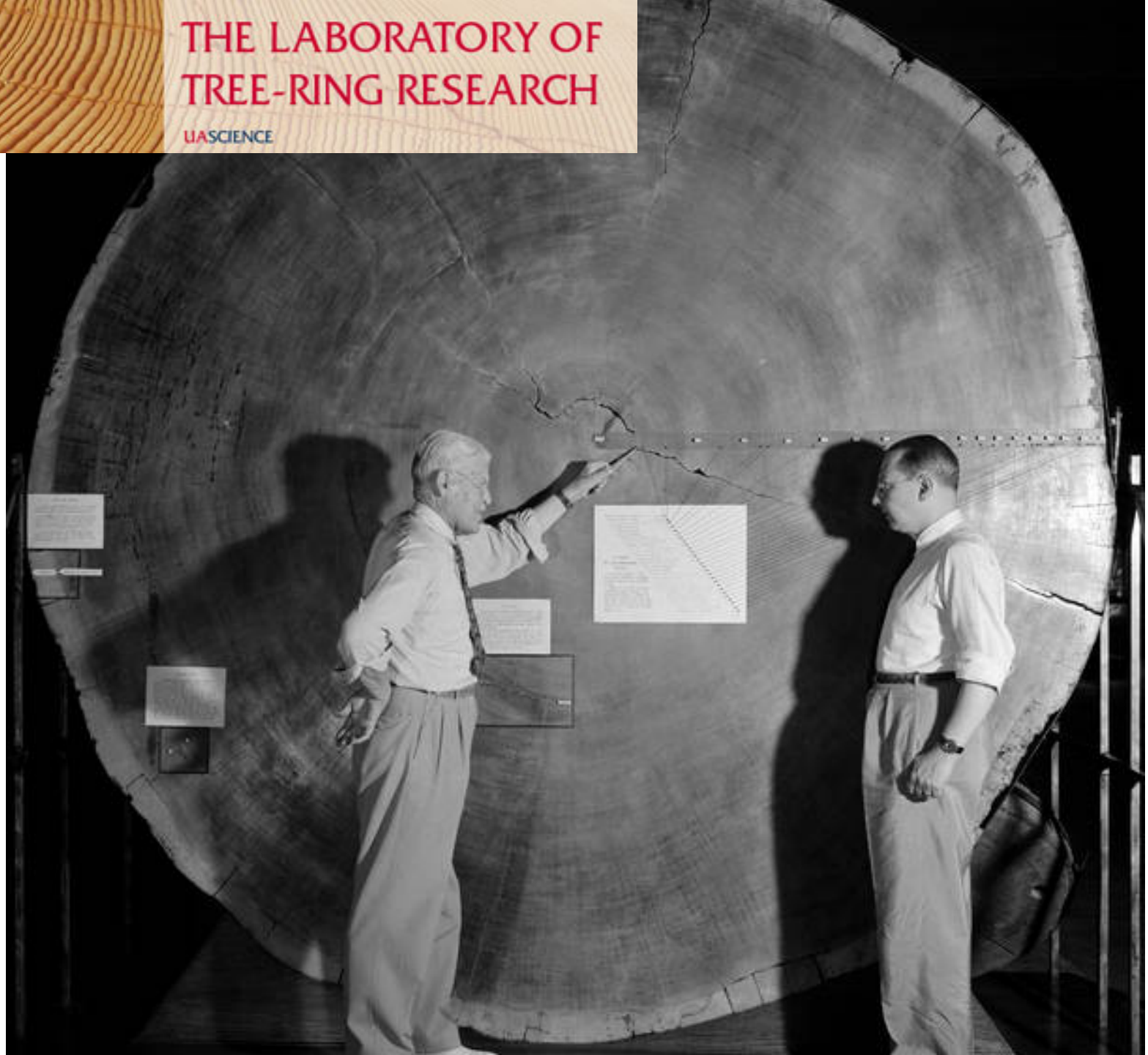
Para acceder a esta información no es necesario cortar el árbol,
se saca una muestra con una herramienta especial, la barrena de Pressler

Imágenes de Miguel Ortega


Dendrocronología = árbol + tiempo + ciencia

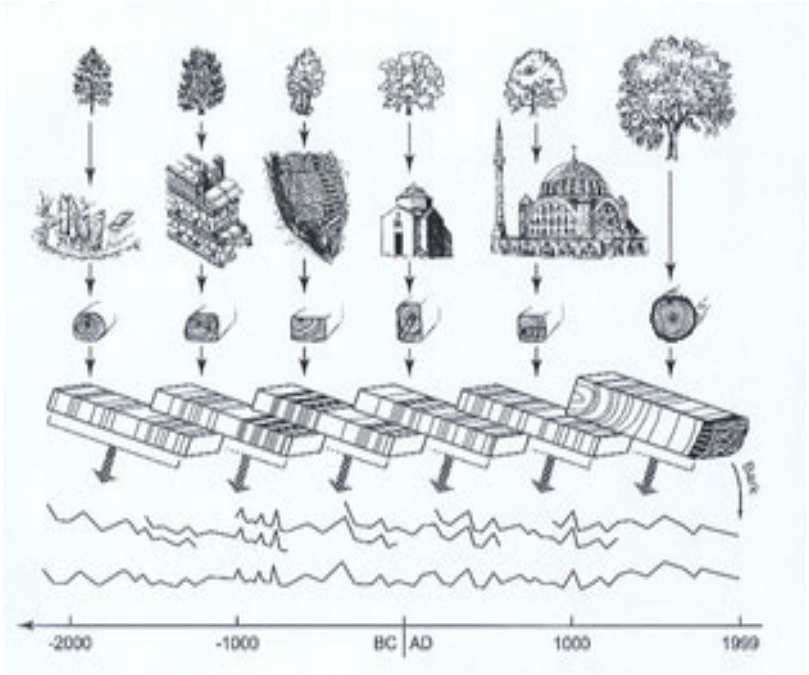
THE LABORATORY OF TREE-RING RESEARCH

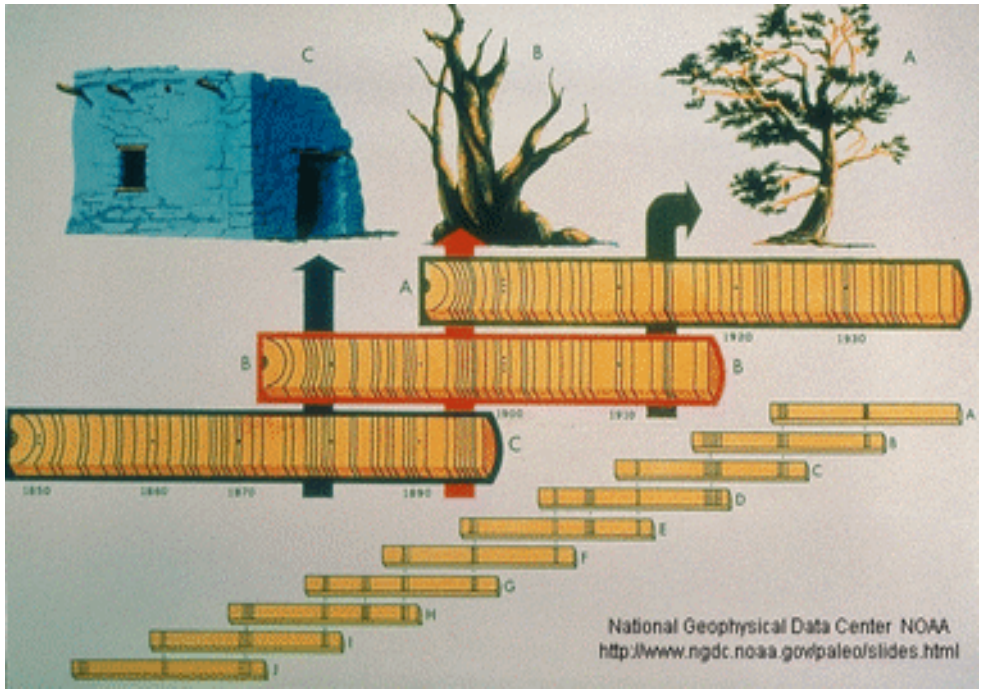
UASCIENCE



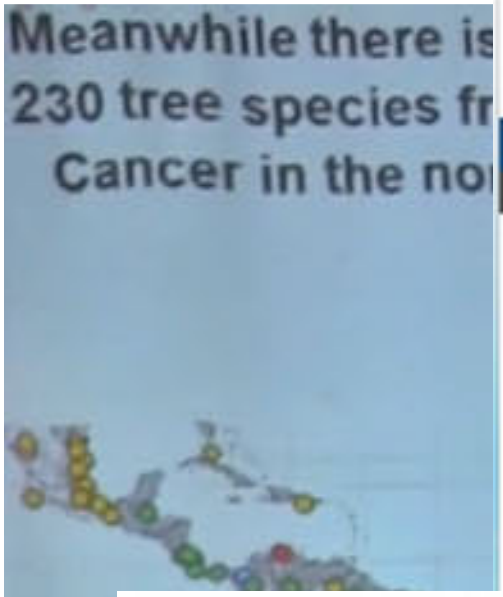
¿Cómo lo hacemos? La datación cruzada.

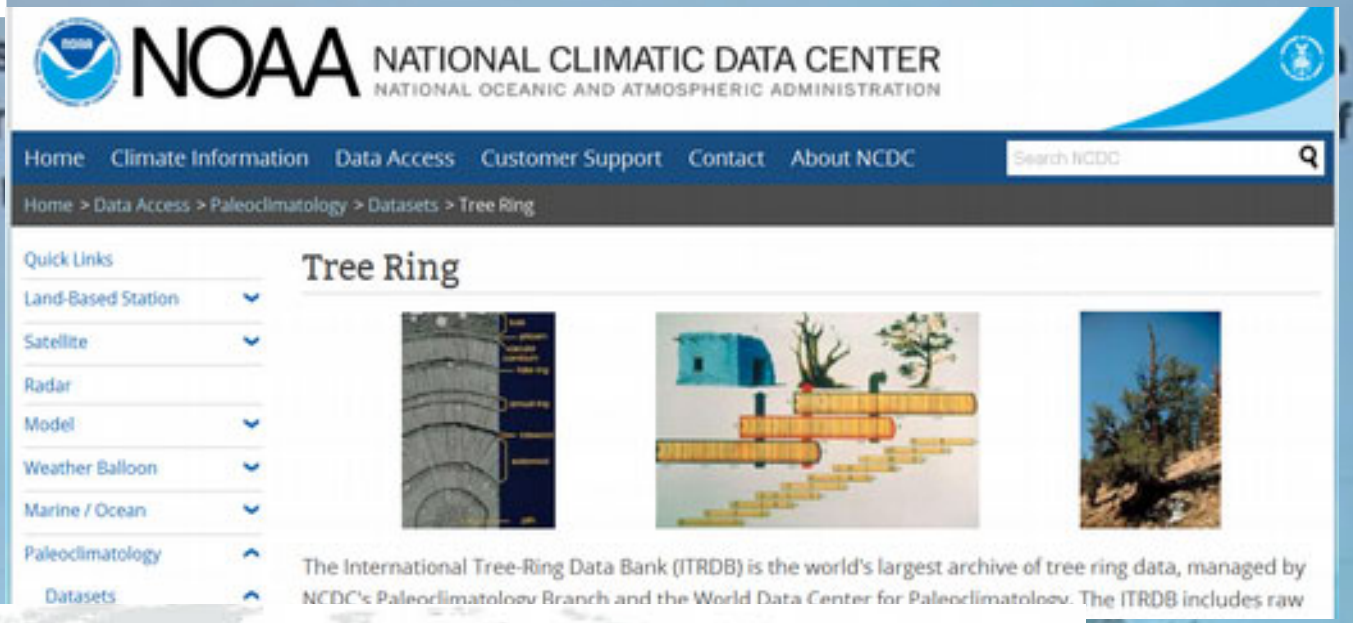
La DENDROCRONOLOGÍA estudia los anillos de crecimiento de los árboles y de las plantas leñosas en zonas de clima estacional donde se forman un anillo por año. El estudio de los anillos de crecimiento permite reconstruir con resolución **ANUAL** eventos que han afectado al árbol durante su crecimiento: el clima, incendios, avalanchas, plagas, talas, etc. Los árboles vivos más viejos alcanzan los 5000 años de edad (*Pinus longaeva*). La datación cruzada ("*cross-dating*") o sincronización de muestras permite solapar series de grosor del anillo y alargar así las reconstrucciones dendrocronológicas en el tiempo hasta los últimos 10000 años.

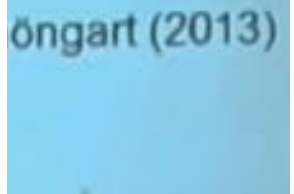




Anillos viajeros.

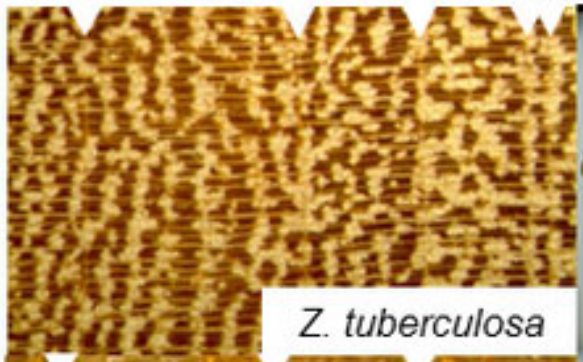




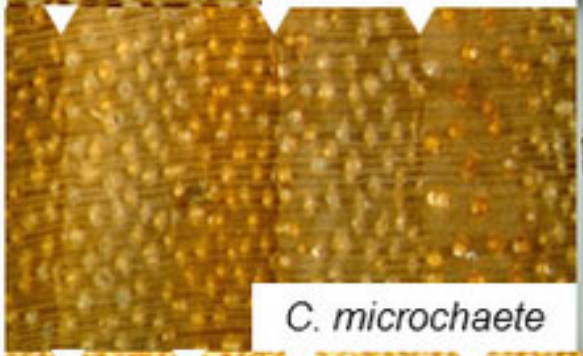


¿Hay anillos en los trópicos?

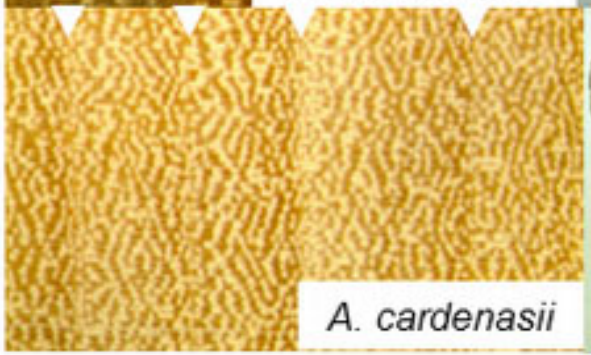

Epi, en los trópicos no hay ni estaciones ni anillos.
No Blas, en algunas zonas **SÍ** los hay (bosques tropicales secos o inundados estacionalmente).



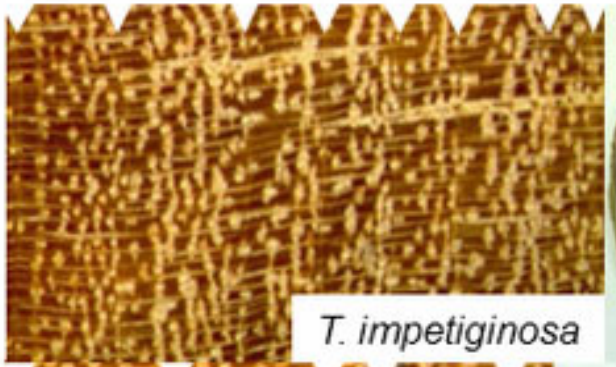
Z. tuberculosa



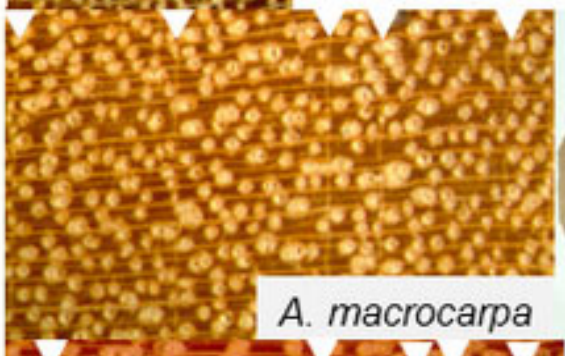
C. microchaete



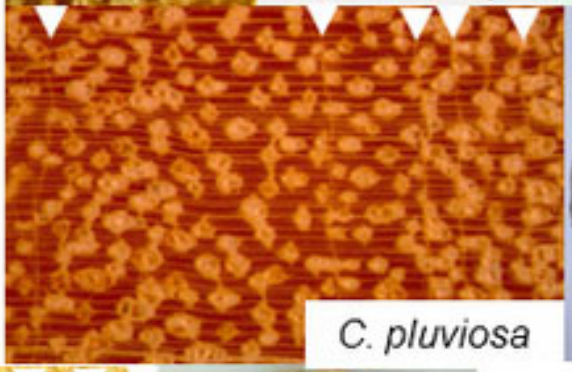
A. cardenasii



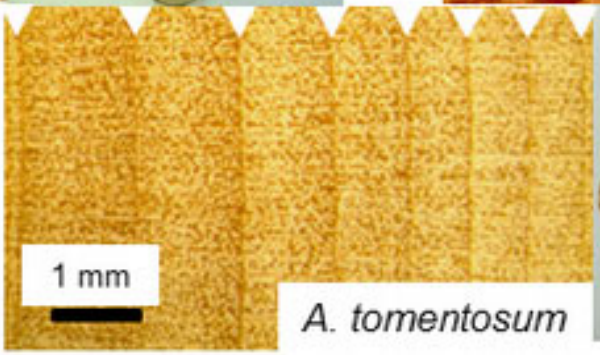
T. impetiginosa



A. macrocarpa

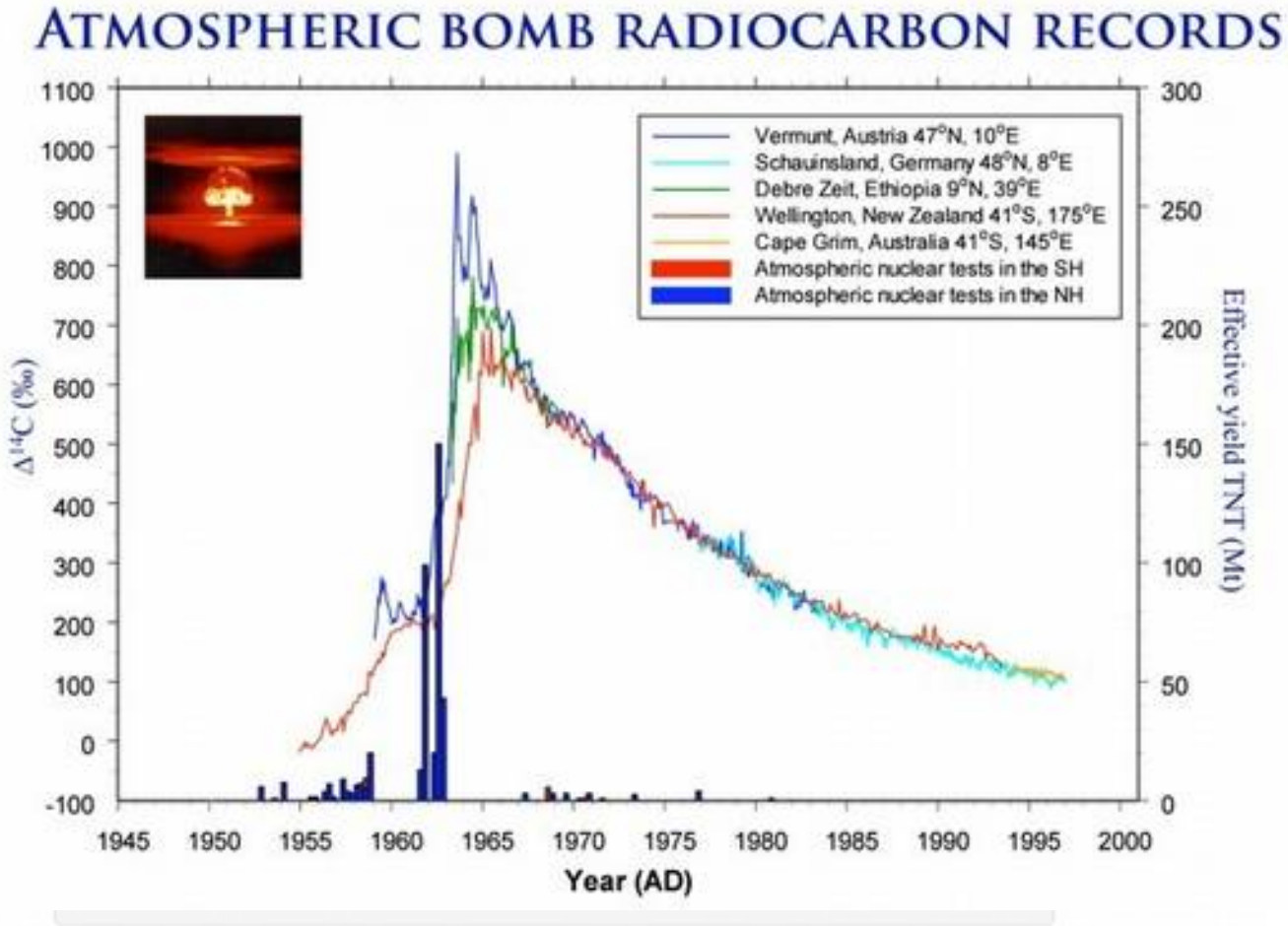


C. pluviosa



A. tomentosum

Radiocarbon or carbon-14 (^{14}C) is produced naturally in the atmosphere by cosmic ray interactions with nitrogen. Single carbon atoms in the atmosphere are quickly oxidized to carbon dioxide CO_2. The atmospheric concentration of natural ^{14}C with respect to all carbon has remained relatively stable at about 1.2 parts per trillion over the past several thousand years. With a radioactive half-life of 5730 years, the radioactive decay of ^{14}C is minimal within the time periods of interest in medical forensic cases and applicable for samples over 300 years of age.



Atmospheric testing of nuclear weapons during the 1950s and early 1960s doubled the concentration of $^{14}C/C$ in the atmosphere (Figure 1). From the peak in 1963, the level of $^{14}CO_2$ has decreased with a mean life of about 16 years, not due to radioactive decay, but due to mixing with large marine and terrestrial carbon reservoirs. The ^{14}C has not actually disappeared, it has simply moved out of the atmosphere. The

Blas: podemos comparar nuestras dataciones basadas en anillos con otras indirectas basas en el descenso de ^{14}C tras los ensayos nucleares de los años 50-60.

❖ ¿Y los olivos milenarios?

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The age of the olive trees in the Garden of Gethsemane

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doi:10.1016/j.jas.2014.10.011
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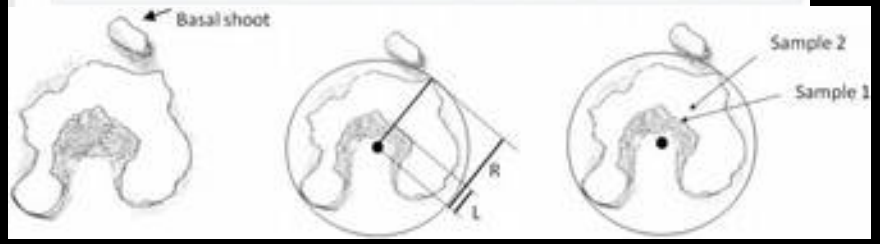
Highlights

- The olive trees in the Garden of Gethsemane were investigated to estimate their ages.
- The trees were examined using dendrological and dendrometric methods.
- A few samples were radiocarbon-dated with the wiggle matching technique.
- The olive trees analysed are of approximately the same age.
- The dated trees started life in the 12th century (the Latin Kingdom of Jerusalem).



Taking samples for radiocarbon dating from tree no. 4. Cross-section at ground level. Determining the stem's shape. The dot in the centre indicates the presumed position of the pith, whereas the segment "*L*" denotes the missing wood in centre.

Dendrochronologia
Volume 30, Issue 1, 2012, Pages 11–14

Original article

The age of monumental olive trees (*Olea europaea*) in northeastern Spain

X. Aman[a], B.C. López[a], J. Martínez-Vilalta[a], M. Estorach[a], R. Poyatos[a]

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doi:10.1016/j.dendro.2011.02.002
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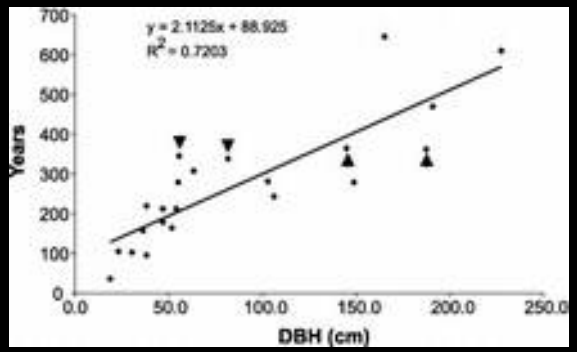
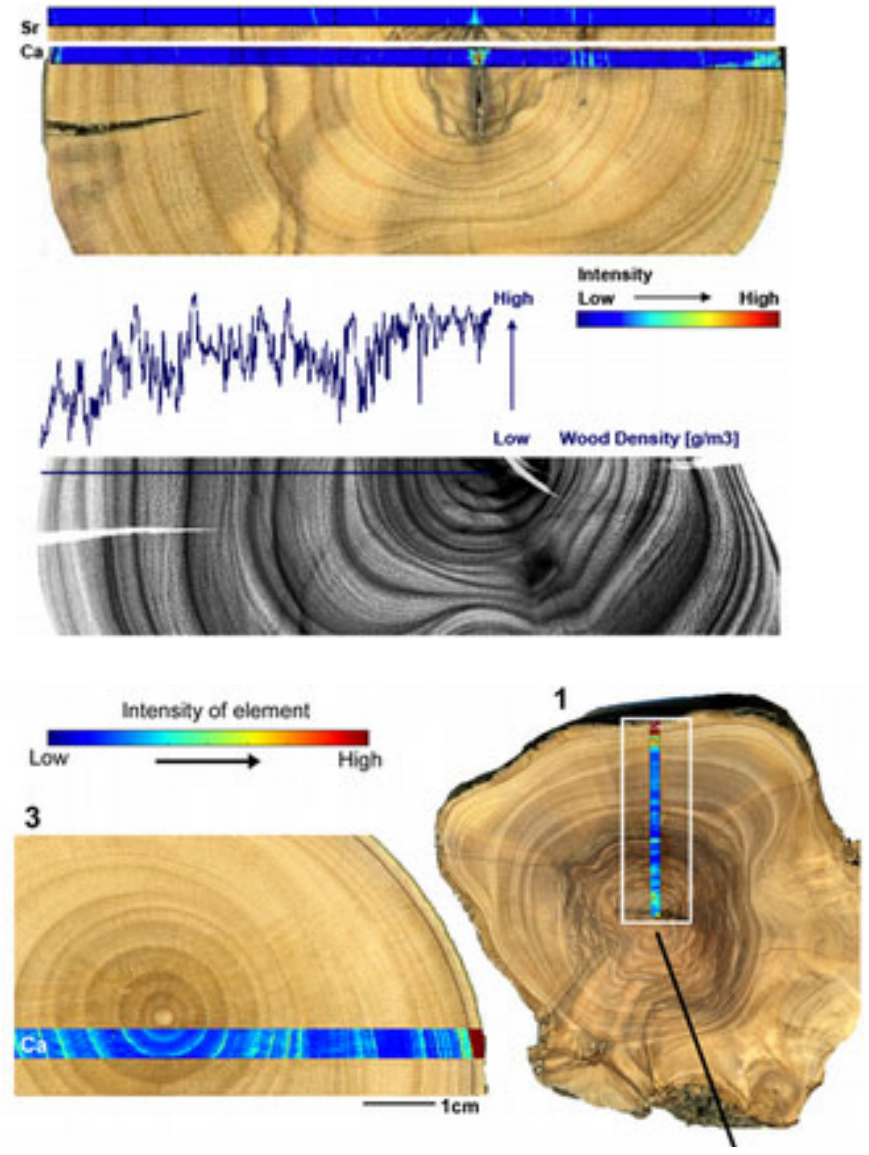
Abstract

Trees can reach ages that in some cases amount to thousands of years. In the Mediterranean region, olive trees (*Olea europaea*) have traditionally been considered a particularly long-lived species. The main objective of this study was to assess the age of large olive trees considered to be millenarian and classified as monumental trees in northeastern Spain. We extracted cores of 14 individuals and obtained 8 sections of trees which had already been cut in the area where the largest olive trees in the northeastern Iberian Peninsula are found. The age of the sampled olive trees was assessed by counting the number of annual growth rings. Tree rings did not cross-date well, neither within nor between individuals, but boundaries between likely annual rings were clearly distinct. We found a linear relationship between DBH and tree age (in years) (Age = 2.11 × diameter(cm) + 88.93, R^2 = 0.80), which was used to estimate the age of unsampled olive trees. The maximum estimated age (627 ± 110 years) is among the greatest ages reported for olive trees around the world (700 years) and among the oldest trees in Mediterranean ecosystems.



Regression function used to predict the age of trees (years) from their DBH (cm). This equation was obtained from 14 cores + 8 sections. Range of DBH values used was 37–645 cm. Points with an arrow indicate samples > 1 one center



Stem disc from sample E3 overlayed by a SXFM-profile. Content of calcium and strontium increases at the tree-ring borders. Below: Neutron Image of a section of the same sample (E3). Higher density peaks should reflect tree-ring borders but can also be induced by Intra-Annual-Density-Fluctuations, **making tree-ring dating impossible.**

Calcium intensity increases match visually determinable ‘boundaries’ with varying degrees of clarity depending on the physical structure of the wood. The main advantage of the mapping is the association of particular elements with that structure, not in providing an alternate means to resolve and count the years of growth represented

Cherubini P, Humbel T, Beeckman H, Gärtner H, Mannes D, et al. (2013) Olive Tree-Ring Problematic Dating: A Comparative Analysis on Santorini (Greece). PLoS ONE 8(1): e54730. doi:10.1371/journal.pone.0054730
http://journals.plos.org/plosone/article?id=info:doi/10.1371/journal.pone.0054730

❖ ¿Y los olivos milenarios?

- **Olive trees are a classic component of Mediterranean environments and some of them are known historically to be very old.**
- **Dendrochronological analyses of olive trees growing on the Aegean island Santorini (Greece) show that the determination of the number of tree-rings is impossible because of:**
- **intra-annual wood density fluctuations, variability in tree-ring boundary structure, and restriction of its cambial activity to shifting sectors of the circumference, causing the tree-ring sequences along radii of the same cross section to differ.**

Lo siento Epi, pero no usando los anillos de crecimiento.

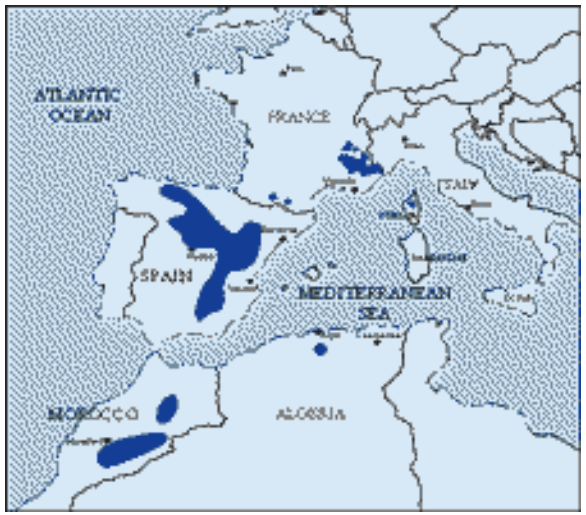
¿Podemos saber la edad de los olivos?

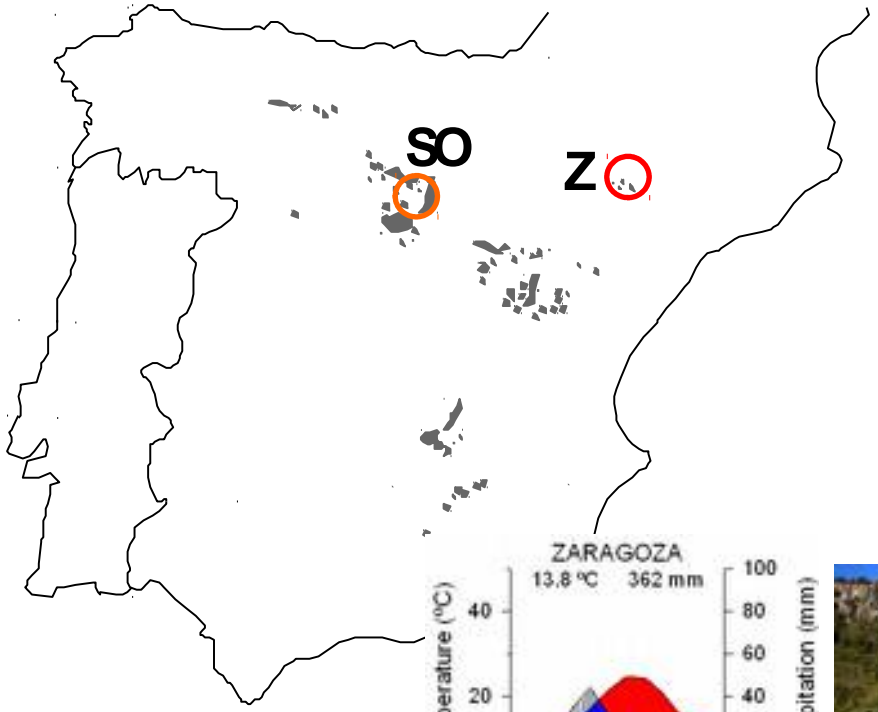
❖ ¿Y la sabina albar?

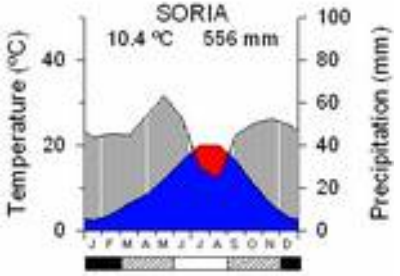
¡Sí Epi! Usando los anillos de crecimiento.

¿Podemos saber la edad de las sabinas?

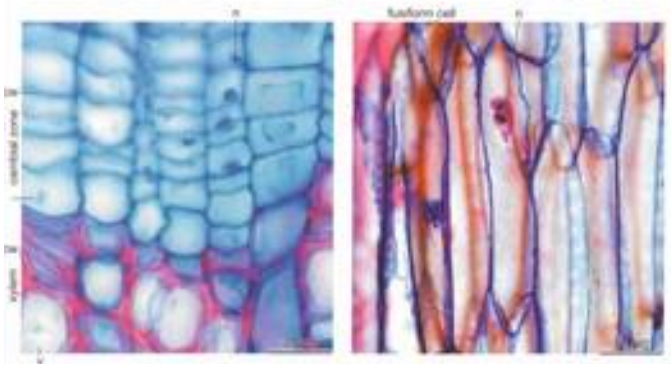
Sabina albar (*Juniperus thurifera*).

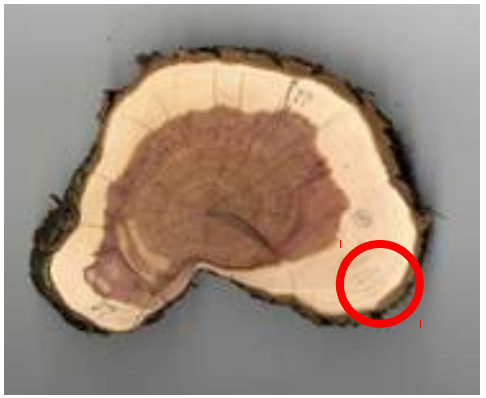






Crecimiento intra-anual del anillo*: xilogénesis.*





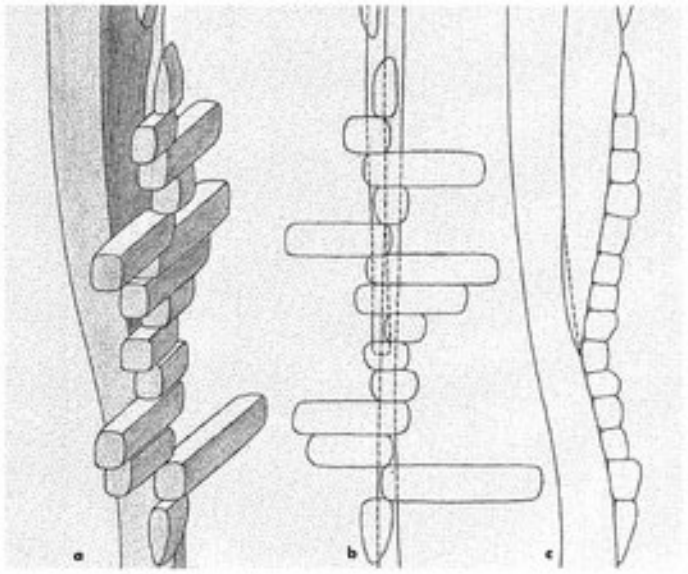


FIG. 11.—Model of cambium structure in the stem of species belonging to the family of Pinaceae which forms thick-walled epithelial cells in xylem. Three-dimensional aspect: *a*, radial; *b*, tangential; *c*, sectional view.

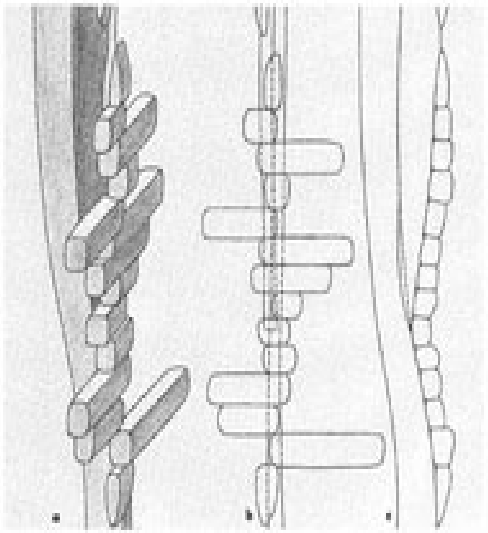


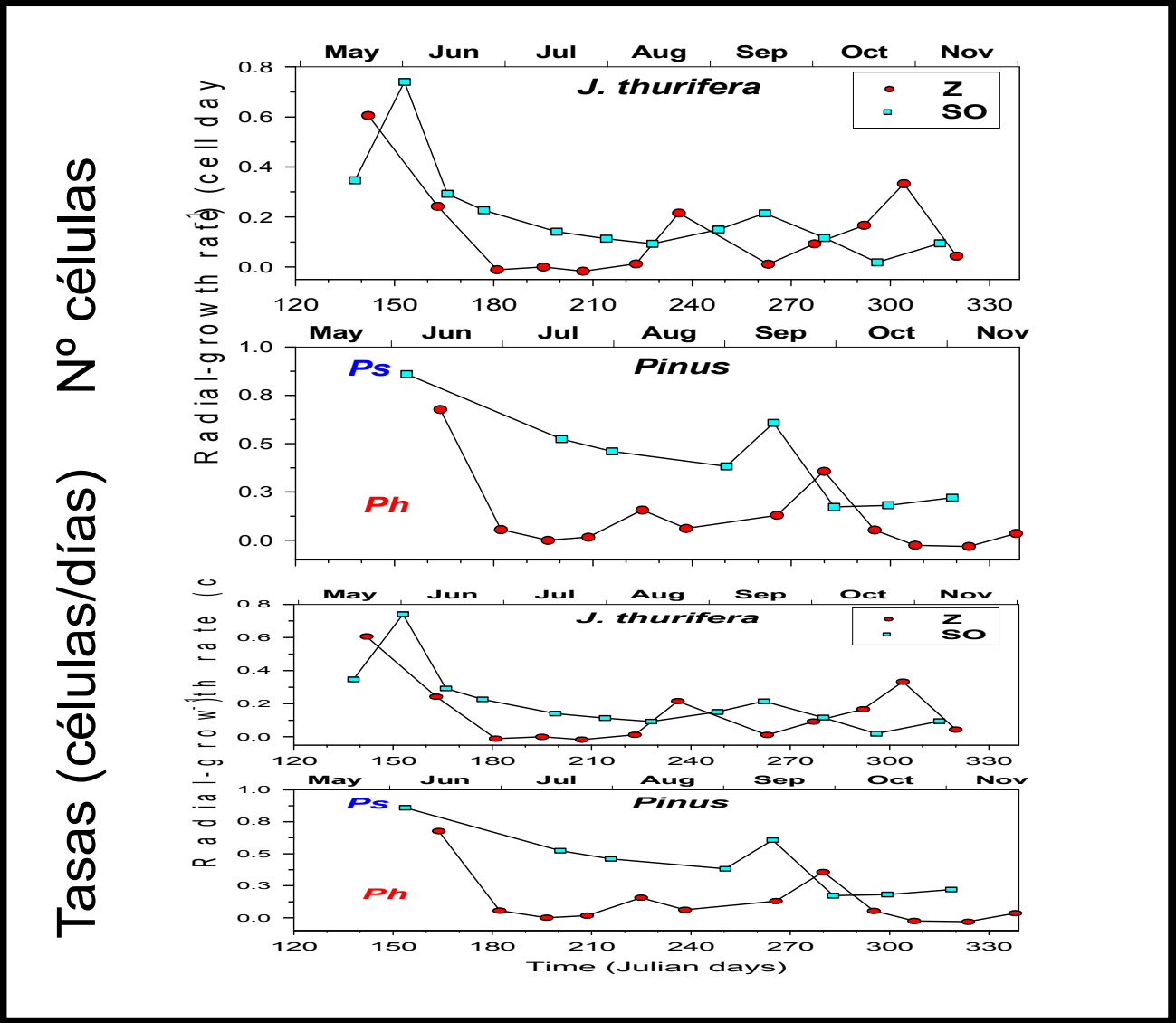
FIG. 11.—Model of cambium structure in the stem of species belonging to the family of Pinaceae which forms thick-walled epithelial cells in xylem. Three-dimensional aspect: *a*, radial; *b*, tangential; *c*, sectional view.

Floema

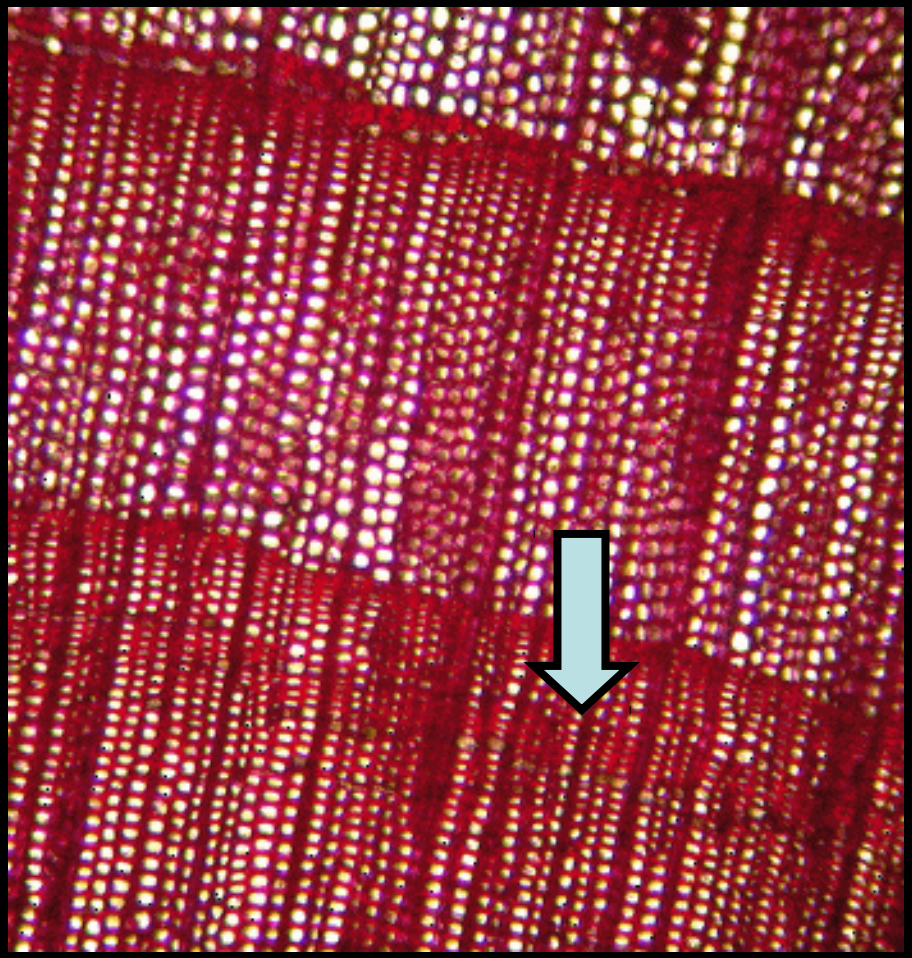
CAMBIUM

Xilema

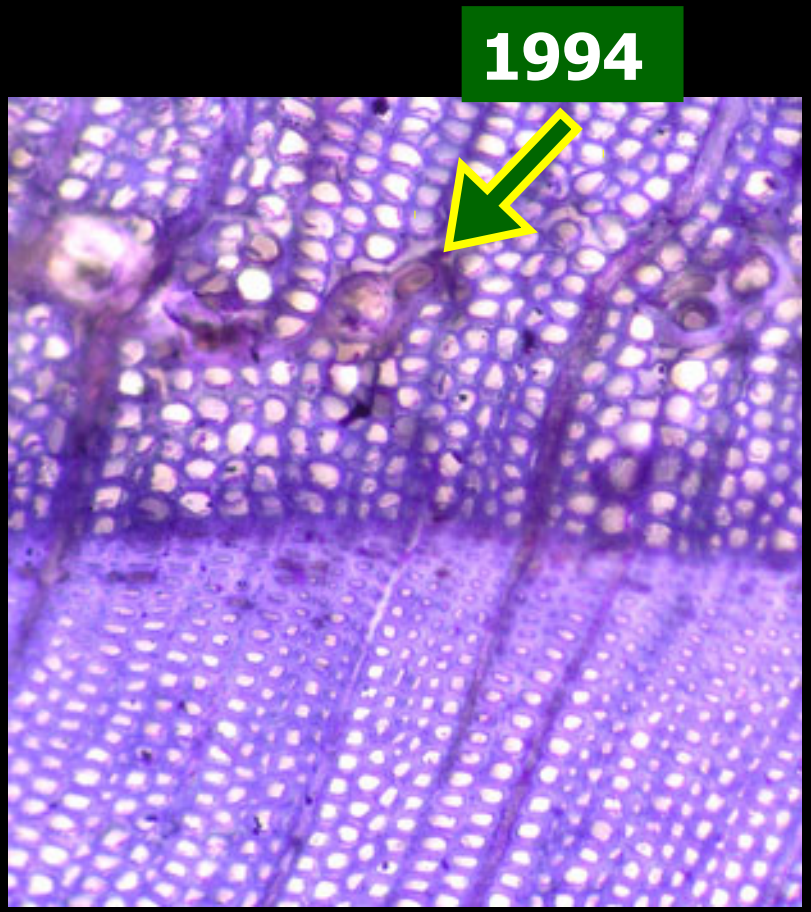
Crecimiento radial (células, traqueidas).



Anillo con **FLUCTUACIÓN DE DENSIDAD**



Anillo de **HELADA**



Muchas gracias / Moltes gràcies