Geochemical Analyses of Macrophytes (*Potamogeton* sp.) and ancient DNA from Lake Karakul, Tajikistan

Liv Heinecke [1,2] (Liv.Heinecke@awi.de) , Laura S. Epp [1], Maria Reschke [1,2], Kathleen Stoof-Leichsenring [1], Steffen Mischke [3], Ulrike Herzschuh [1,2]

1. Alfred-Wegener-Institute Helmholtz Centre for Polar and Marine Science 2. Institute of Earth and Environmental Science, University Potsdam, Germany 3. University of Iceland, Iceland

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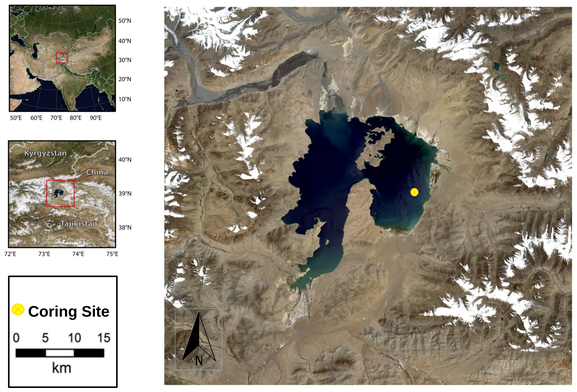
Background

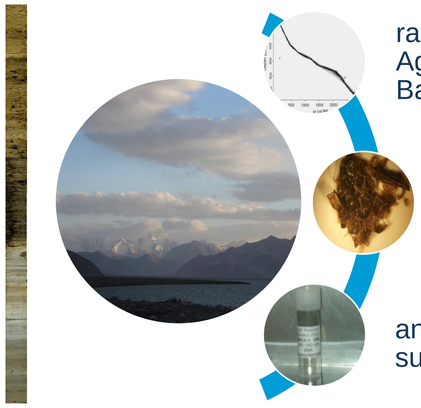
- Holocene climate history of Central Asia reveals significant spatial differences
- low number of records and insufficient data to discuss regional patterns
- from the most continental and highest parts, lake records are rare and paleolimnological information sparse

investigation of paleo-productivity and water plant composition at Lake Karakul

Study Area and Design



- Pamir Mountains, Tajikistan, arid Central Asia
- main climatic influence today: Westerlies and Siberian High (Monsoon in the past?)
- Lake at 3929 m asl, surrounding area up to 5500m asl
- sediment core covers the last ~29 cal kyr BP[1]



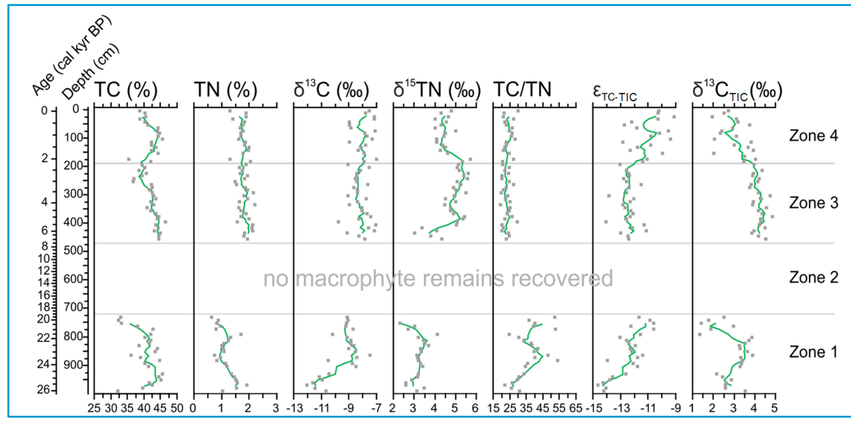
radiocarbon dating, Age-depth model in Bacon[2]

TC, TN, TOC, TIC analyses on *Potamogeton* sp. leaf remains

ancient DNA analyses of submerged water plants

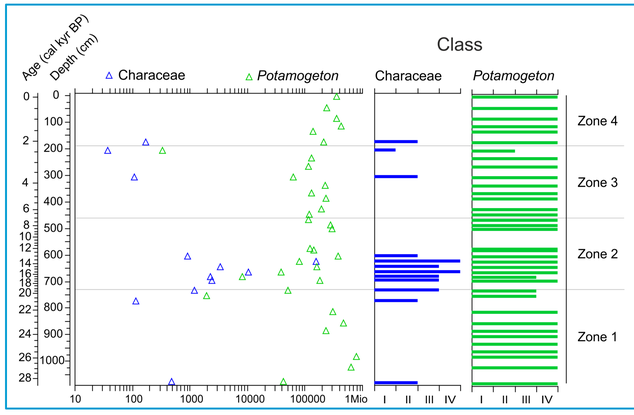
Geochemical data

- *Potamogeton* can utilize HCO_3^- in times of CO_2 shortage
- mean TC/TN-ratio of 17.9; max. values (up to 54) at 7 m to 9 m depth
- stable isotope measurements resulted in $\delta^{13}C$ values from -12‰ to -7‰ (mean -8.6‰) and $\delta^{15}N$ values from 1.9‰ to 5.7‰ (mean 4.2‰)
- low isotope concentration in the upper 4.5 m
- increased isotope enrichment factor $\varepsilon_{TC\text{-}TIC}$ ($\delta^{13}C_{Potamogeton}$ - $\delta^{13}C_{Auth.Carb.}$) indicates high paleo-productivity[3]



Ancient DNA

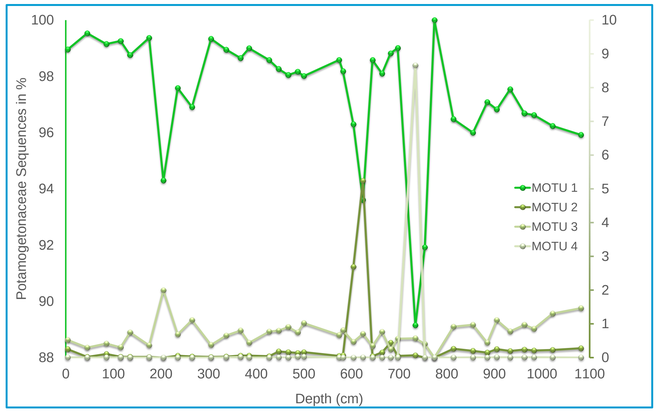
- DNA metabarcoding of 38 ancient DNA samples using universal plant primers (g/h)[4] Illumina amplicon sequencing
- DNA of 37 species and families was recovered
- sequences dominated by *Potamogeton* and Characeae (water plants)
- in our study semi-quantitative evaluations for water plants



Class	No of Sequences
I	0-10
II	11-1000
III	1001-10000
IV	>10000

Potamogetonaceae DNA

- 9 Molecular Operational Taxonomic Units (MOTUs) represented by > 10 k sequences
- best identity with database entries: 100% MOTUs 1+2, 98.9% MOTUs 3+4
- MOTU 1 dominant (mean 97.8%), declines in less favourable conditions →other MOTUs step in



Conclusion

- medium to high paleo-productivity from 7-2.2 cal kyr BP
- increased paleo-productivity from 2.2-0 cal kyr BP
- *Potamogeton* sp. and Characeae present since at least 29 cal kyr BP - even if no macrofossil remains are preserved
- Characeae thrive under unfavourable conditions for *Potamogeton* sp.
- conditions change and habitats shift around 21-13 and 6.7 cal kyr BP

Inferences

→ supports lake level high stands from 19-13 kyr BP[5]

→Lake driven by climate changes → indirect influence on lake system, productivity and vegetation composition

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