

ForSEAdiscovery

FOREST RESOURCES FOR IBERIAN EMPIRES:
ECOLOGY AND GLOBALIZATION IN THE AGE OF DISCOVERY

Developing reference tree-ring data sets for dating and provenancing Iberian shipwrecks

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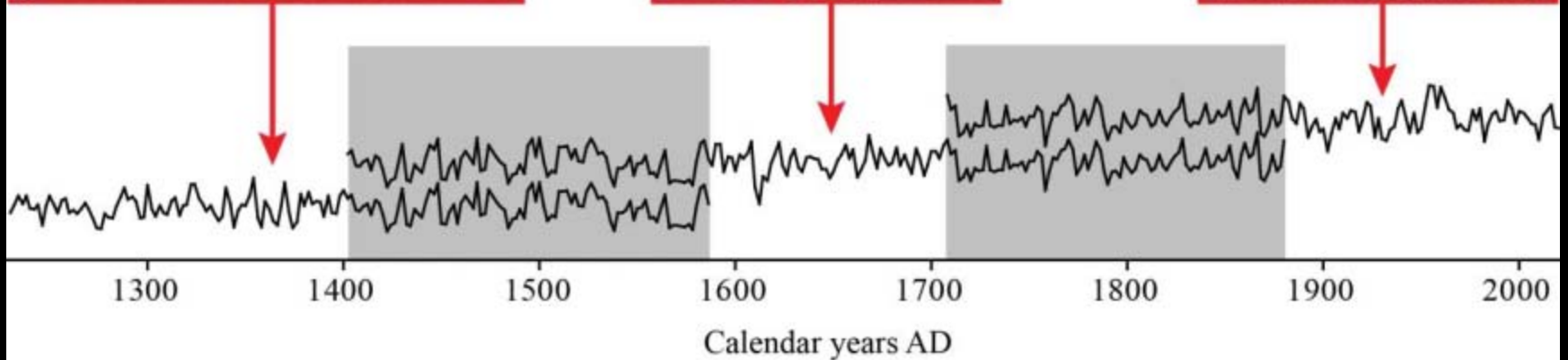
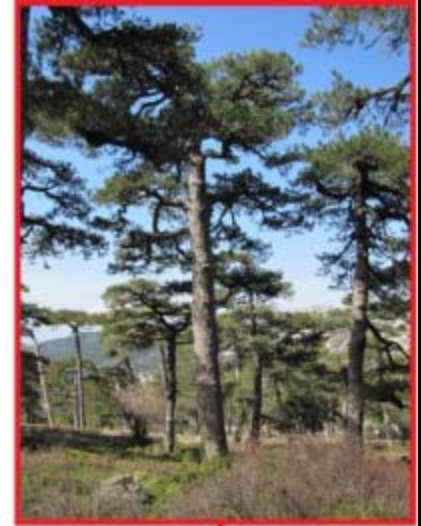
ForSEAdiscovery Fellow (PITN-2013-GA-607545)

Species

Oak (*Quercus robur*, *Q. petraea*, *Q. faginea*, *Q. pyrenaica*,
Q. pubescens)

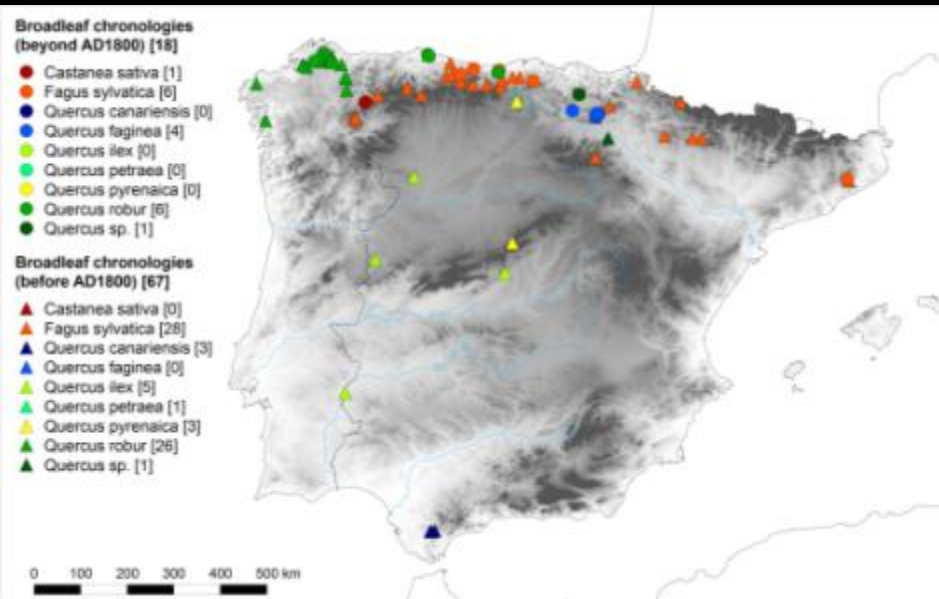
Pine (*Pinus nigra*, *P. sylvestris*)

Dendrochronology and dendro-provenancing

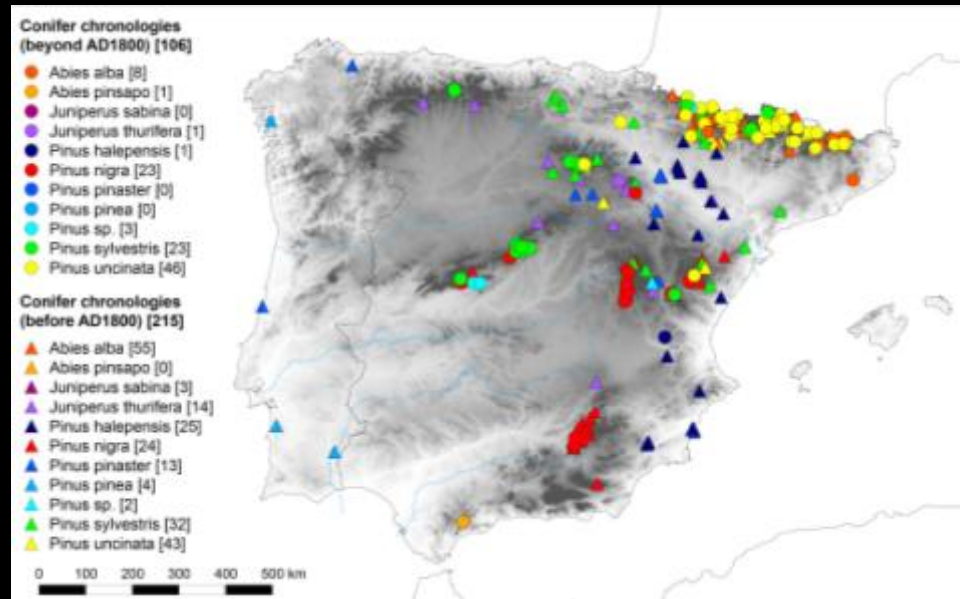


Existing chronologies in 2014

Broadleaf



Conifers



Domínguez-Delmás *et al.* 2015. *Journal of Archaeological Science* 57, 180-196.

Approach

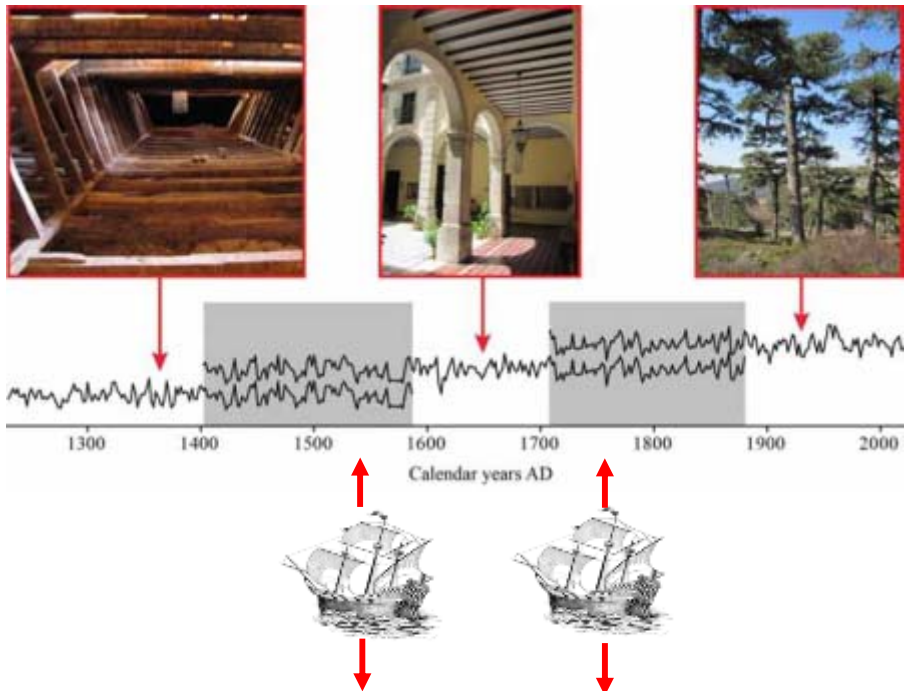
- 1. Division into watersheds
- 2. Definition of provenance micro-units



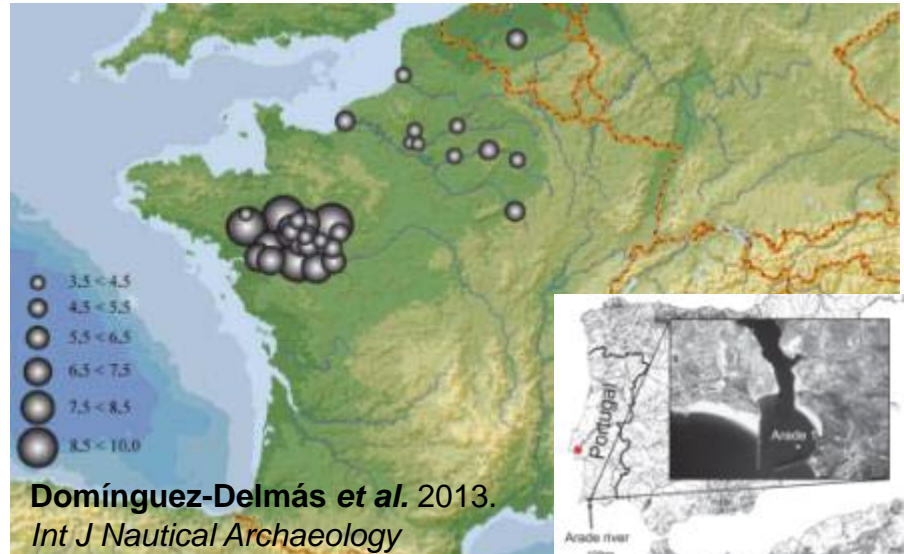
3. Development of local chronologies



4. Retrospective extension of chronologies



5. Dendroprovenancing



Challenges we are facing...

1. Finding the forests



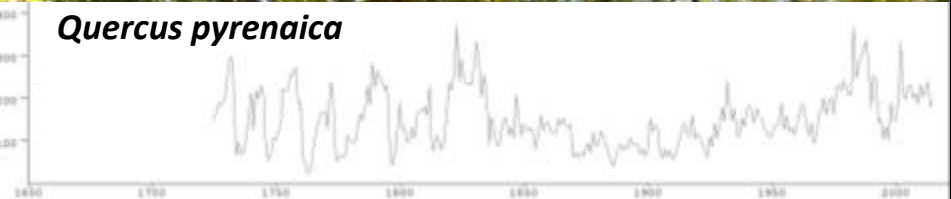
1. Finding the forests



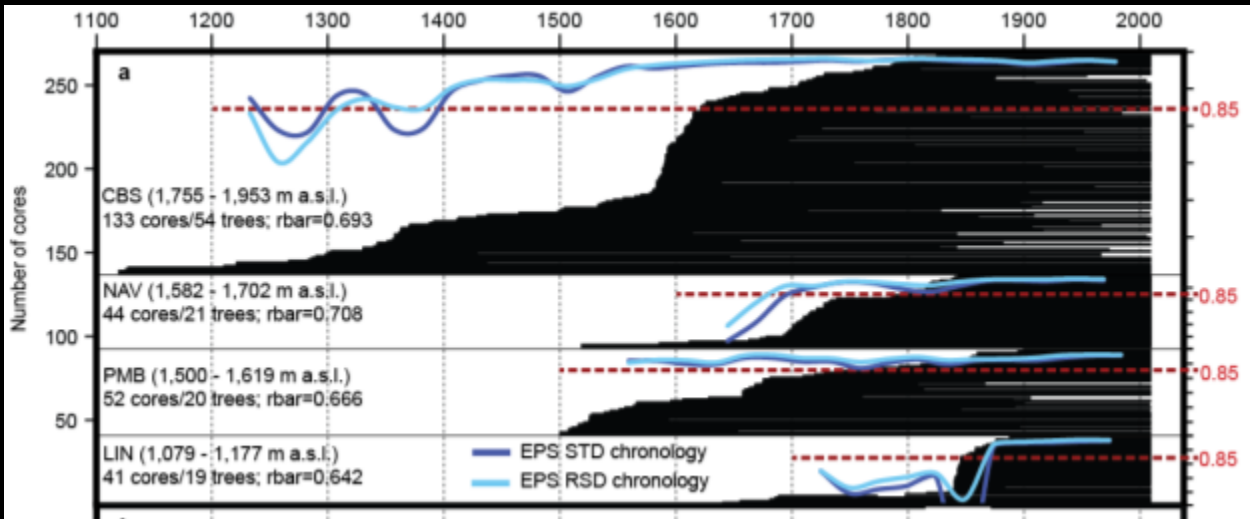
2. Finding the trees



3. Finding the signal: oaks



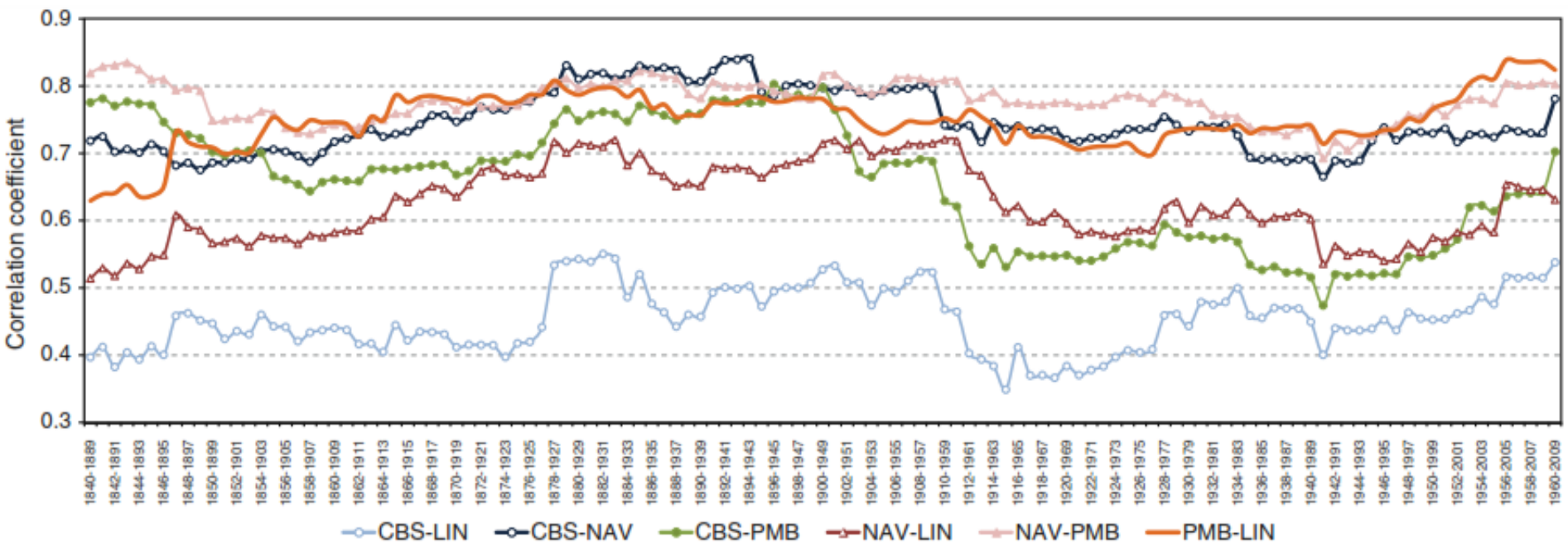
3. Finding the signal: pines



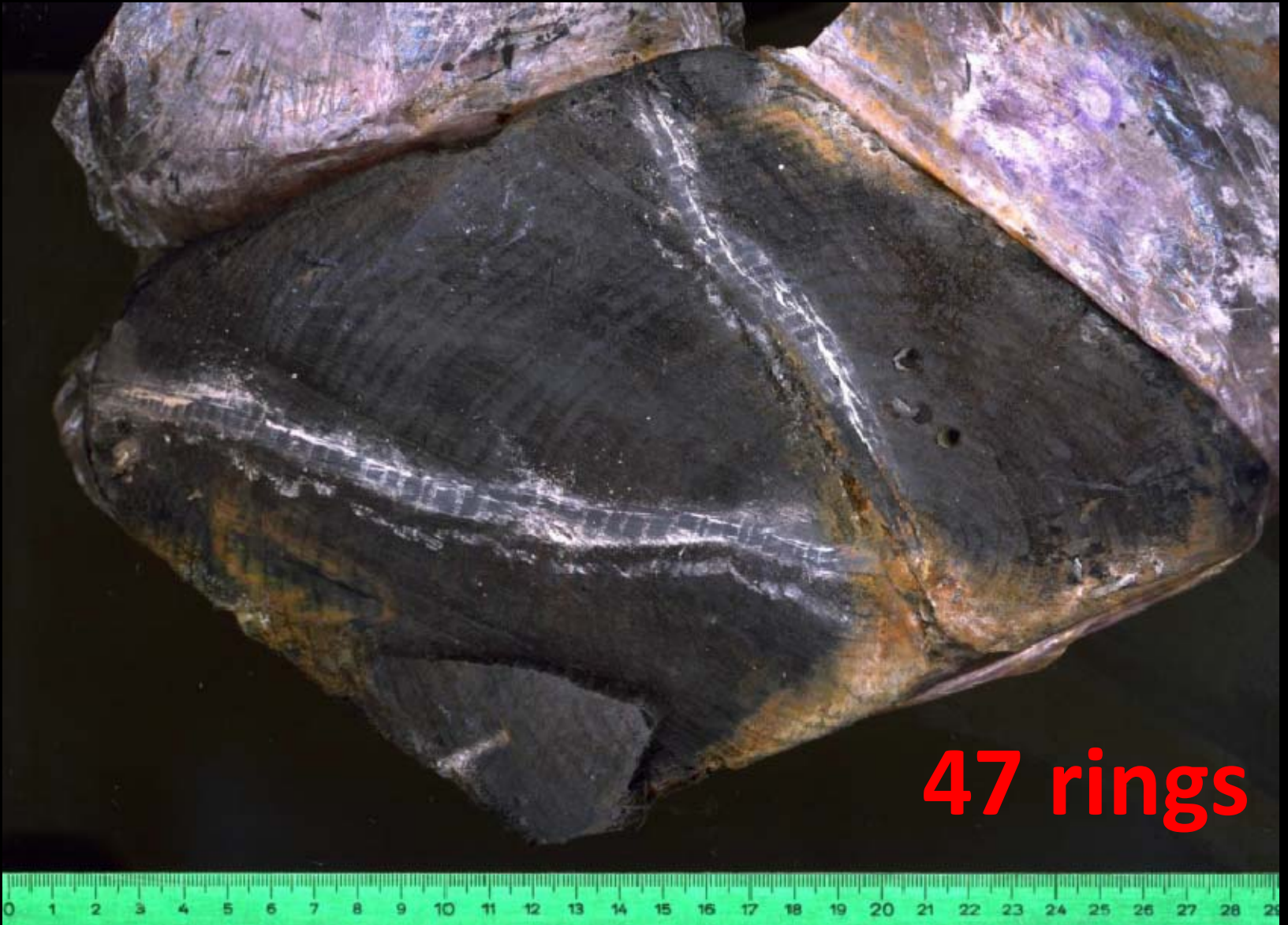
Black pine (*Pinus nigra*)

Domínguez-Delmás *et al.* 2013, European Journal of Forest Research 132(4)

Temporal variation of correlation between chronologies (1840-2009)



4. Finding suitable dendro-samples



47 rings

YAR01-001W-01S, *Quercus* subg. *quercus* (dendro-code YAR00010)

4. Finding suitable dendro-samples



RIB01-006W-01S, *Quercus* subg. *quercus* (dendro-code RIB00060)

4. Finding suitable dendro-samples

144 rings



MAG01-010W-01S, *Quercus* subg. *Quercus* (dendro-code MAG00080)

353 trees

(*Quercus* sp. and *Pinus nigra*)
in Gipuzkoa, Araba, Navarra and Jaen

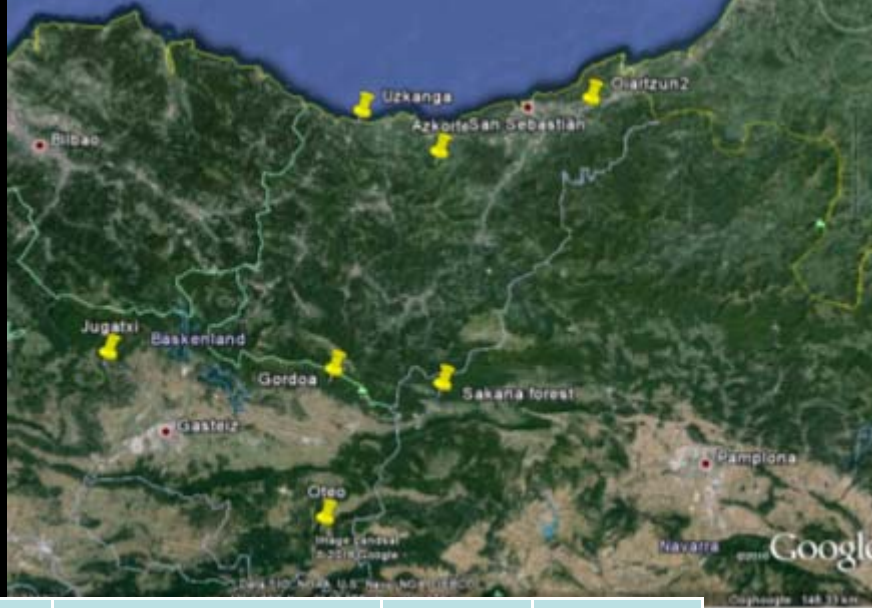
220 timber elements

(*Quercus* sp. and *Pinus* sp.) from buildings in
Gipuzkoa, Segovia, Jaen and Granada

131 shipwreck samples

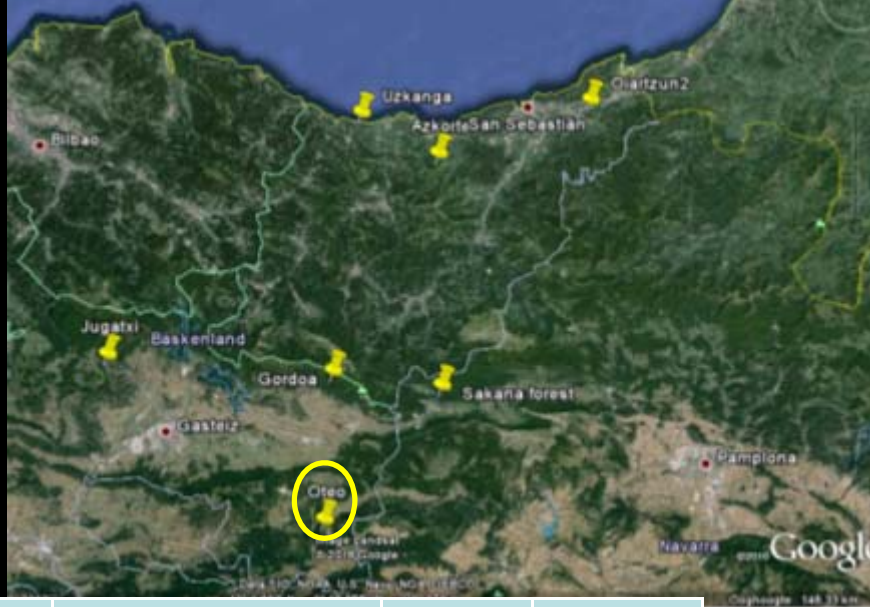
Preliminary results...

Oaks in the Basque Country



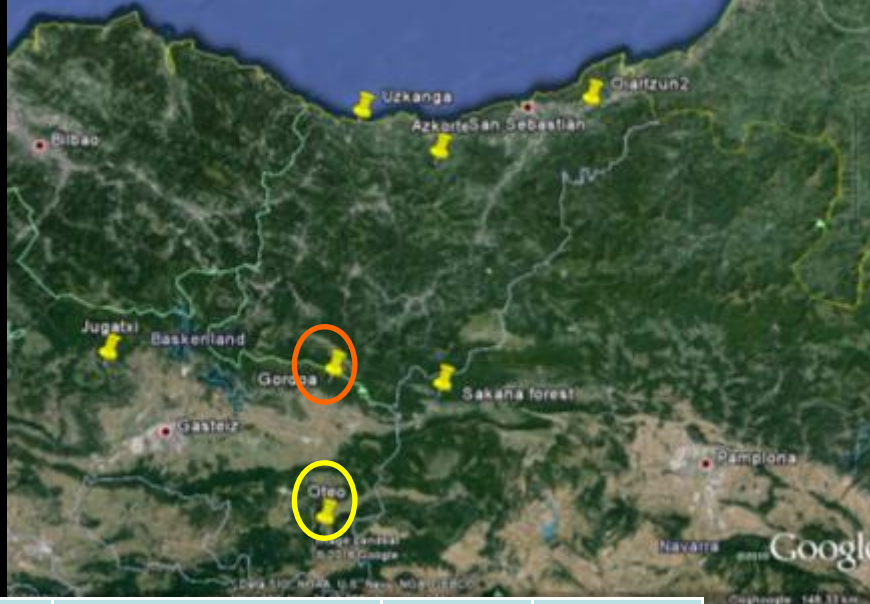
Sites	Species	N rings	Span	N trees	<i>r</i>
AZK	<i>Q. robur</i>	115	1901-2015	6	0.533
UZK1m	<i>Q. robur</i>	111	1904-2014	3	0.405
UZK2u	<i>Q. robur</i>	109	1906-2014	6	0.554
OIR	<i>Q. robur</i>	137	1878-2014	9	0.412
ALB	<i>Quercus sp.</i>	217	1798-2014	21	0.504
JUG	<i>Q. pyrenaica</i> <i>Q. robur</i>	183	1833-2015	3	0.323
OTE	<i>Q. faginea</i>	(492)	(1524)1583-2015	21	0.574
GOR1	<i>Q. pyrenaica</i>	(470)	(1546)1631-2015	18	0.475
GOR2	<i>Q. petraea</i>	207	1809-2015	5	0.394

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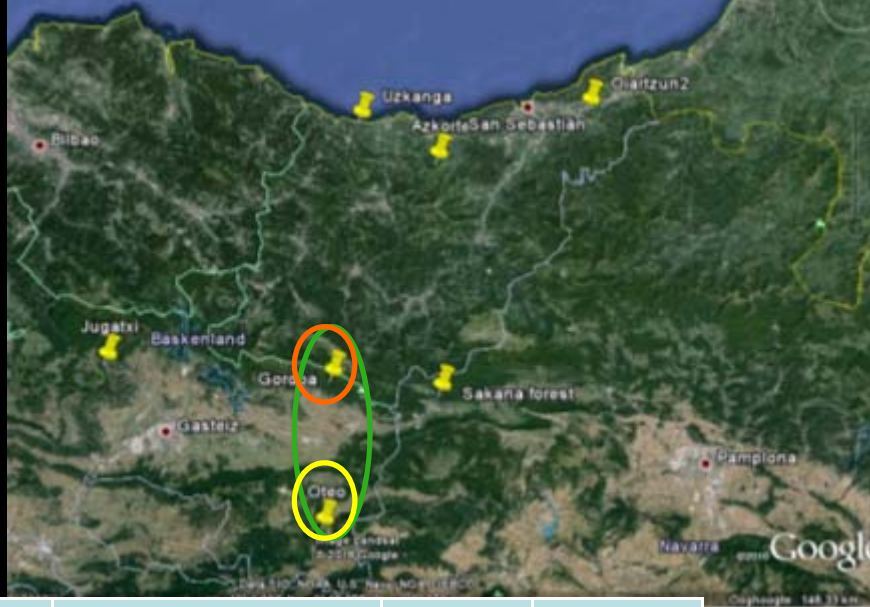
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} CC=0.69
tBP=12.2

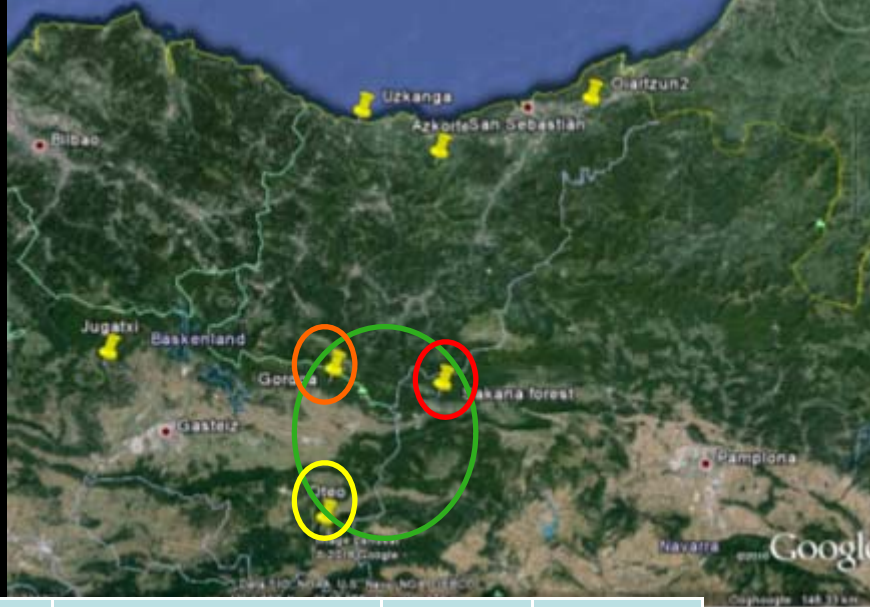
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OTE-GOR1 **OTE-GOR2**
TBP = 11.4 **TBP = 7.81**
CC = 0.48 **CC = 0.53**

Oaks in the Basque Country



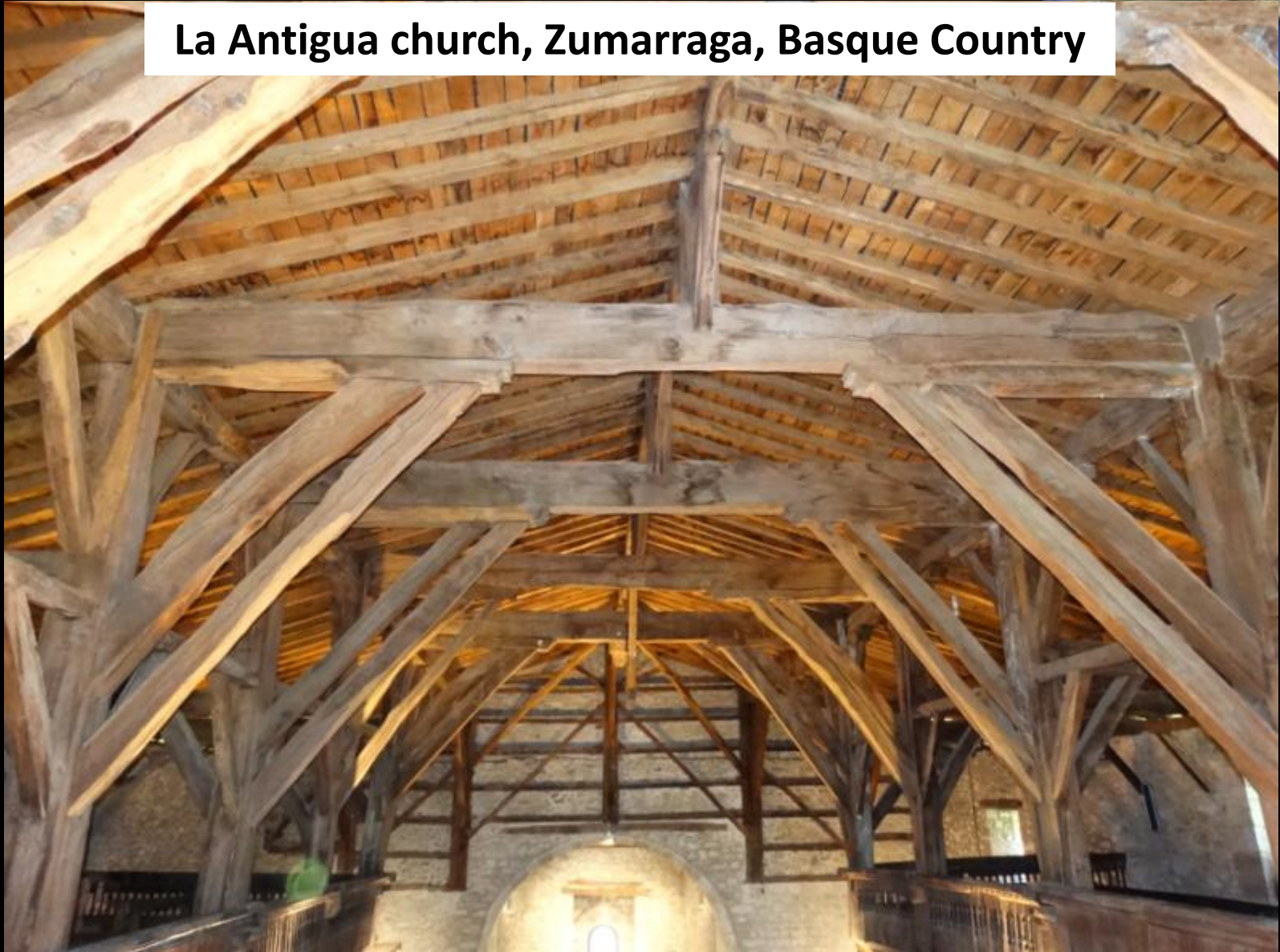
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OTE-ALB **GOR1-ALB**
 TBP = 9.15 TBP = 7.96
 CC = 0.52 CC = 0.48

**Buildings in coastal areas contain only timbers
from fast grown trees**



La Antigua church, Zumarraga, Basque Country



**Buildings in coastal areas contain only timbers
from fast grown trees**



St. Martin of Tours church, Urretxu, Basque Country



Pines in Andalusia



Sites	Species	N rings	Span	N trees	r
LIN	<i>P. nigra</i>	374	1641-2014	72	0.658
NAV		491	1519-2009	21	0.708
PMB		510	1500-2009	21	0.666
LSA		692	1323-2014	19	0.660
CBR		484	1531-2014	13	0.502
CBS		888	1123-2010	54	0.691

Pinus nigra shows strong teleconnections over large distances



Pinus nigra shows strong teleconnections over large distances



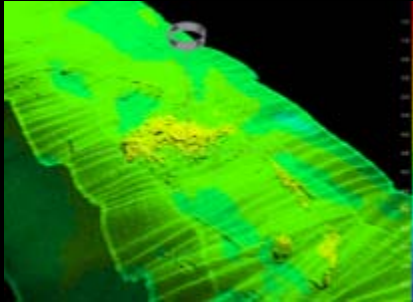
Window sleeper
AD 1771



Timbers from Andalusian buildings are an excellent source of tree-ring data



Shipwrecks IHP and ForSEAdiscovery



Yarmouth
Roads



Foto: archivo SEAS

Fotos: archivo Archaeonauta

Cee 2

Ribadeo

Barreiros

Cee 1

Magdalena

Bayonnaise

Bracara Augusta

Belinho

Ria de Aveiro F,G

Mortella III

Triunfante

Barceloneta I

Praça do
Municipio

Matagrana

San Sebastian

Arade 1

Delta I

Delta II



Fotos: M. Domínguez Delmás



Foto: archivo CODEX Arqueología i Patrimoni



Foto: archivo CASC

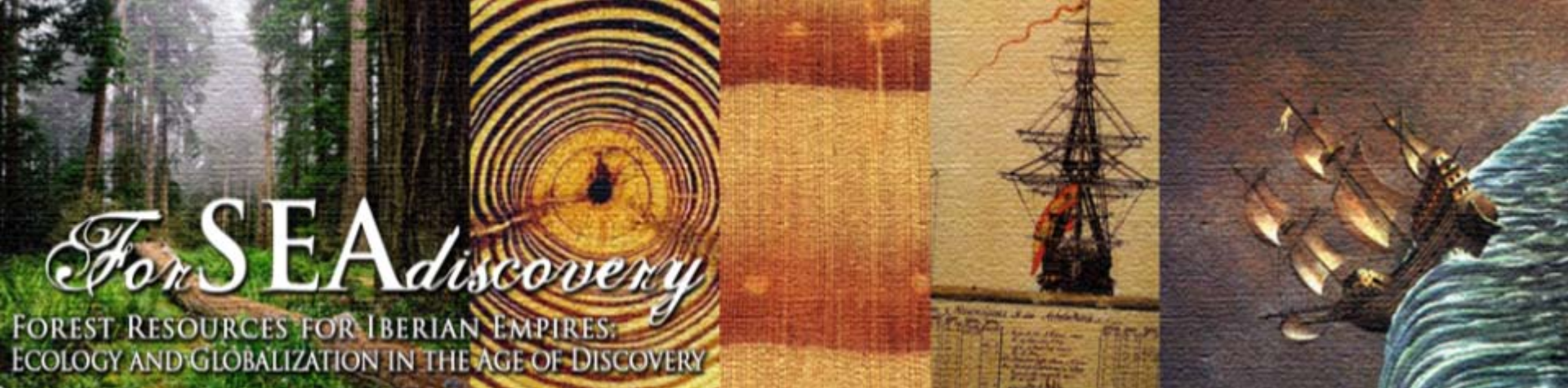
Shipwrecks IHP and ForSEAdiscovery

			Quercus subg. Quercus	Pinus sylvestris/nigra	Picea abies/Larix decidua	Abies alba	Conifer	Fagus sylvatica	Castanea sativa	Tropical	Others
<i>Barceloneta I</i>	Spain	CASC	13								
<i>Triufante</i>	Spain	CASC		6							
<i>Ribadeo</i>	Spain	Archeonauta/ForSEAdiscovery	36	2	3	2	1	1	2		1
<i>Arade I</i>	Portugal	DANS	24						2		
<i>Matagrana</i>	Spain	CAS	2								
<i>San Sebastián</i>	Spain	CAS	2								
<i>Bracara Augusta</i>	Portugal	DANS	2								
<i>Ria de Aveiro F</i>	Portugal	DANS								4	
<i>Ria de Aveiro G</i>	Portugal	DANS	2								
<i>Mortella III</i>	France (Corsi	SEAS	11					2			
<i>Magdalena</i>	Spain	Archeonauta/ForSEAdiscovery	17	4			1				
<i>Cee 1</i>	Spain	Archeonauta/ForSEAdiscovery	5				1				
<i>Cee 2</i>	Spain	Archeonauta/ForSEAdiscovery	3								
<i>Belinho</i>	Portugal	Belinho archaeologists/ForSEAdiscovery	12				2			3	
<i>Bayonnaise</i>	Spain	Archeonauta/ForSEAdiscovery	10								
<i>Barreiros</i>	Spain	ZETA Arqueologia	4								1
<i>Delta 1</i>	Spain	CAS	22	3				1			
<i>Delta II</i>	Spain	CAS	35				3	2		4	5
<i>Yarmouth Roads</i>	England	Maritime Archaeology Ltd./ForSEAdiscovery	3								

30% suitable samples

Concluding remarks

- Oaks show high inter-species correlation: potential for a *Quercus* spp. master chronology
- Pines show good teleconnections over large distances, which will facilitate dating of samples. The strong elevation signal however may hinder dating of timbers from lower elevations
- Sampling of shipwreck timbers must be biased towards timber elements obtained from slow-grown trees



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Isis Farias