OSTRACODA AS PALAEO-ENVIRONMENT INDICATORS

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Organizers: University of Michigan-University of Ghana

Outline

Background

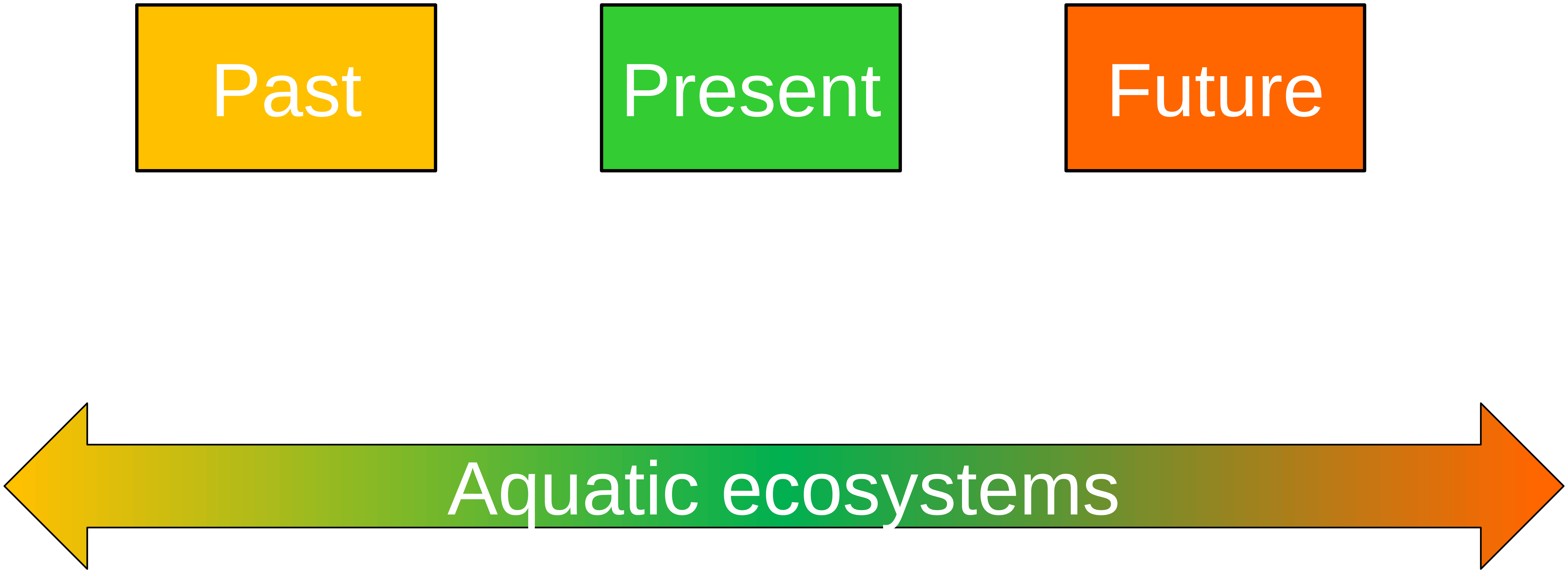
Theme I: Ecology

Theme II: Palaeoecology

Summary

References

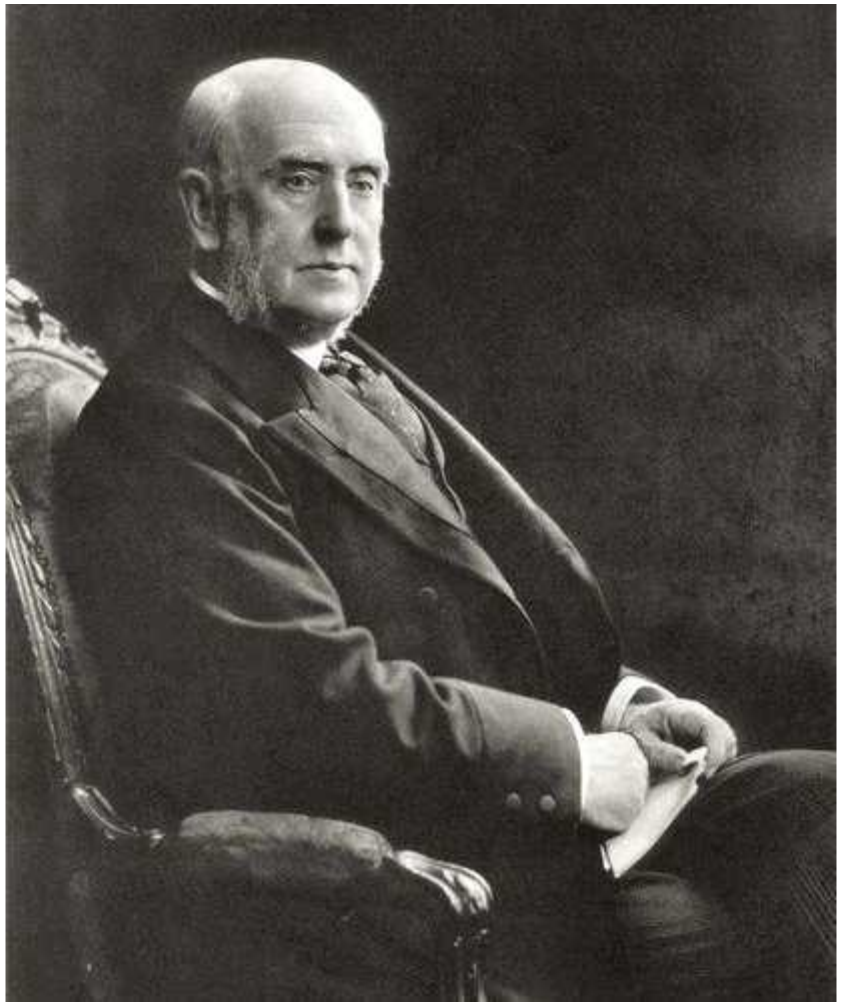
Background: Environmental change



Uniformitarianism

Charles Lyell (1797-1875) Scottish geologist and also botanist
Principles of Geology (1830-33)

Presented idea of **uniformitarianism** to propose that **processes at work today** have operated over the immense span of geological time but that the rates may have changed



Archibald Geikie (1835-1924) Scottish Geologist

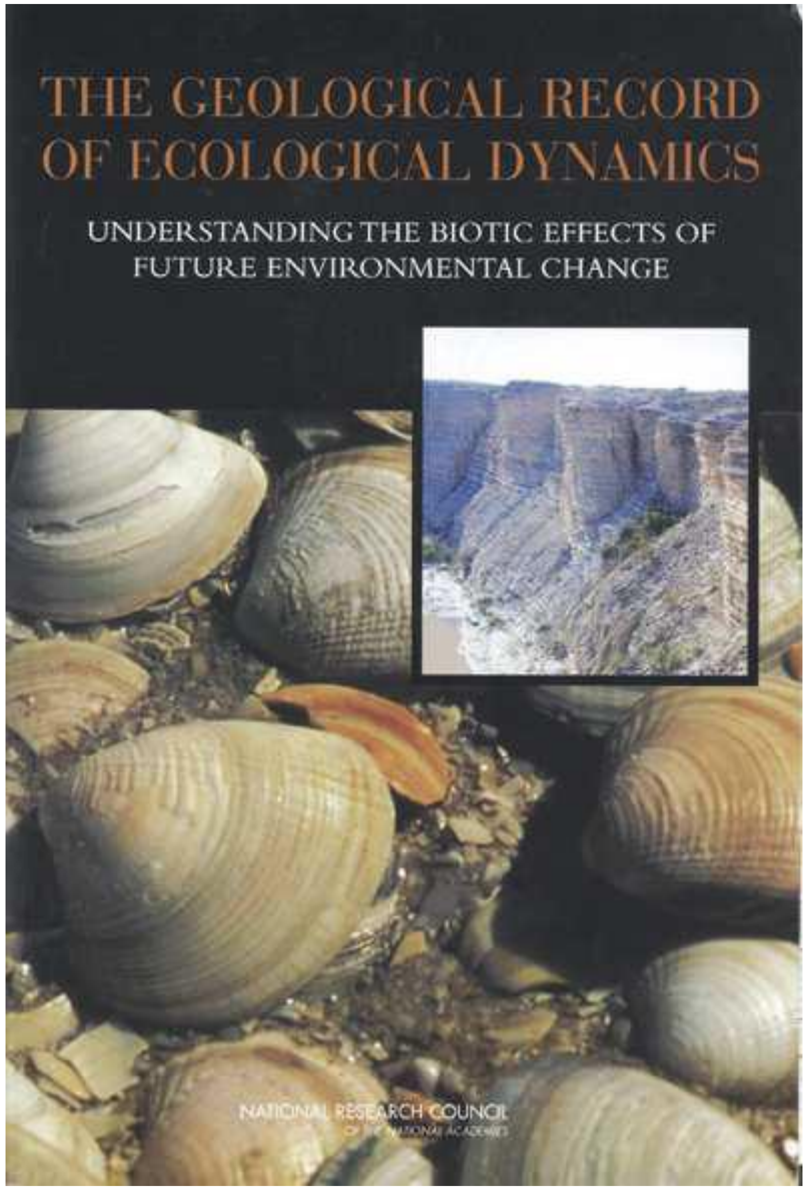
Coined the phrase
"The present is the key to the past"

Important to distinguish between substantive uniformitarianism (rates of processes are invariant) and methodological uniformitarianism (processes are invariant).

Palaeoecology

Palaeoecology is the study of the ecology of the past

Important and critical role for palaeoecology.



The Geological Record of Ecological Dynamics – Understanding the Biotic Effects of Future Environmental Change (Flessa & Jackson 2005)

Bioindication

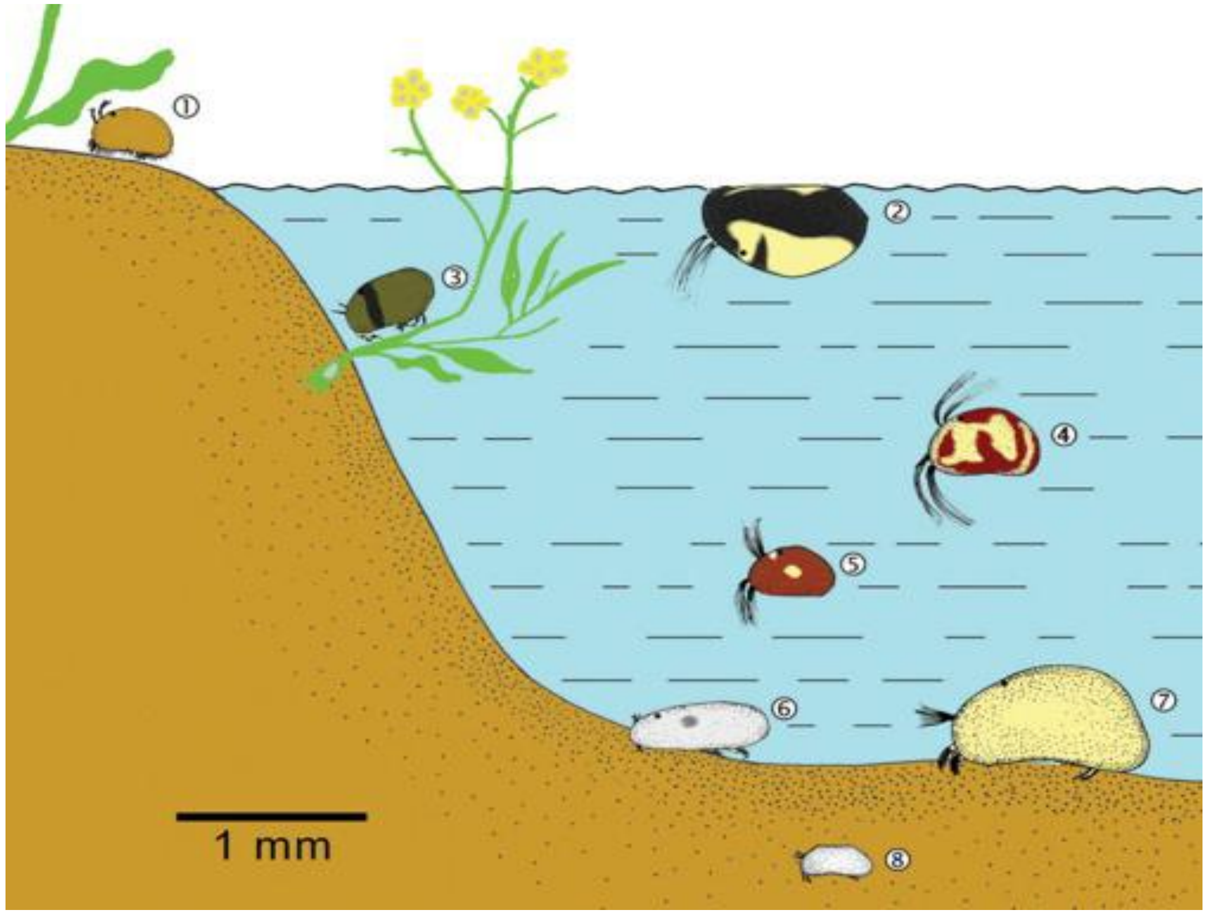
Ecology

Environmental gradient → Assemblage

Palaeoecology

Fossil association → Palaeoenvironmental gradient

Why ostracods?



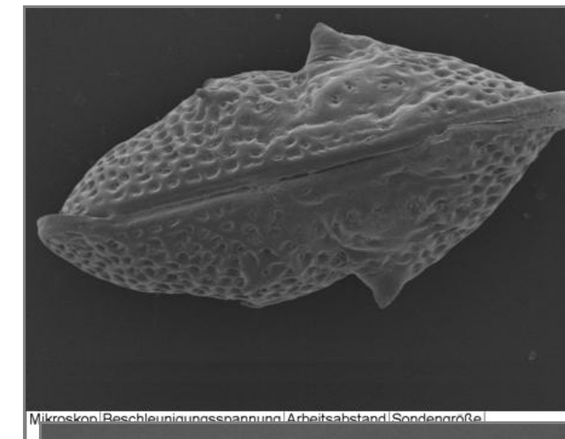
Frenzel et al… 2006

Video: P. Frenzel & F. Viehberg

- Seed shrimp (0.3 - 3.0 mm)
- Species-specific sensitivity
- Long fossil record

Ostracoda as indicators of past environment

- Class of Crustacea - 'Seed Shrimp'
- Live in marine and non-marine aquatic habitats (e.g. Horne et al. 2002)
- Indicators of (palaeo)environmental parameters (e.g., Holmes & Chivas, 2002; Park & Smith 2003)
- Monitoring of recent freshwater conditions (e.g., Külköylüoğlu , 2004)



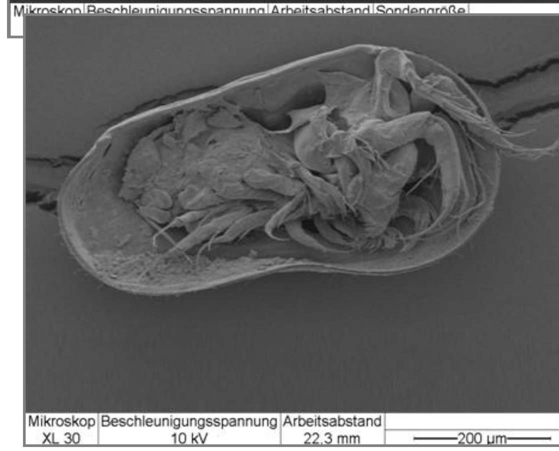


Photo: P. Frenzel

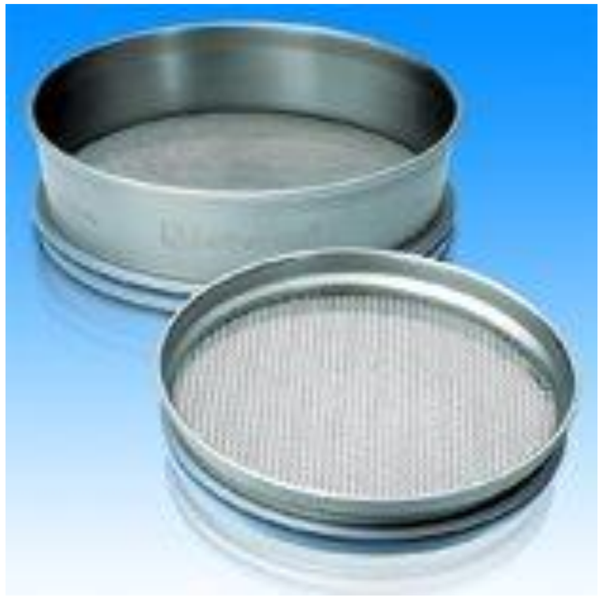
Aims :

- ➢Ecology of ostracods
- ➢Reconstruction of past aquatic environments

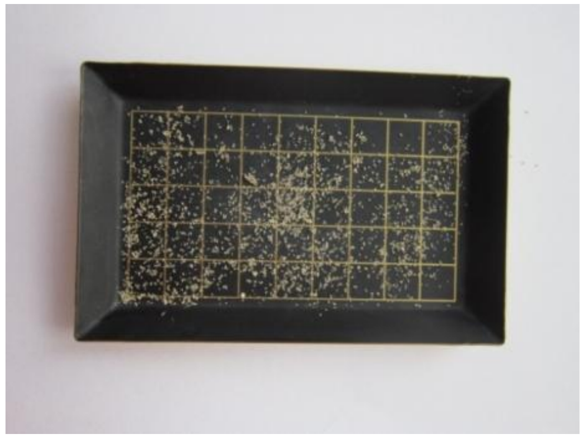
Sediment sampling shallow waters

Sampling lake sediments

Laboratory work



63 µm
200 µm



- All ostracods picked from dried residues
- Identification and counting

Statistical Analyses

Taxonomic analysis

e.g., Meisch 2000; Wrozyna et al. 2009

Multivariate analyses

e.g., PAST, PRIMER 6, CANOCO 5

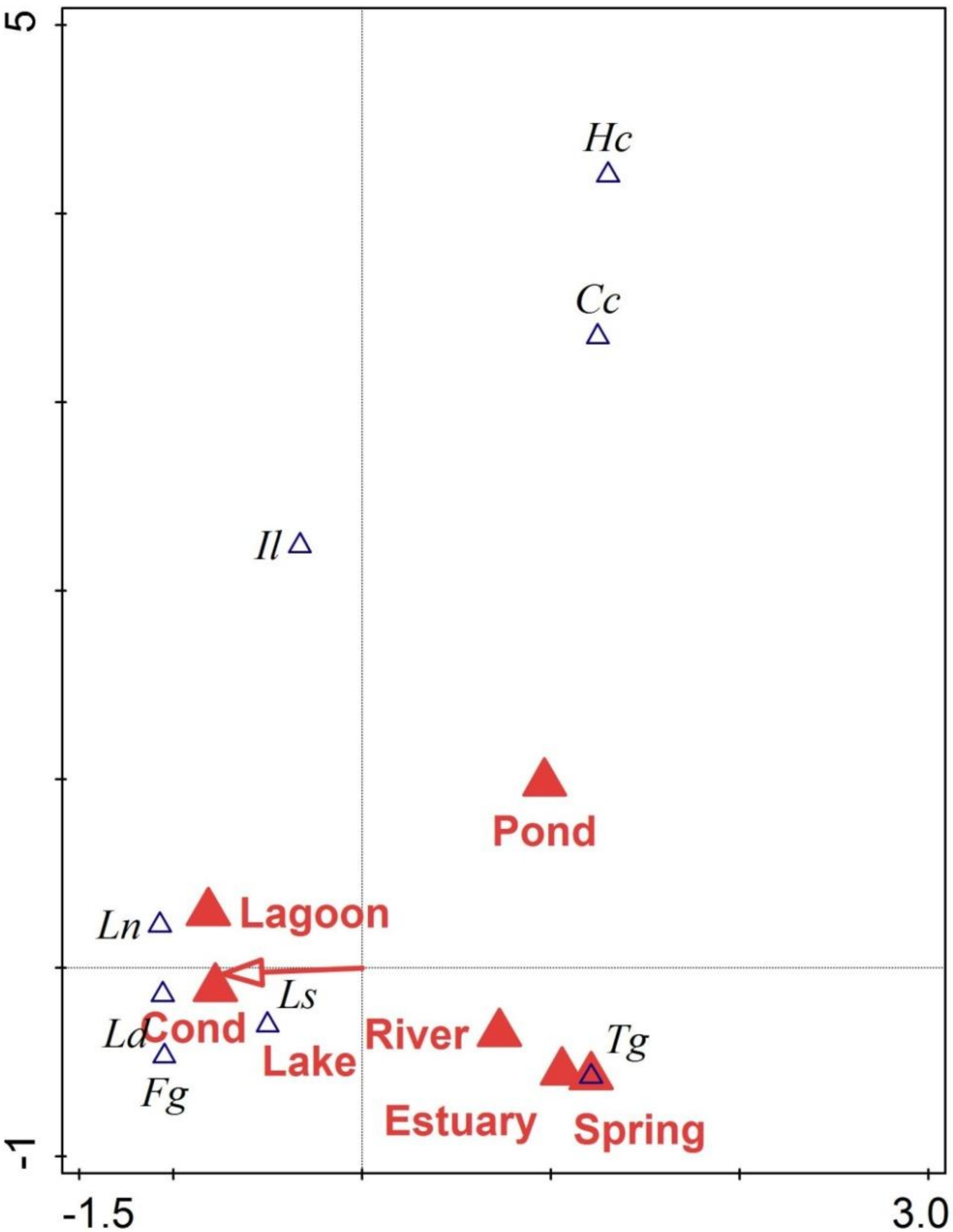
Ostracod-based transfer function

e.g., Frenzel et al. 2010; Peng et al. 2014

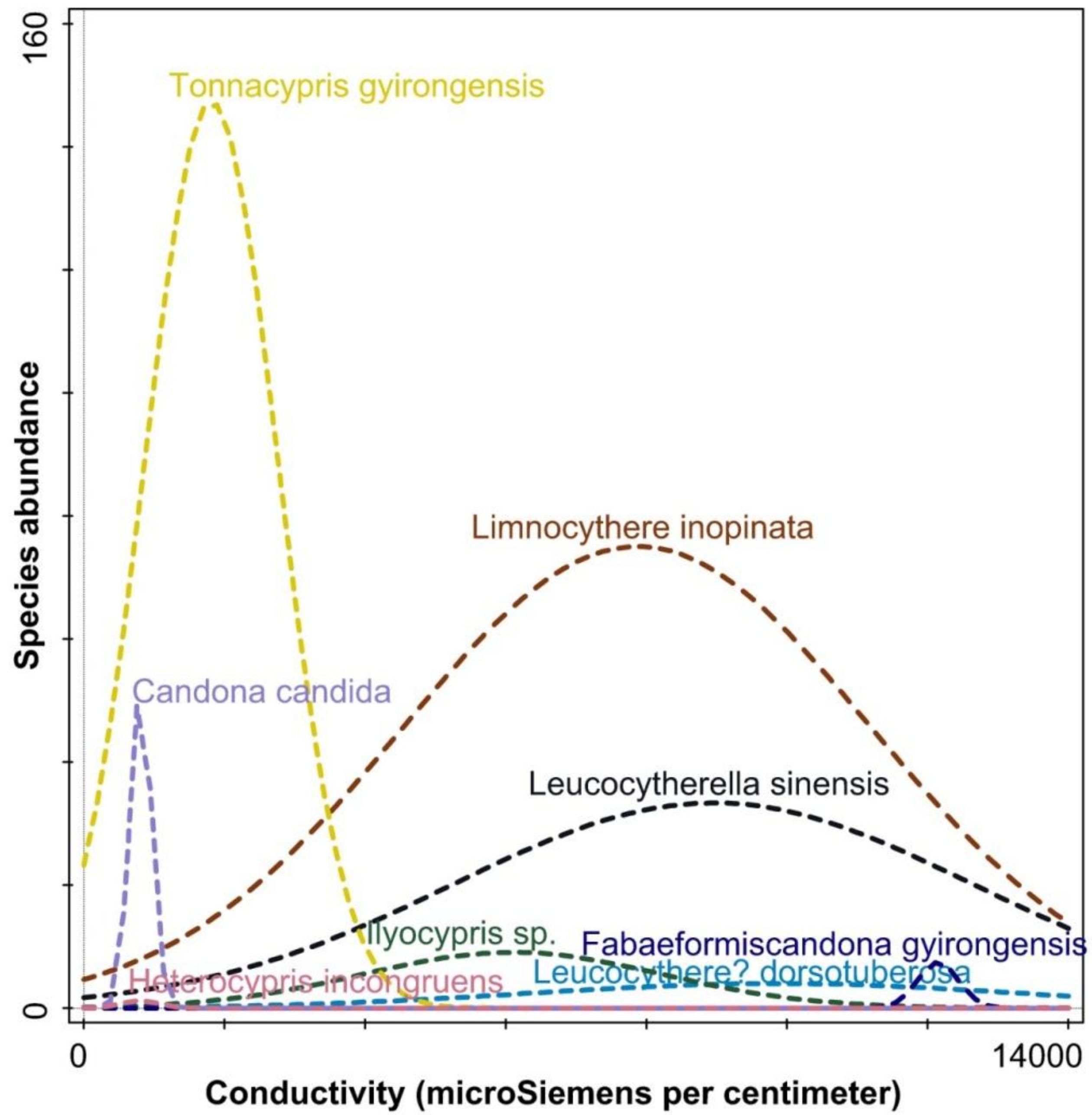
Ecological data

Method	Date / samples	Aquatic ecosystems	Environmental variables
Random Sampling **Gears**: Box corer Hand-net	2009 = 8 2010 = 2 2011 = 35 2012 = 21	Lakes (n = 29) Rivers (n = 13) Estuary (n = 10) Lagoons (n = 8) Ponds (n = 3) Spring (n = 3) **66 samples**	Conductivity Temperature pH O_2 Alkalinity Water depth Sediment type*

Conductivity correlates with species distribution



	1	2	3	4
Explained by constrained axis [%]	24.70	9.60	3.57	1.67
Explained by unconstrained axis [%]	31.78	17.19	8.04	2.80
Efficiency of constrained axis [%]	77.72	55.87	44.40	59.80



Recent ecology of Tibetan Ostracoda: Akita et al. 2016

Conclusions

❑Indicator species: distinct water body and water depth

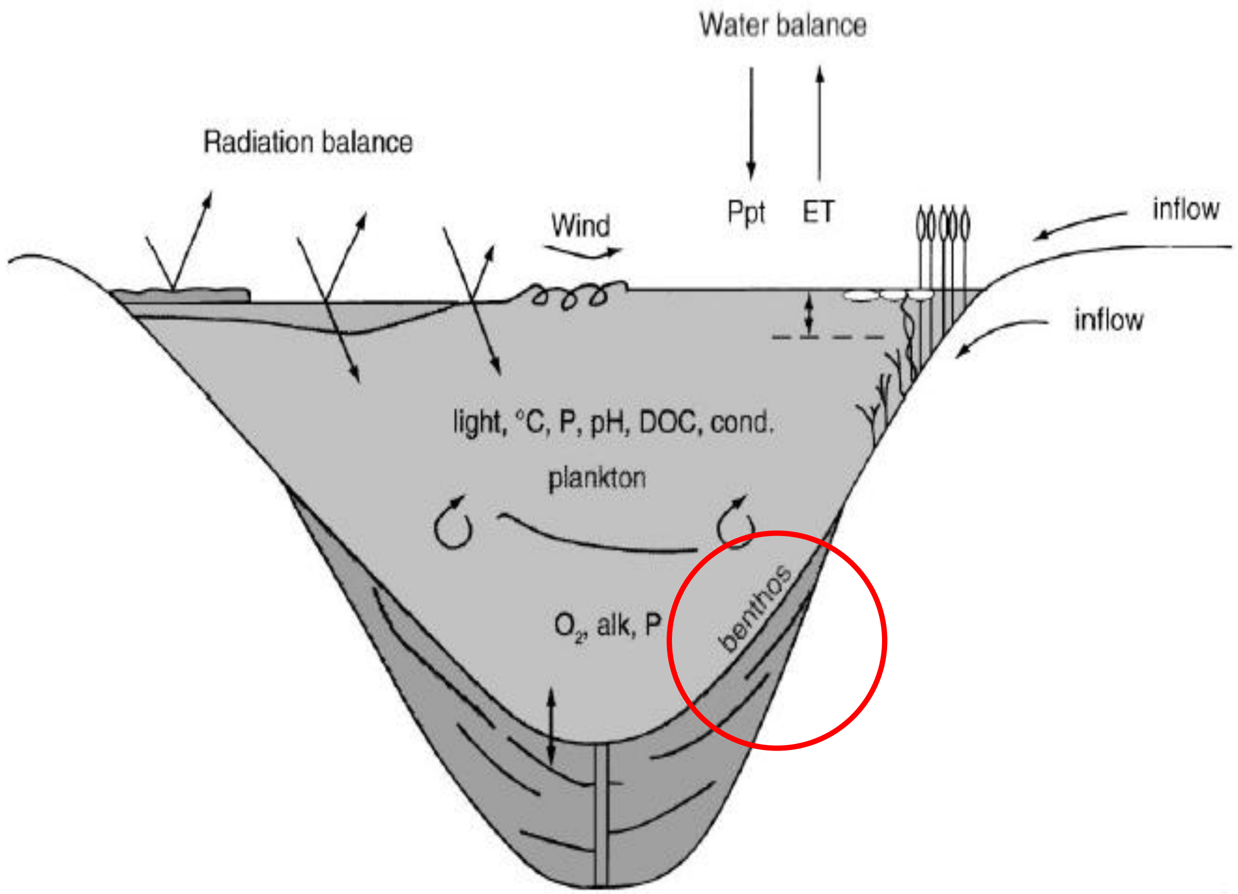
❑Conductivity is the best environmental parameter

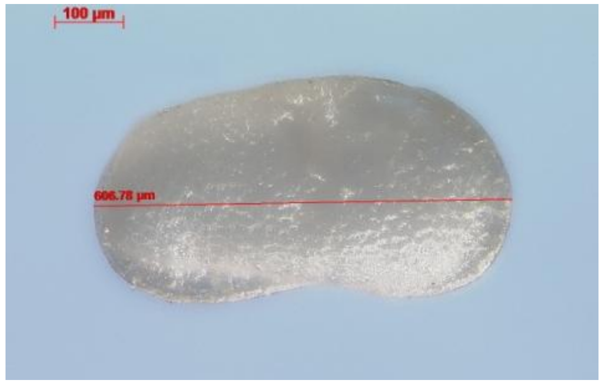
Name	Explains %	Contribution %	pseudo-F	P	P(adj)
Conductivity	21	25.6	9.8	0.001	0.008
Habitats	9	11	4.6	0.003	0.024

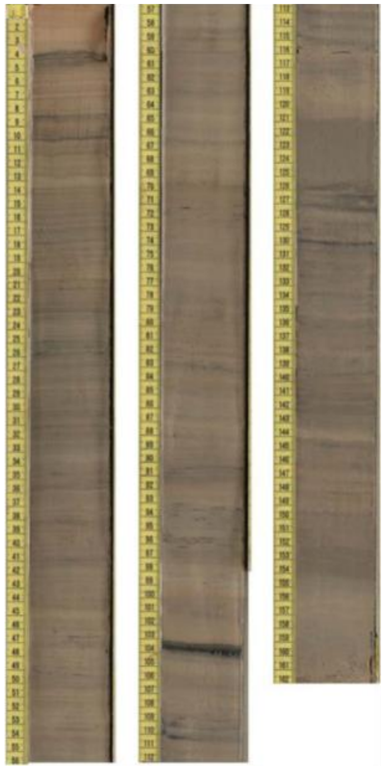
➔ **Ostracoda are sensitive bioindicators**

Recent ecology of Tibetan Ostracoda: Akita ett al. 2016

… memory of lake history







Lake complex system ⇨ Climate

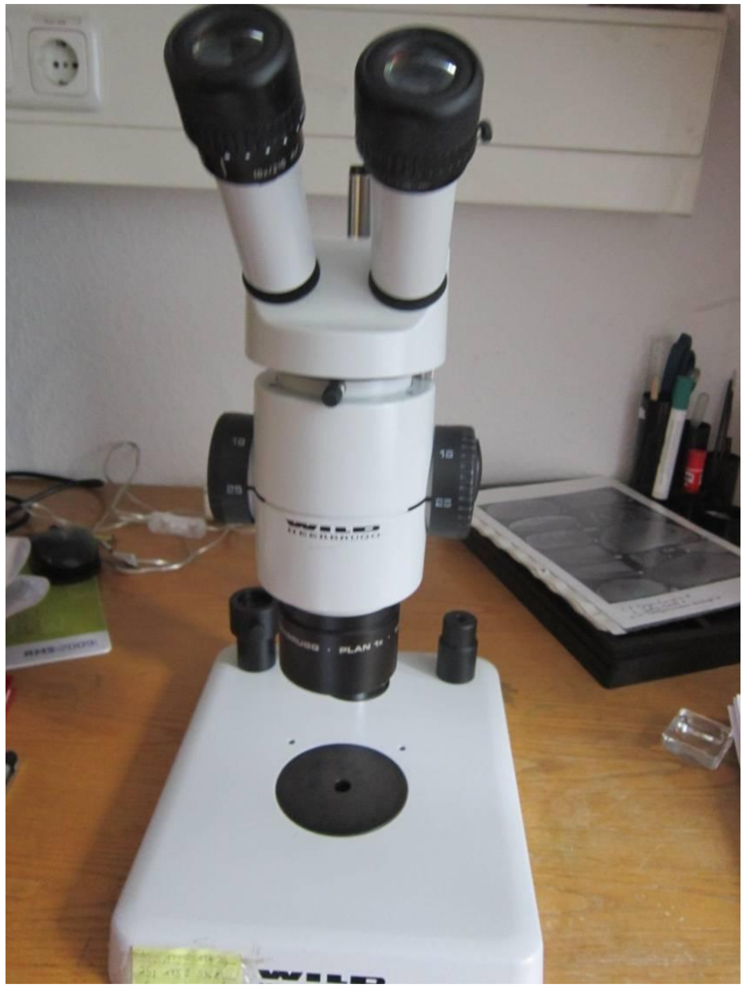
(Source: Battarbee 2000)

Sediment core processing

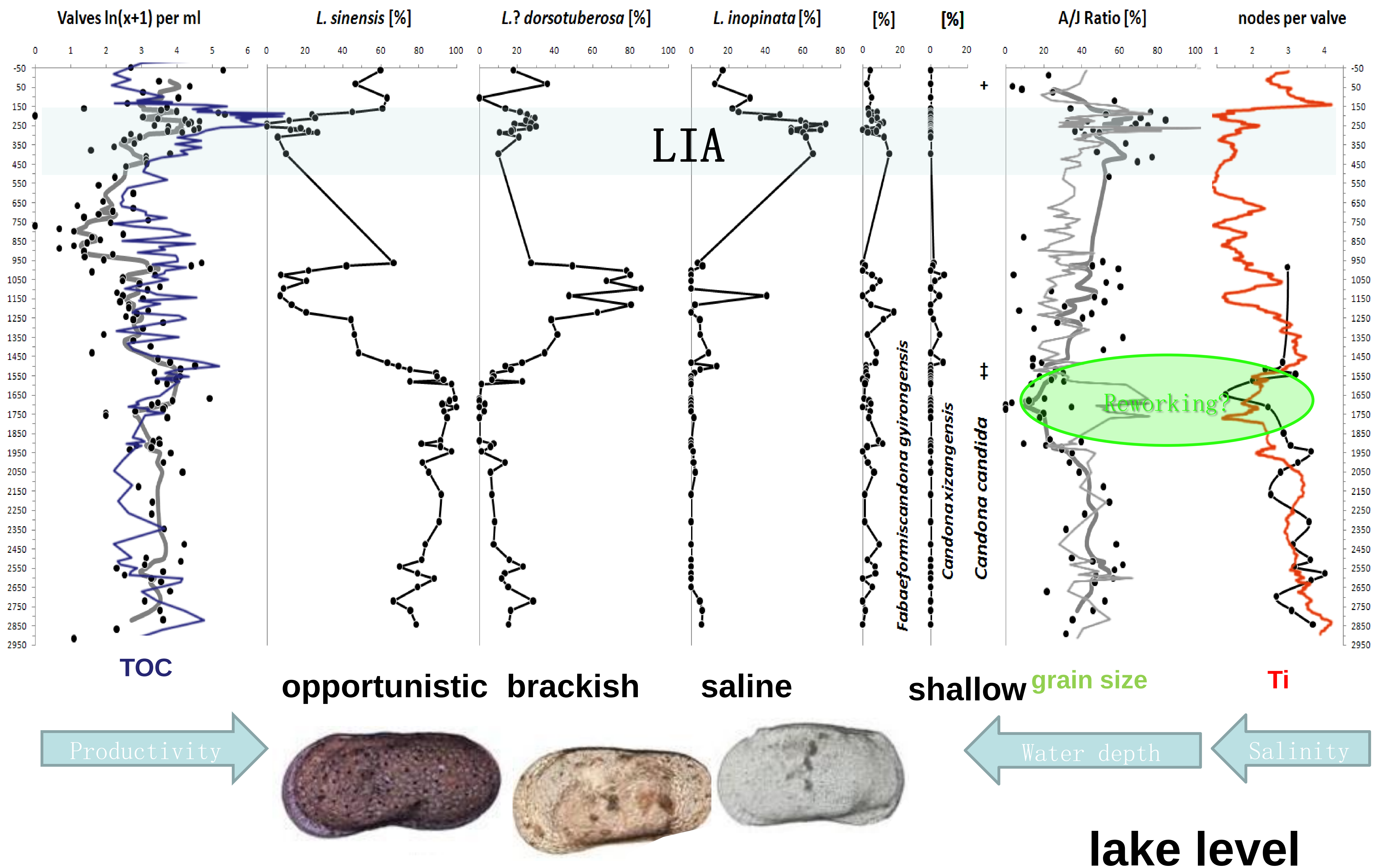
- Sediment Core sampled in 1cm intervals

Standard Sieves
63 µm and 200 µm

- Wet sieved with distilled water



Example:ostracods as environmental indicators



Conclusions

- ❑Ostracod abundance changes with lake productivity
- ❑Ostracod dominance detects lake level changes via salinity tolerance
- ❑Climate change causes lake level changes

➔ Monsoon climate influences water levels of closed lakes

Summary

- Ostracods (small crustaceans) lives in all types of waterbodies
- Changes in ostracod associations reflect changing aquatic environments (fresh to marine, shallow water to deep water)
- Understanding of historical climate and environmental changes

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