Rethinking the Agrarian Transition through the lens of long-term history of subsistence strategies and use of energy and resources in Cantabrian Spain

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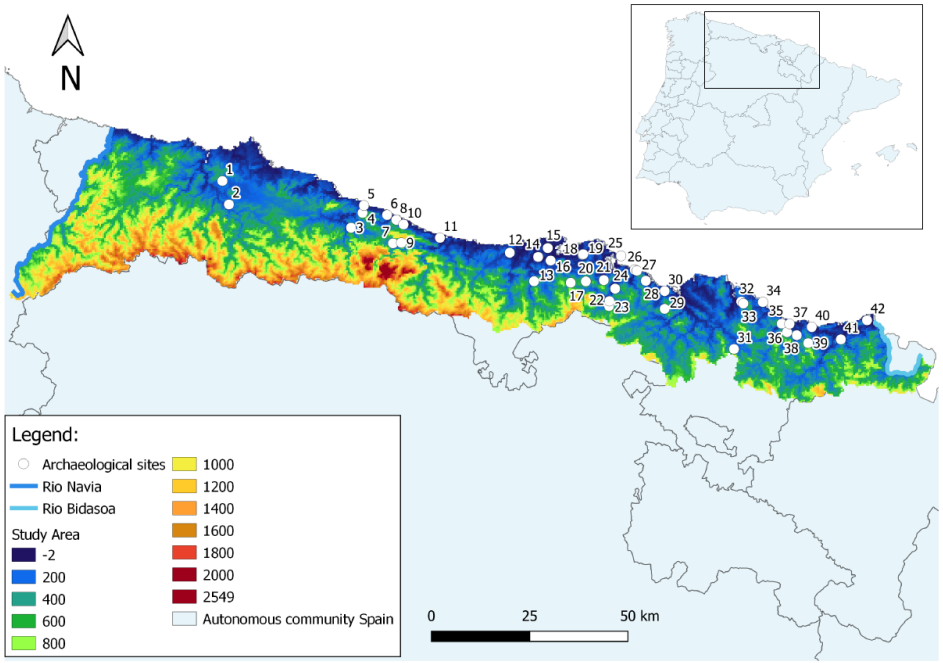
1. Limitations of cultural phases



Study area: Cantabrian Spain (Martinez et al., in press). Temporal settings: From the Last Glacial Maximum (24,000 cal BP) to the Mid-Holocene (5,300 cal BP).

Prehistoric chronology

- Cultural phases: Upper Paleolithic, Epipaleolithic, Mesolithic, Neolithic.
- Classification based on technological typologies of stone tools.
- No much societal information → need complementary approach: Energy Regimes.

Energy Regimes (ER)

- Describe Human-environment interactions based on energy sources.
- Independent from cultural entities.
- Allow comparison with past societies, ethnographic studies, and current societies.

Aim

Connect traditional cultural phases with Energy Regimes.

2. Methodology

Data acquisition

- Dataset with 336 entries (archaeological remains).

Connection with Energy Regimes

- ***Immediate Return societies***: Little planning and specific strategies, e.g. following the migration pattern of big mammals.
- ***Delayed Return societies***: Planning of the exploitation of the environment, e.g. forest burning for a profitable future.
- ***Transition to Agrarian regime***: First appearance of sedentary economies.

Proxies	Indicators
Variance of site elevation	Logistical/Residential continuum
First appearances of ceramics	Reduction of mobility
Marine mollusk MNI Ungulate MNI	Foraging economy
Domestic plants and fauna	Sedentary Economy
Marine mollusk size Marine mollusk age Young ungulate proportion	Overexploitation
Burials Megalithic structures	Societal complexity

3. Mobility

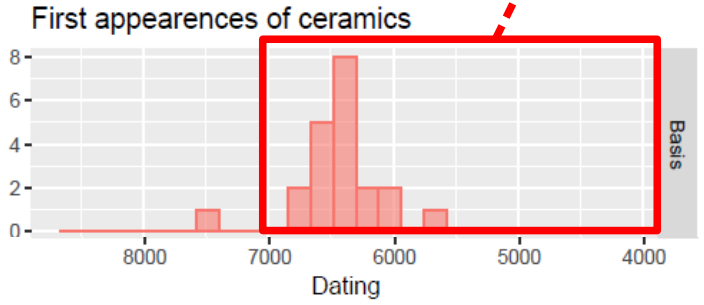
Shift from Residential mobility (base camp cosntantly moving) to Logistical mobility (base camp fixed, with satelite expedition camps)

Increase of site elevation variance in altitude

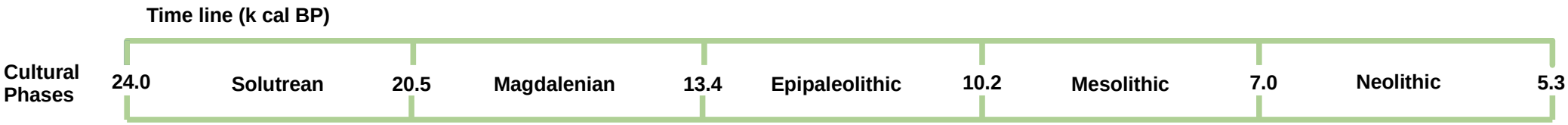
	Solutrean	Magdalenian	Epipaleolithic	Mesolithic	Neolithic
Below 400m	11,198	10,464	10,210	9,821	10,066
Above 400m	25,349	16,064	44,101	89,700	11,434

Variance of site elevation

Appearance of ceramics



4. Economy

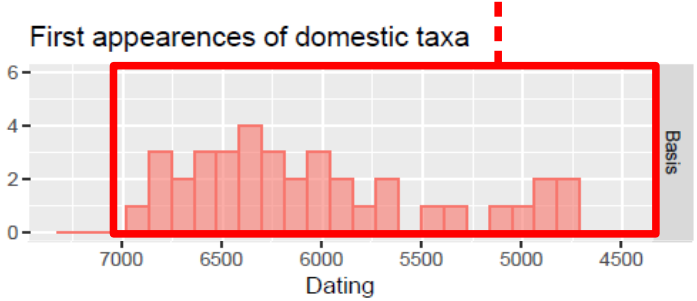


Decrease of ungulate MNIs per stratigraphic level

	Ungulate				Mollusk			
	Entries in database	MNI	Level	MNI/ Level	Entries in database	MNI	Level	MNI/Level
Solutrean	43	1081	48	22.52	5	7601	18	422.28
Magdalenian	58	1988	72	27.61	24	41820	50	836.40
Epipaleolithic	15	382	31	12.32	15	30875	22	1403.41
Mesolithic	10	156	12	13.00	23	75234	38	1979.84
Neolithic	5	78	7	11.14	9	36343	14	2595.93

MNIs of ungulate and marine mollusks per stratigraphic level

Appearance of domestic taxa

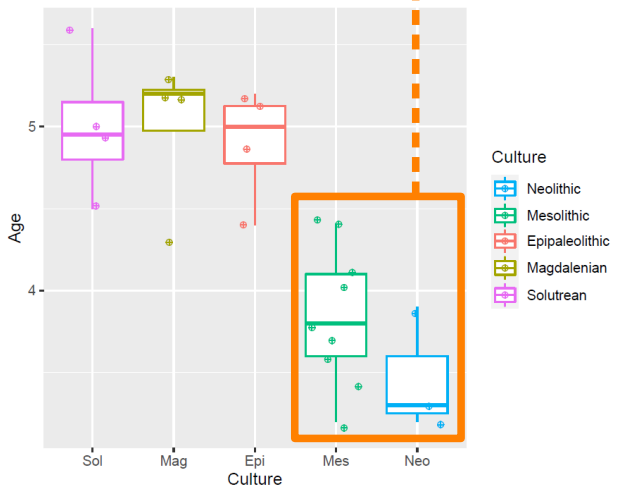


5. Overexploitation

Increase in the proportion of young individuals in hunted ungulates

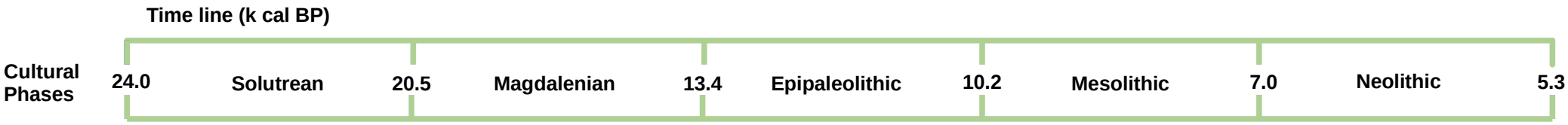
	Adult	Young	Total	Young proportion
Solutrean	399	181	580	0.3121
Magdalenian	509	249	758	0.3285
Epipaleolithic	159	108	267	0.4045
Mesolithic	27	31	58	0.5345
Neolithic	16	13	29	0.4483

Decrease in marine mollusk age



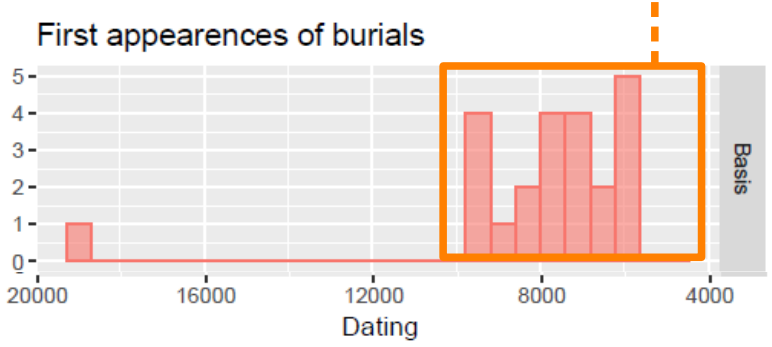
Marine mollusk age

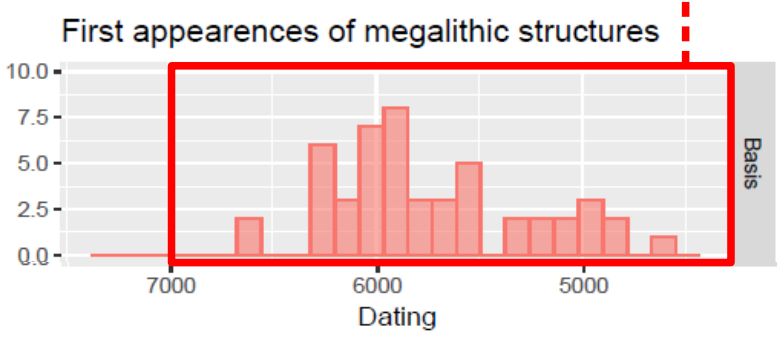
6. Societal complexity



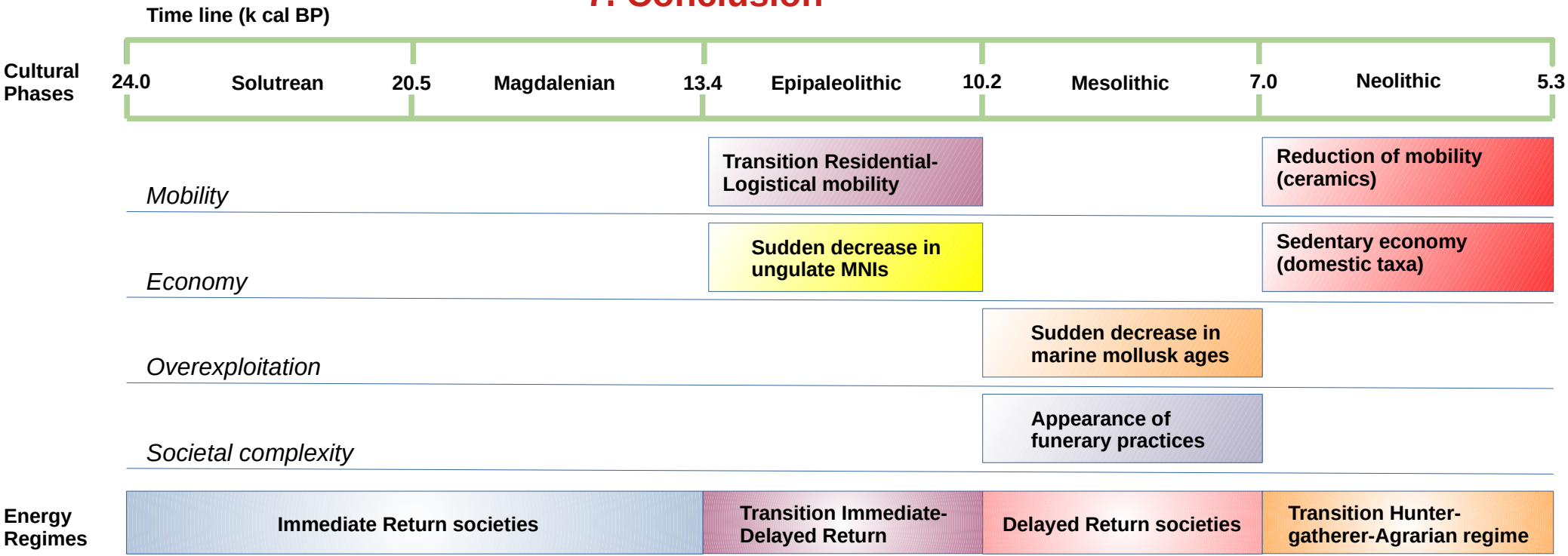
Appearance of burials

Appearance of megalithic structures





7. Conclusion



Concluding remarks

- Connection of cultural phases with Energy Regimes.
- Open ways to quantification of past energy systems.
- Make possible comparison with archaeological and ethnographic studies, as well as current societies.

Thank you for your attention !

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