Climatic variability during the last two millennia in the Tyrrhenian Sea: evidence from marine sediments

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Climate is changing?

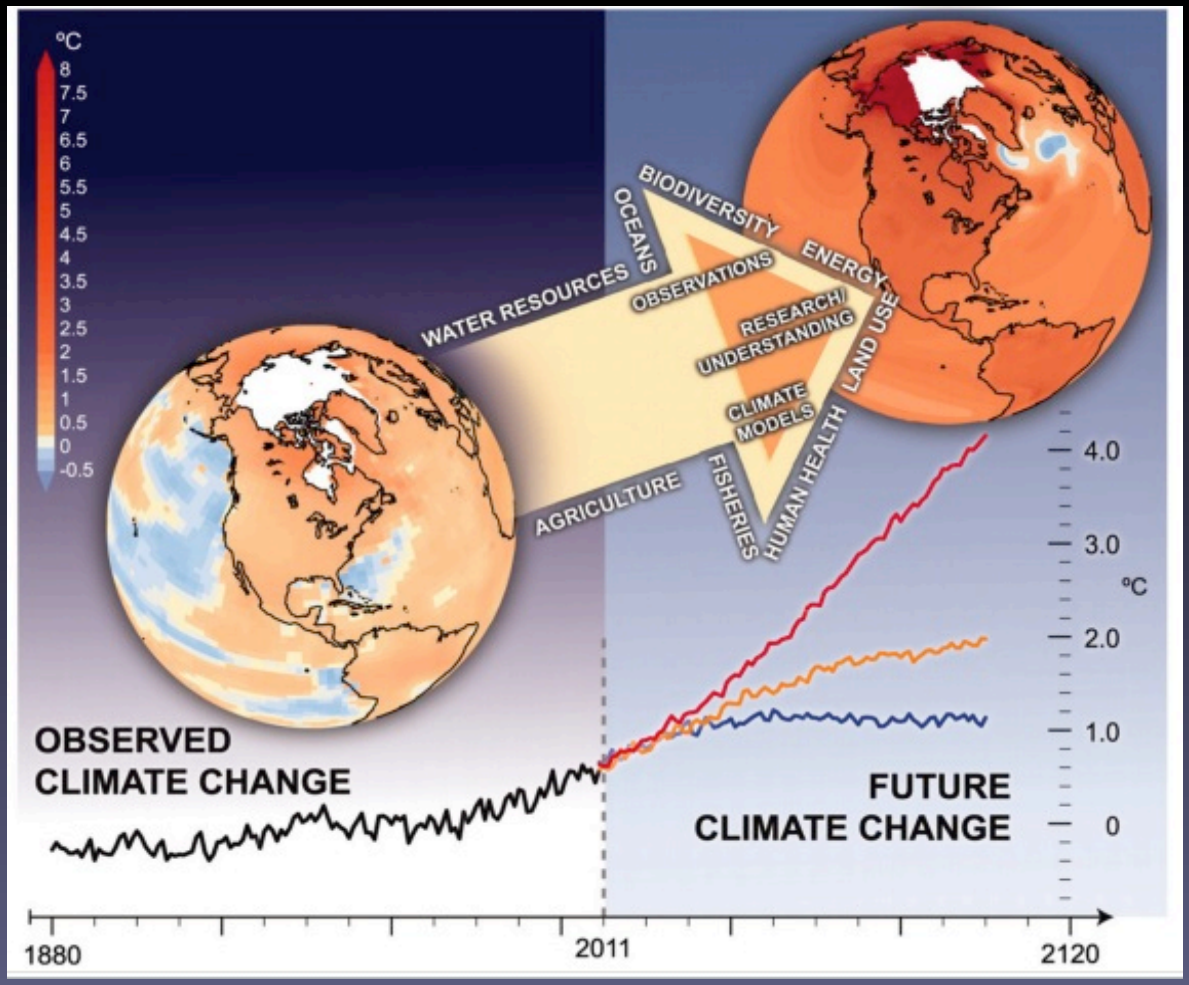
Which are the evidences?

Is this a normal process?

Which have been recent past climatic changes?

Which has been their impact?

How will adapt ecosystem to climate change in the near future?



Necessity: urderstanding the past is the key to understand the present

The Mediterranean basin represents an Hot Spot for paleoclimatic reconstruction for the last millennia, but unfortunately temporally and spatially high-resolution climate information / reconstruction from marine archives is still limited.

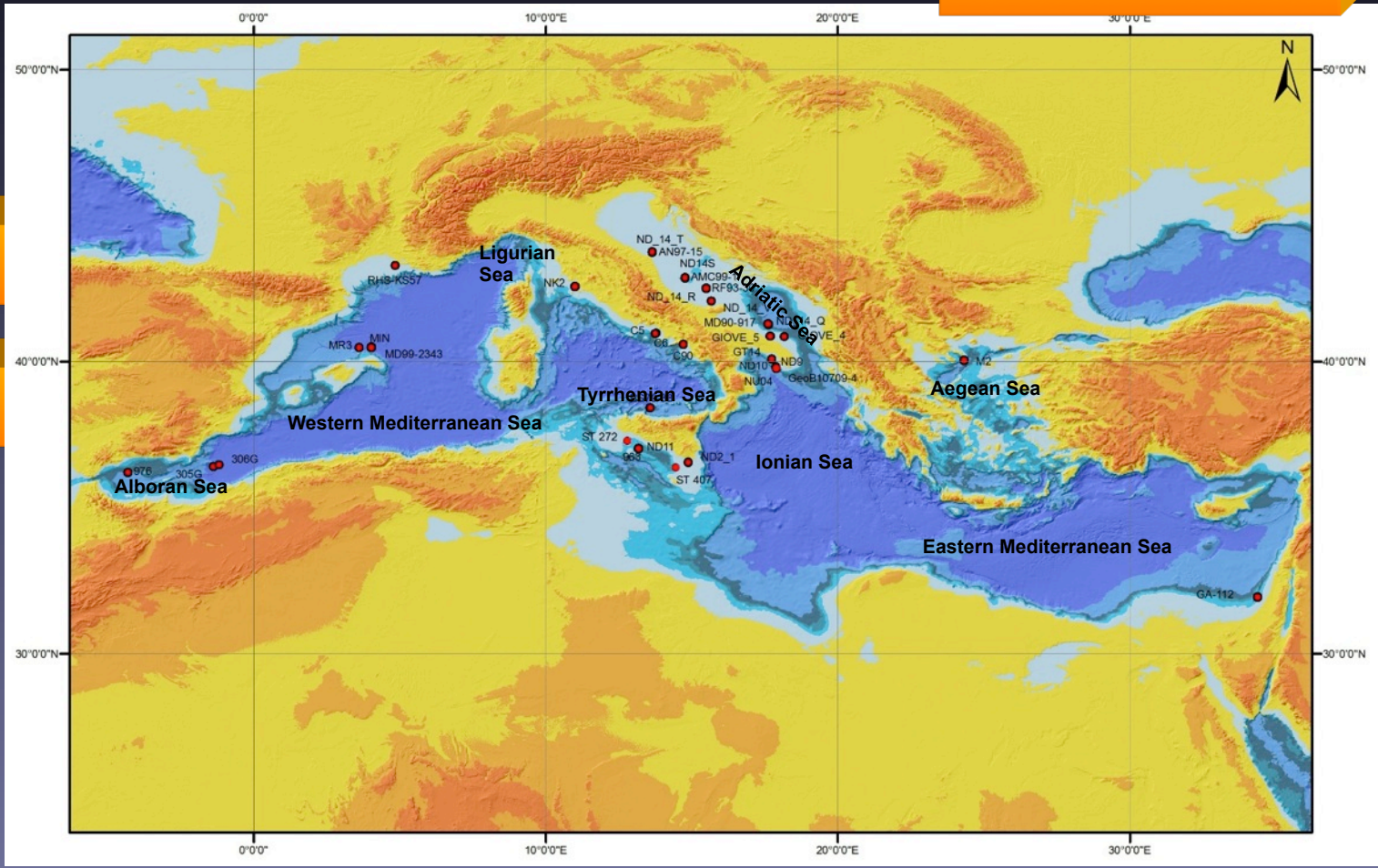
32 marine cores

Chronology

Time resolution

Shallow/deep

Proxy

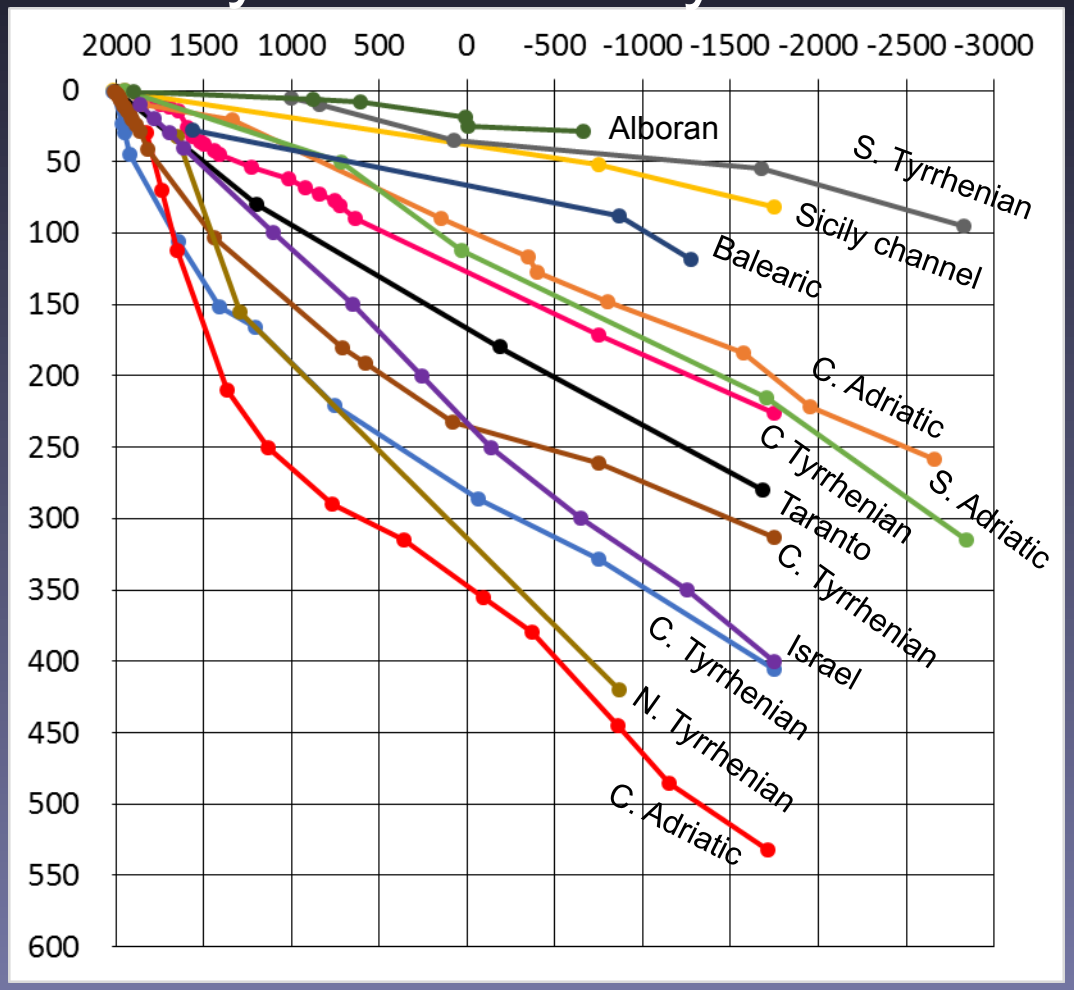


9 high resolution 2k

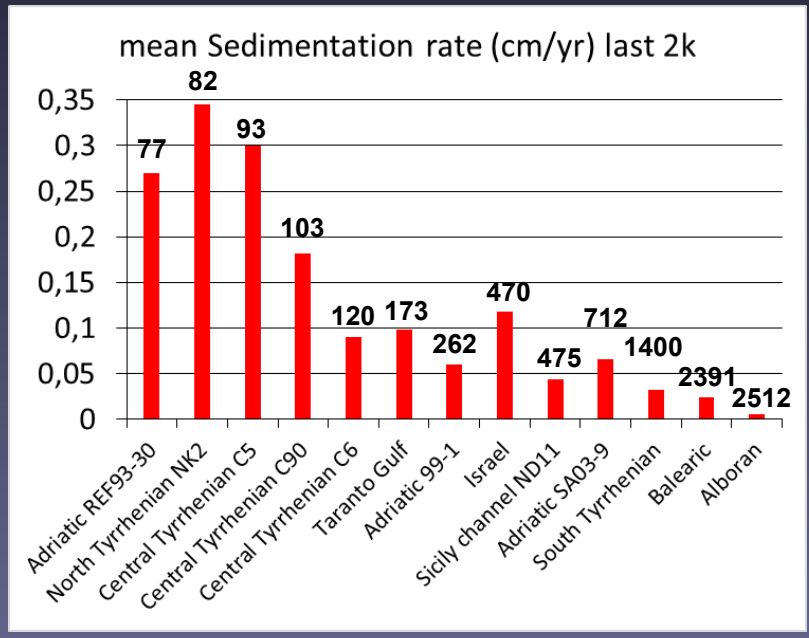
10 low resolution 2k

NextData
un sistema nazionale per la raccolta, conservazione, accessibilità e diffusione dei dati ambientali e climatici in aree montane e marine

Age-depth profiles for Mediterranean marine records during the last 4000 years



Mean Sediment.Rate last 2k



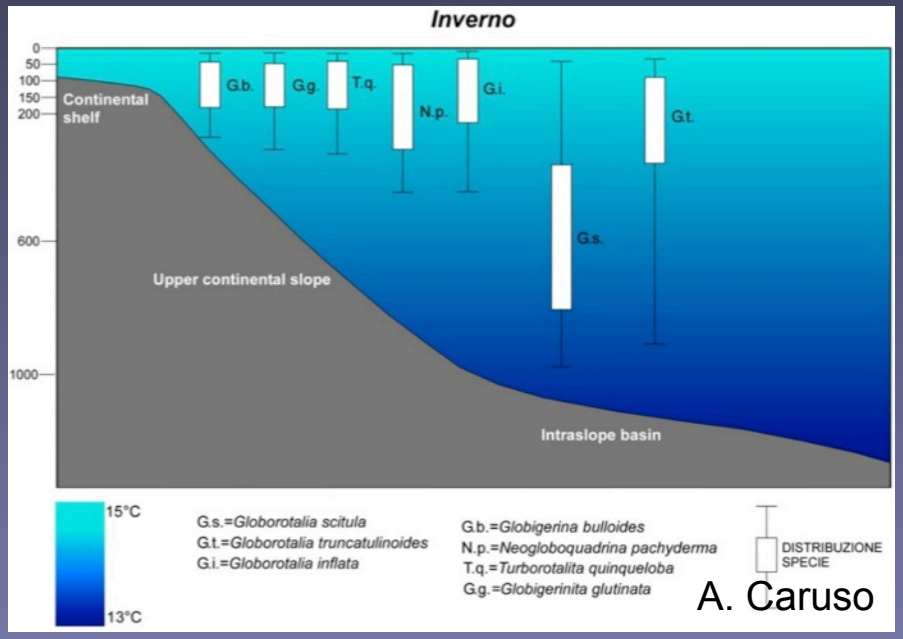
The continental platform …a key area for monitoring the past climatic changes during the last 2000 years

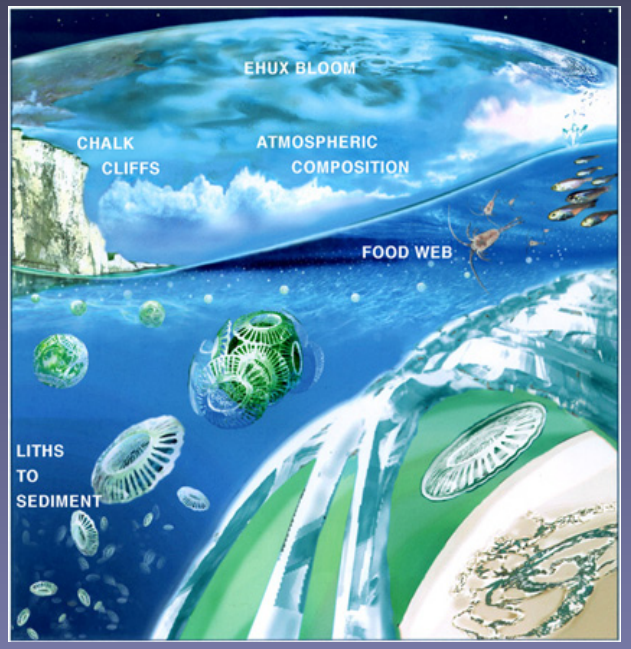
Climatic phases identified in Marine Mediterranean records during the last two millennia

Nieto Moreno (2012) western Alborean Sea		Lirer et al. (2014) south Tyrrhenian Sea (Salerno Gulf)		Grauel et al. (2013) central Mediterranean (Taranto Gulf)		Piva et al. (2008) (Adriatic Sea)		Gogou et al. (2012) (Aegean Sea)	
Climatic phase/interval	Ages	Climatic phase/interval	Ages	Climatic phase/interval	Ages	Climatic phase/interval	Ages	Climatic phase/interval	Ages
		Modern warm Period	1940AD upwards						
Industrial Period	1800AD upwards	Industrial Period	1940AD-1850AD						
Little Ice Age	1800AD-1300AD	Little Ice Age	1850AD-1240AD	Little Ice Age	1850AD-1400AD	Little Ice Age	1840AD-1400/1450AD	Little Ice Age	1850AD-1300AD
Medieval Classic Anomaly	1300AD-800AD	Medieval Classic Anomaly	1240AD-840AD	Medieval Warm Period	1200AD-800AD	Medieval Warm Period	1200AD-600AD	Medieval Warm Period	1300AD-900AD
Dark Age	800AD-650AD	Dark Age	840AD-530AD	Dark Age Cold Period	750AD-500AD	Dark Age Cold Period	600AD-350AD	Dark Age	900AD-500AD
Roman Humid Period	300AD - 650BC	Roman Period	top 530AD	Roman Classic Warm Period	200AD-1AD	Roman Warm Period	350AD-150AD	Roman Warm Period	500AD-0AD

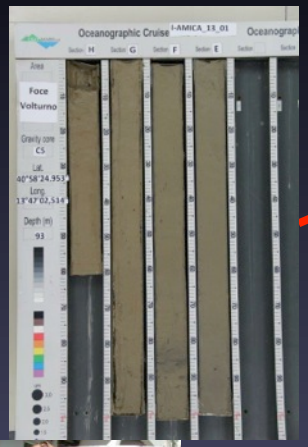
Tool: the planktonic foraminifera

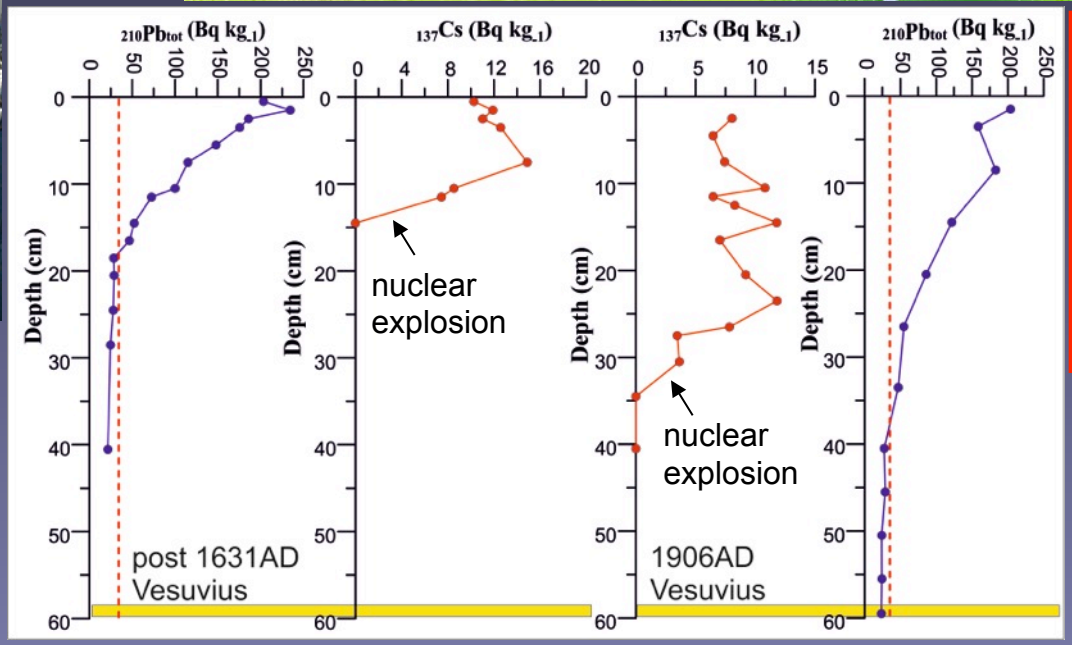
The planktonic foraminifera are commonly used as **proxy** for the paleoceanographic and sea-surface temperature reconstructions because they record the changes of the environmental parameters of the water masses in which they live (Bè & Tolderlund, 1971; Bè, 1977; Fairbanks et al., 1980; Hemleben et al., 1989; Ravelo et al., 1990; Le & Shackleton, 1994; Kucera et al., 2005).

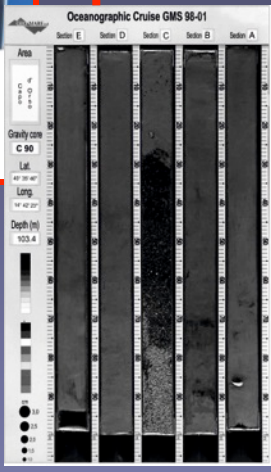


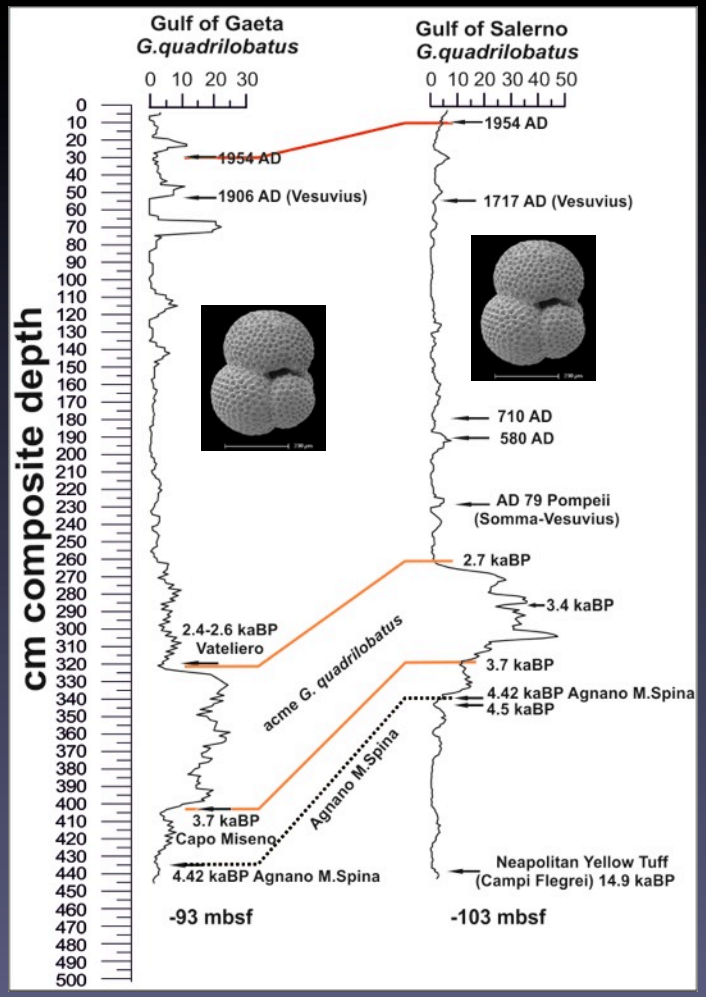


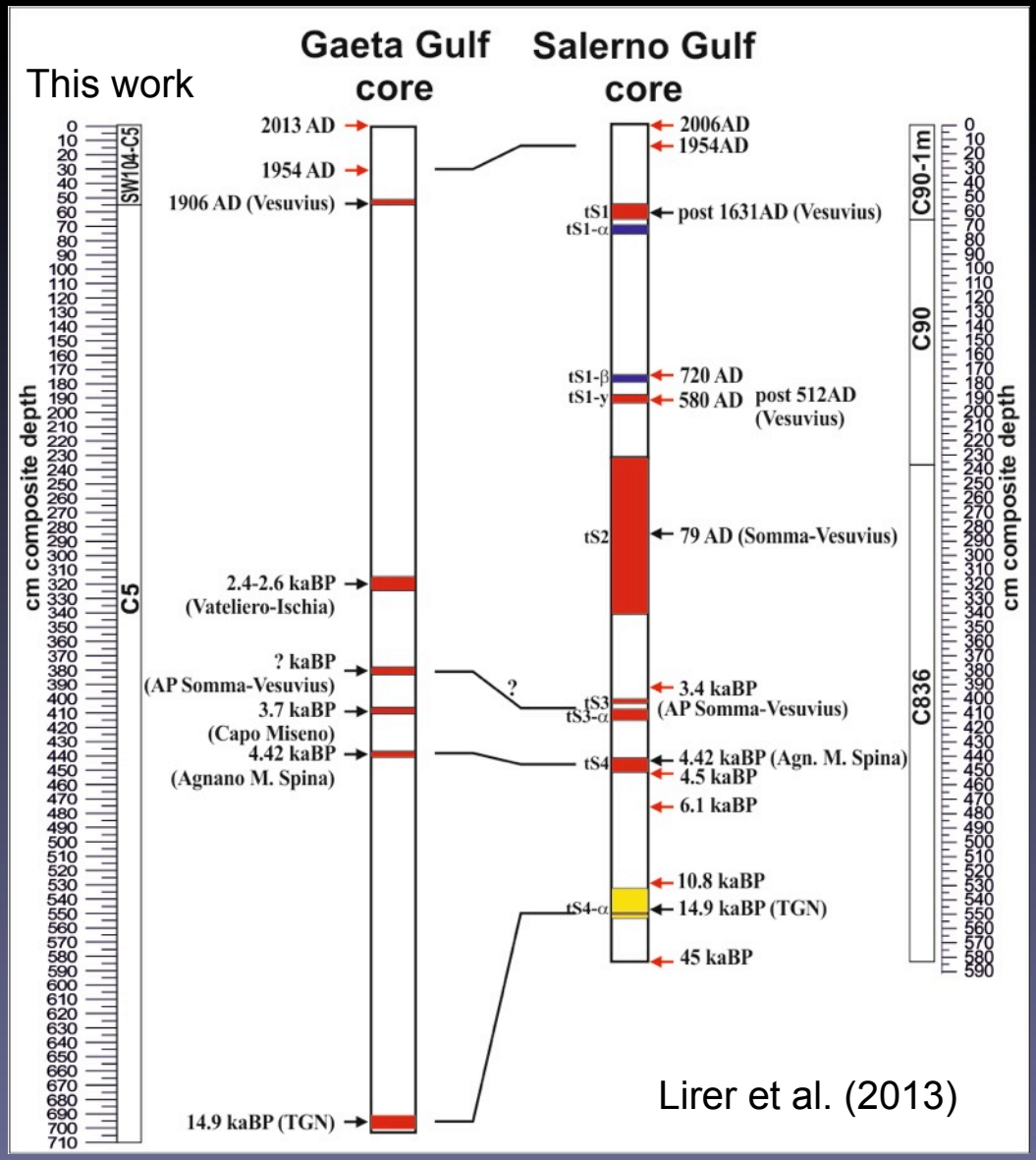
The study areas











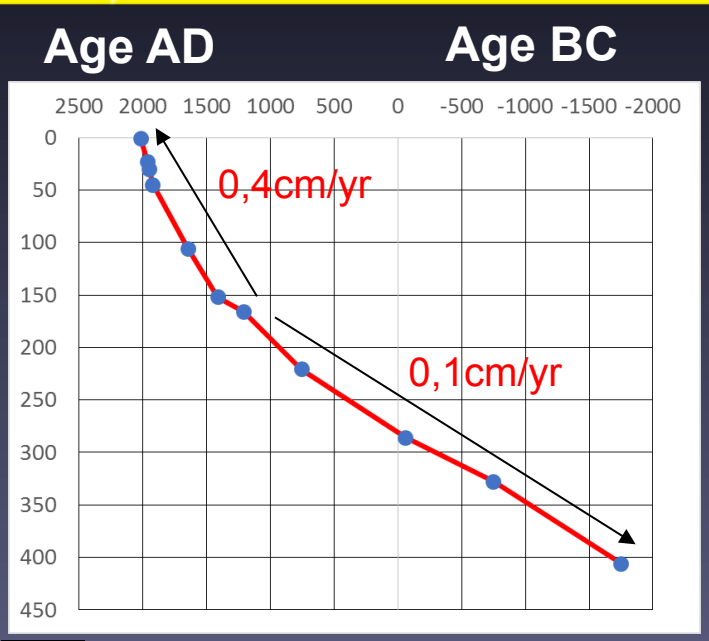
Radionuclides ^{210}Pb e ^{137}Cs

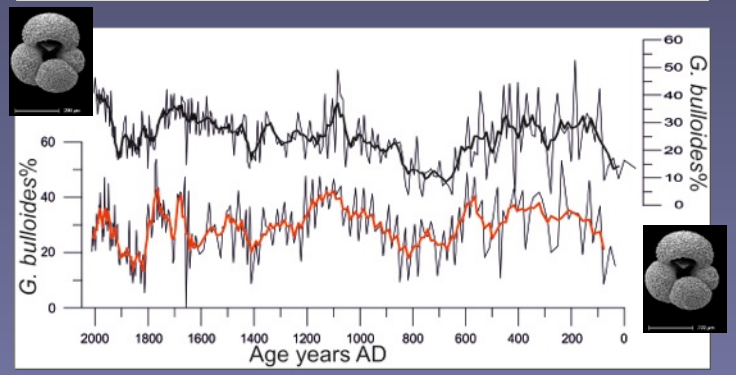
Tefrochronology

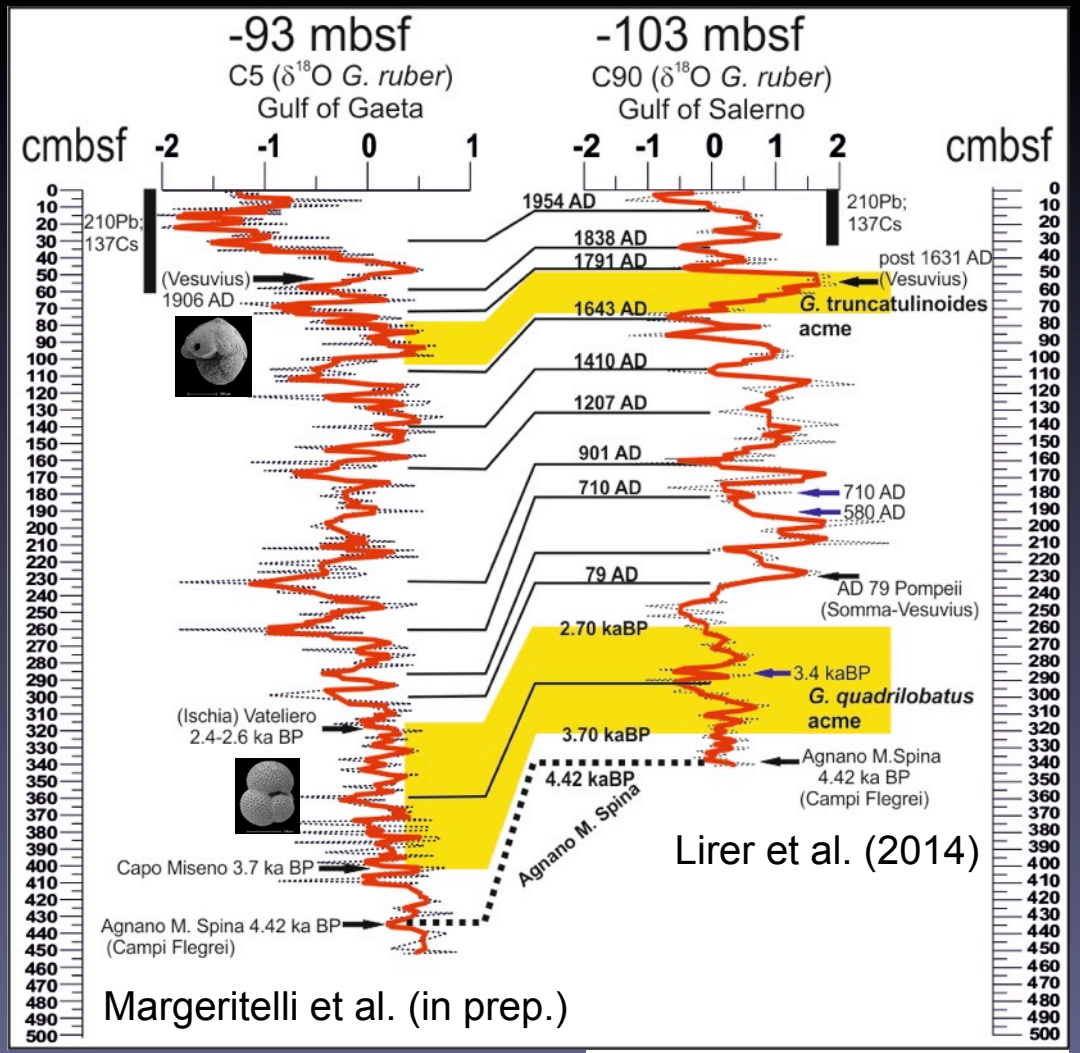
AMS 14C

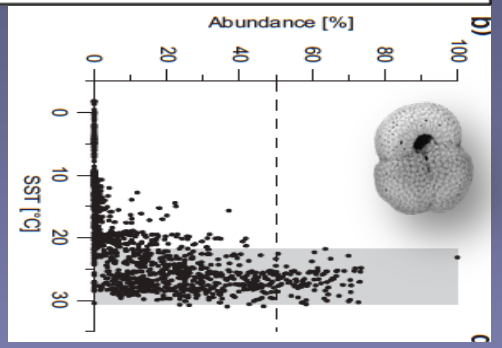
High-resolution Chronology

Oxygen stable isotopic correlation between cores C5 (Gaeta Gulf) and C90 (Salerno Gulf)

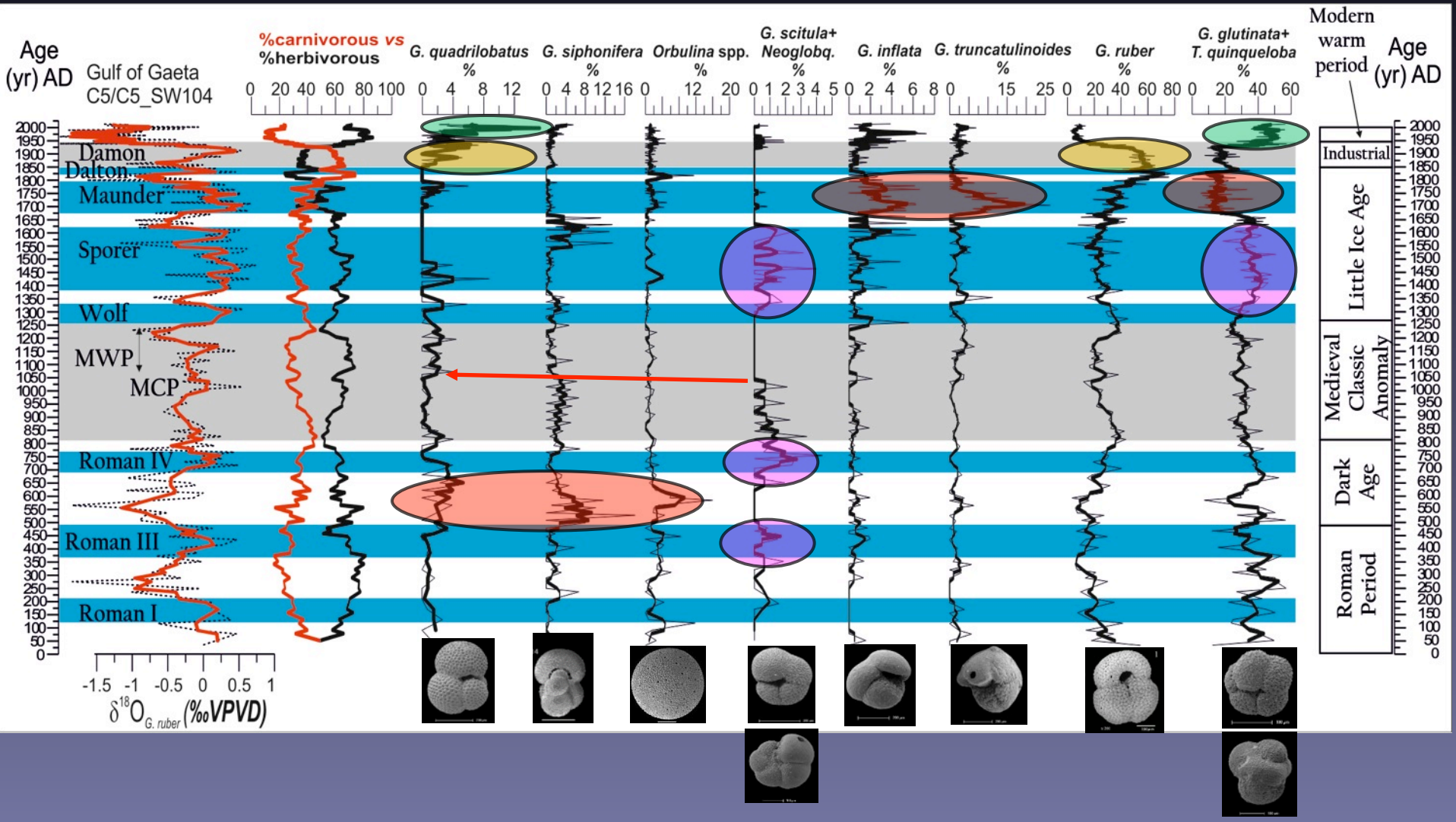




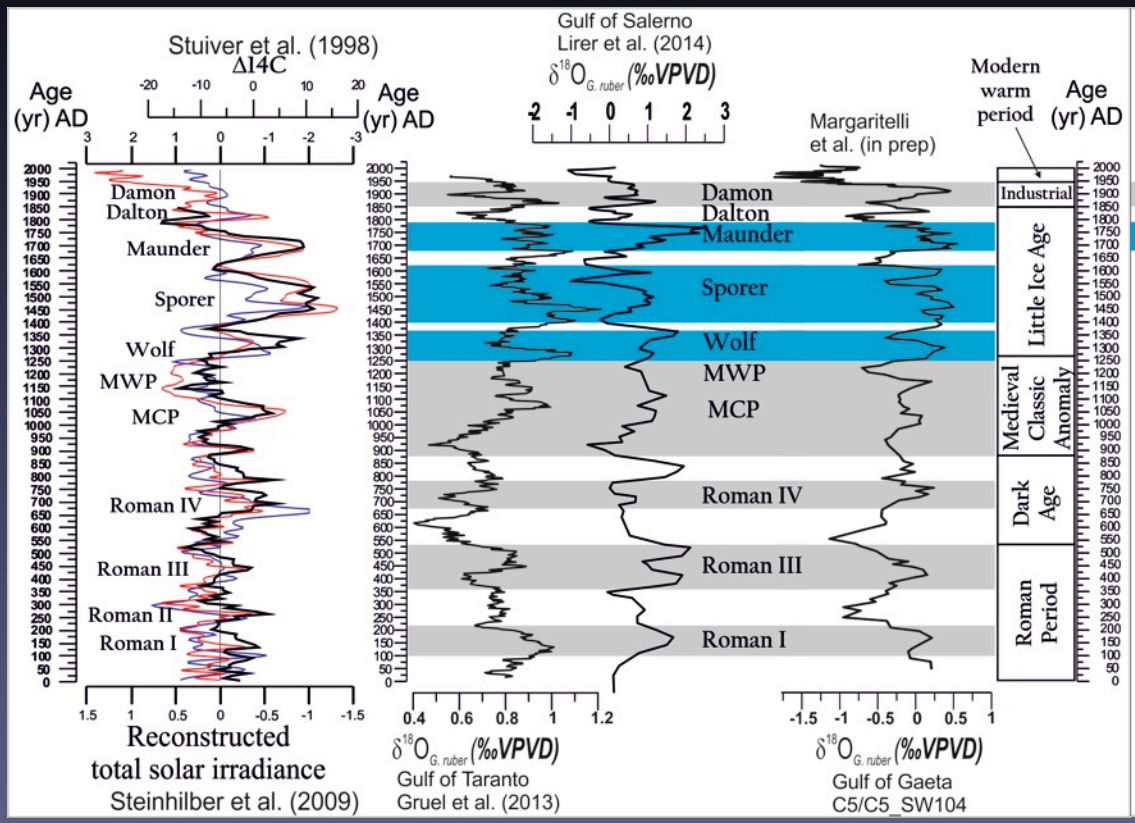


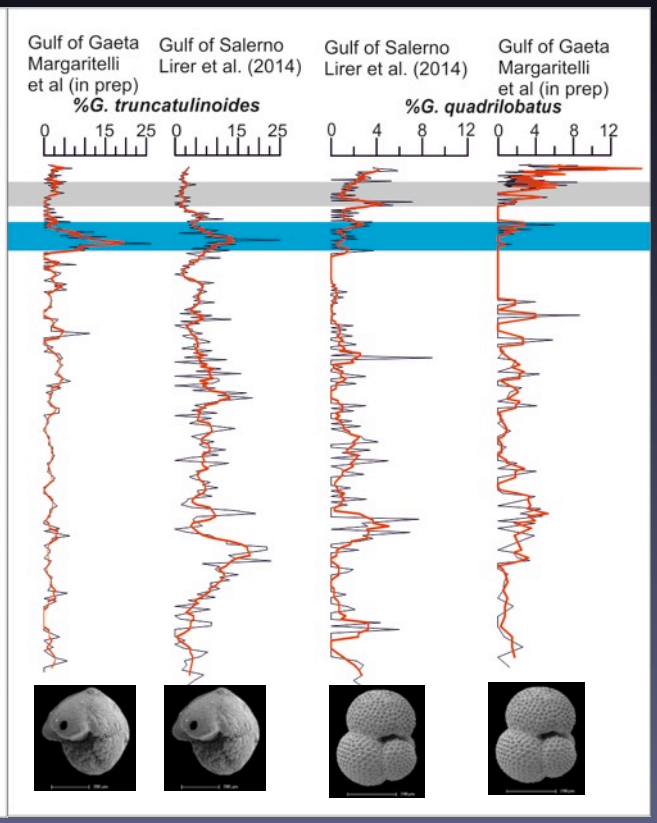


Planktonic foraminifera and δ18O *G. ruber* vs time (AD)
Gulf of Gaeta (central Tyrrhenian Sea)

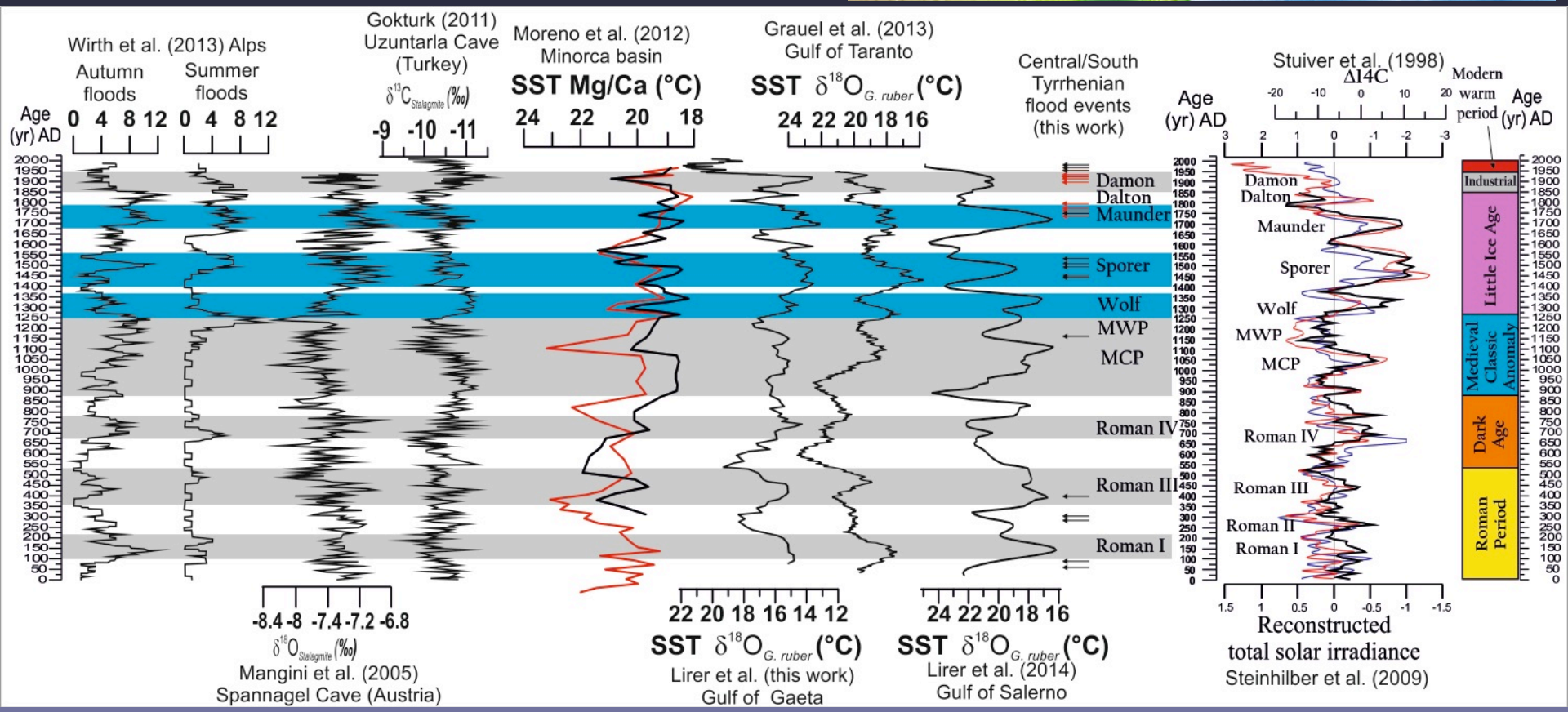


δ18O *G. ruber* comparison between south-central Tyrrhenian Sea and Gulf of Taranto for the last 2000 years

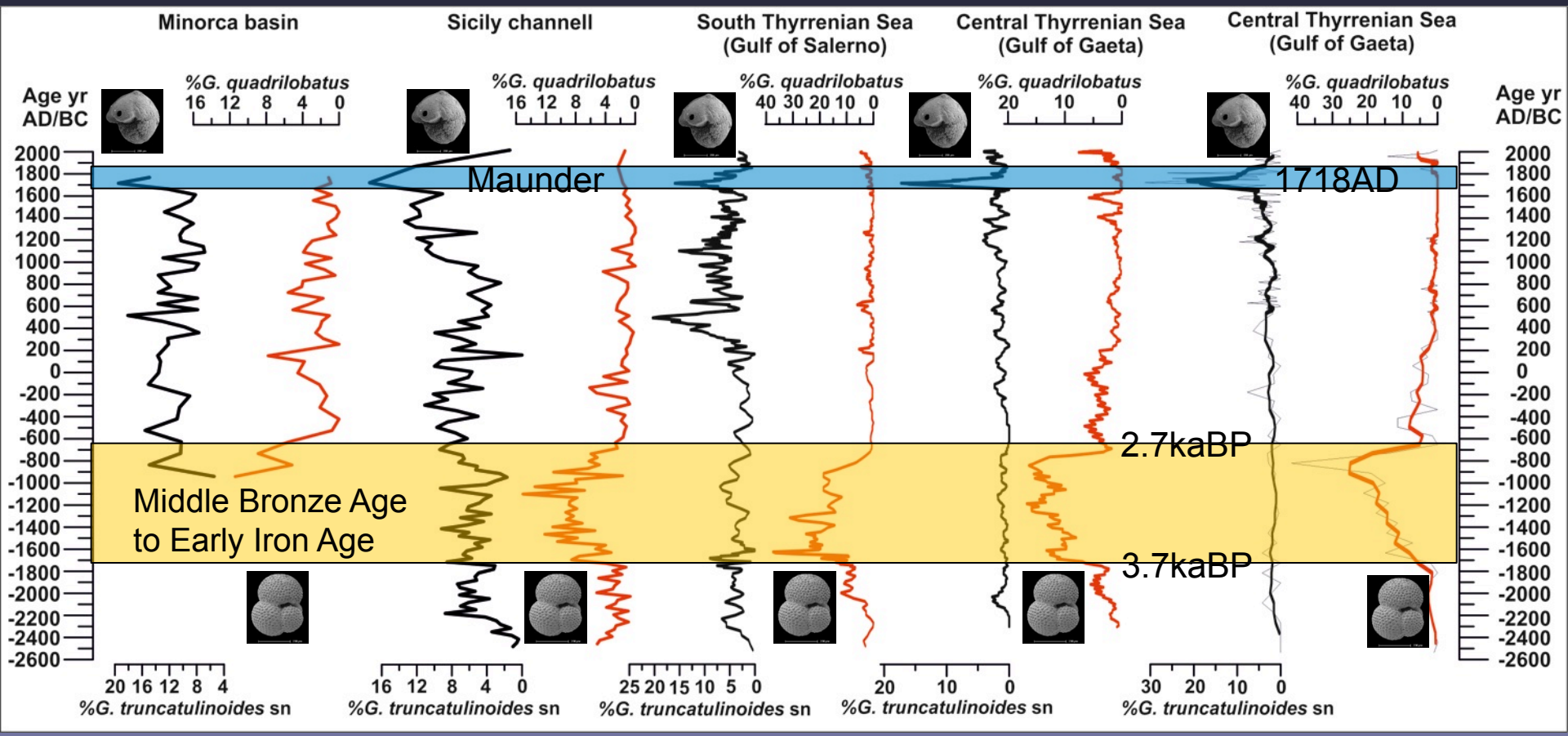


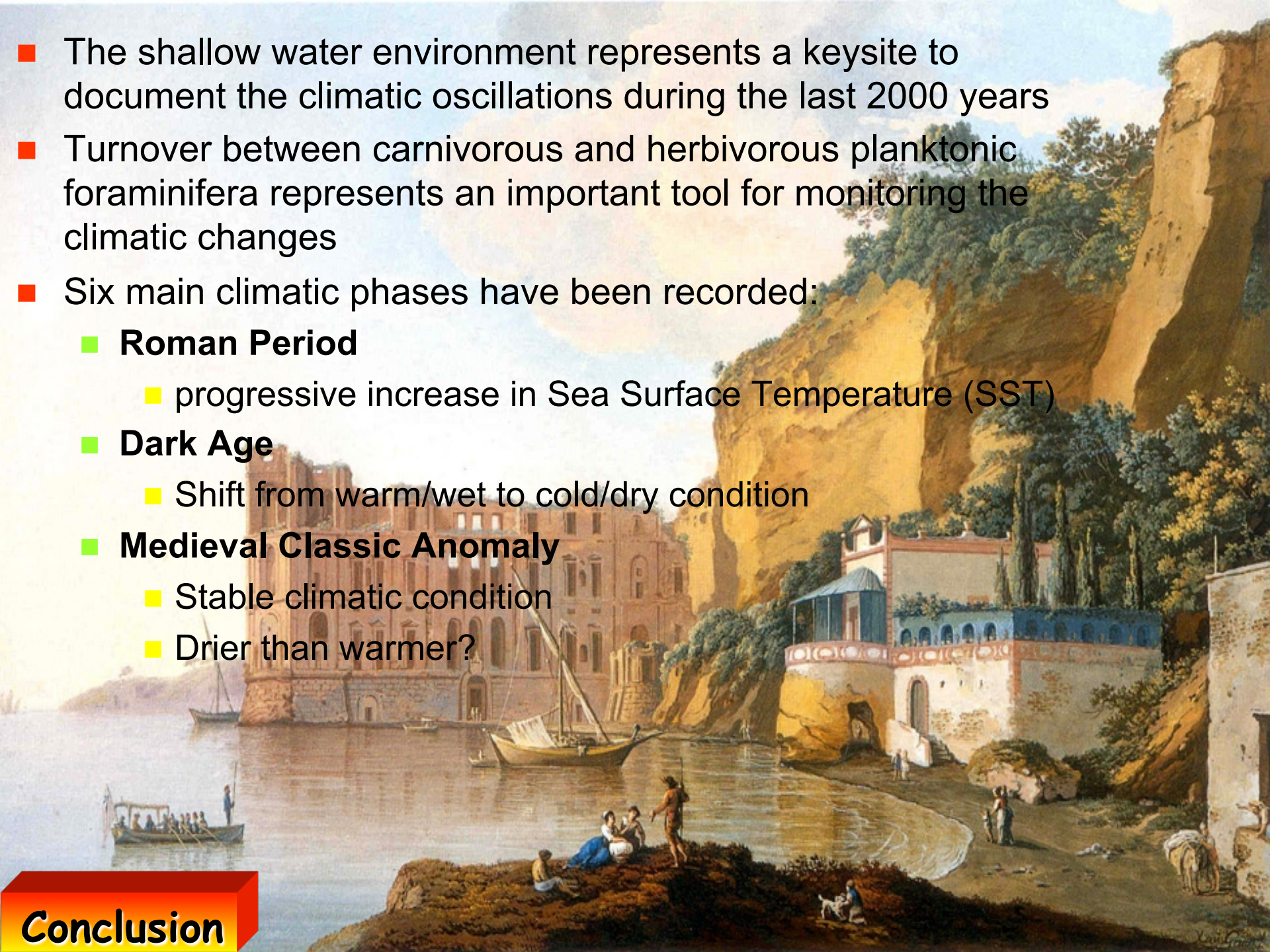


Marine Sea Surface Temperature reconstruction and correlation with continental data



Western Mediterranean Sea events during the last 4000 years





- The shallow water environment represents a keysite to document the climatic oscillations during the last 2000 years
- Turnover between carnivorous and herbivorous planktonic foraminifera represents an important tool for monitoring the climatic changes
- Six main climatic phases have been recorded:
  - **Roman Period**
    - progressive increase in Sea Surface Temperature (SST)
  - **Dark Age**
    - Shift from warm/wet to cold/dry condition
  - **Medieval Classic Anomaly**
    - Stable climatic condition
    - Drier than warmer?

Conclusion

- **Little Ice Age**
  - Maunder: maxima in *G. truncatulinoides* left coiled associated with *G. inflata* maxima = deep mixed layers during winter – This features is recorded in all the western Mediterranean – inflow of Atlantic water
  - Sporer and Wolf: peaks in cold planktonic foraminiferal species (*G. scitula* + *N. pachyderma*)
- **Industrial Period**
  - Strong oligotrophic condition: progressive increase in *G. quadrilobatus* abundance
- **Modern Warm Period**
  - Strong increase in sea surface productivity associated to human impact

Thank you for your attention

Conclusion