The Times of Sand: Applying Cosmogenic ^{21}Ne to Examine the Brief Exposure Times of Quartz Sands throughout Sedimentary Cycles

Michal Ben-Israel (UC Merced), Ari Matmon (HUJI), Samuel Niedermann (GFZ, Potsdam)

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הקרן הלאומית למדע
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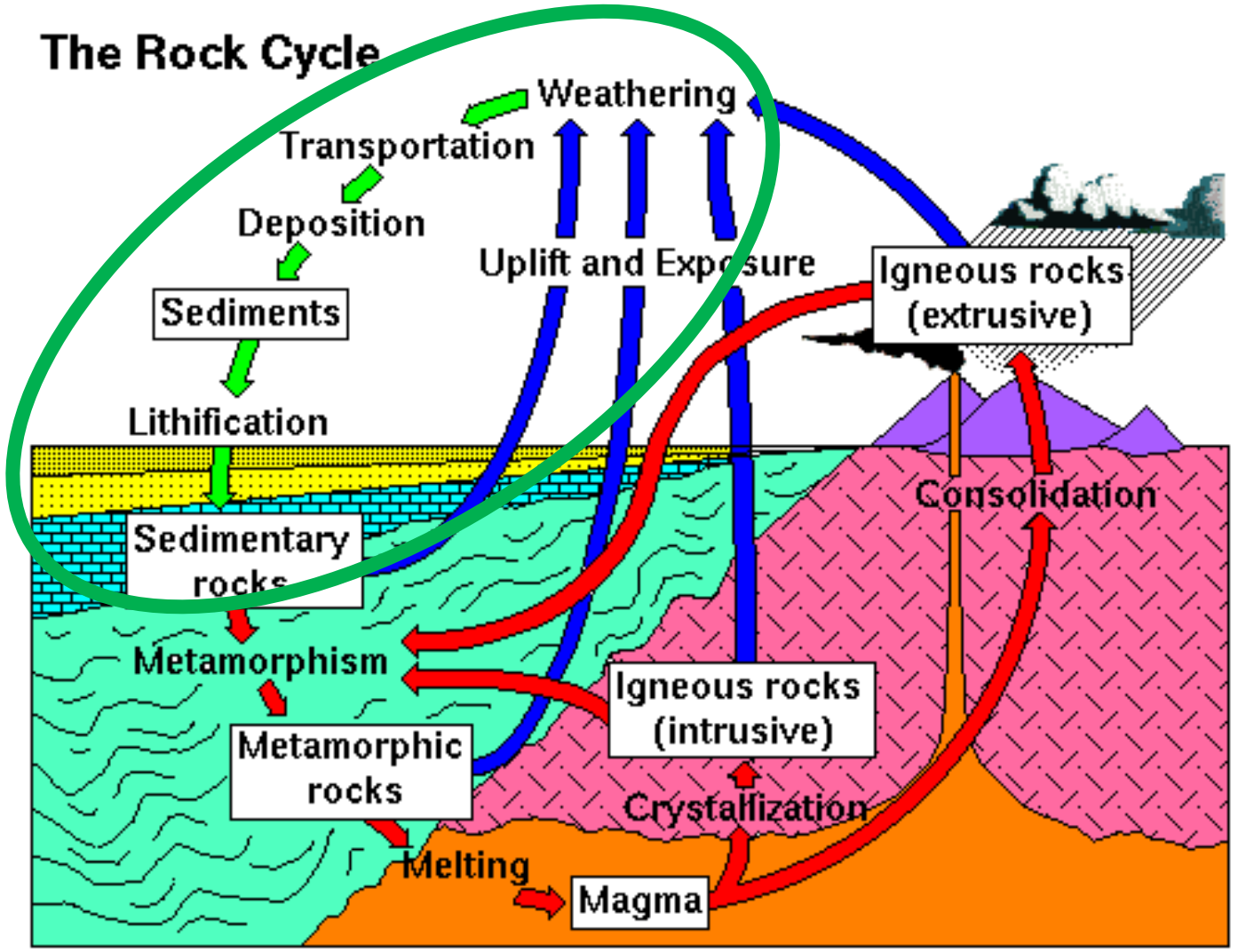
Quantifying exposure over sedimentary cycles

- The sedimentary cycle includes all surface processes
- Quantifying rates of surface processes usually only focuses on one aspect of sedimentary cycle
- Examine the timescales of overall exposure at the surface during sedimentary cycles



Timescales of exposure over sedimentary cycles

Questions and (somewhat obvious) answers

- What are the timescale of sedimentary cycles?

→ *Probably long exposure times…*

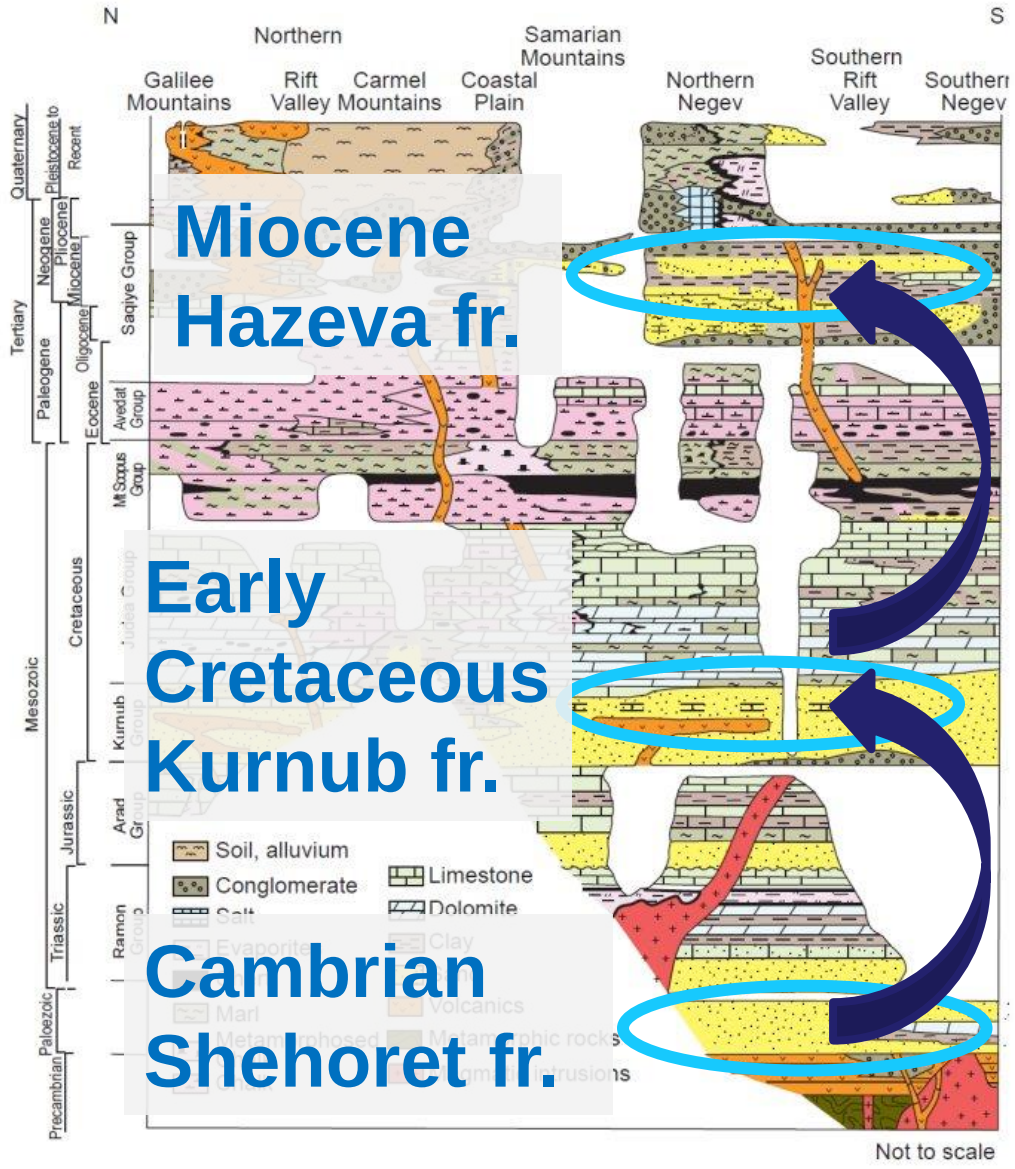
- How do these timescales compare to other processes in the rock cycle

→ *Probably shorter than most processes…*

- Can we give a quantitative answer?

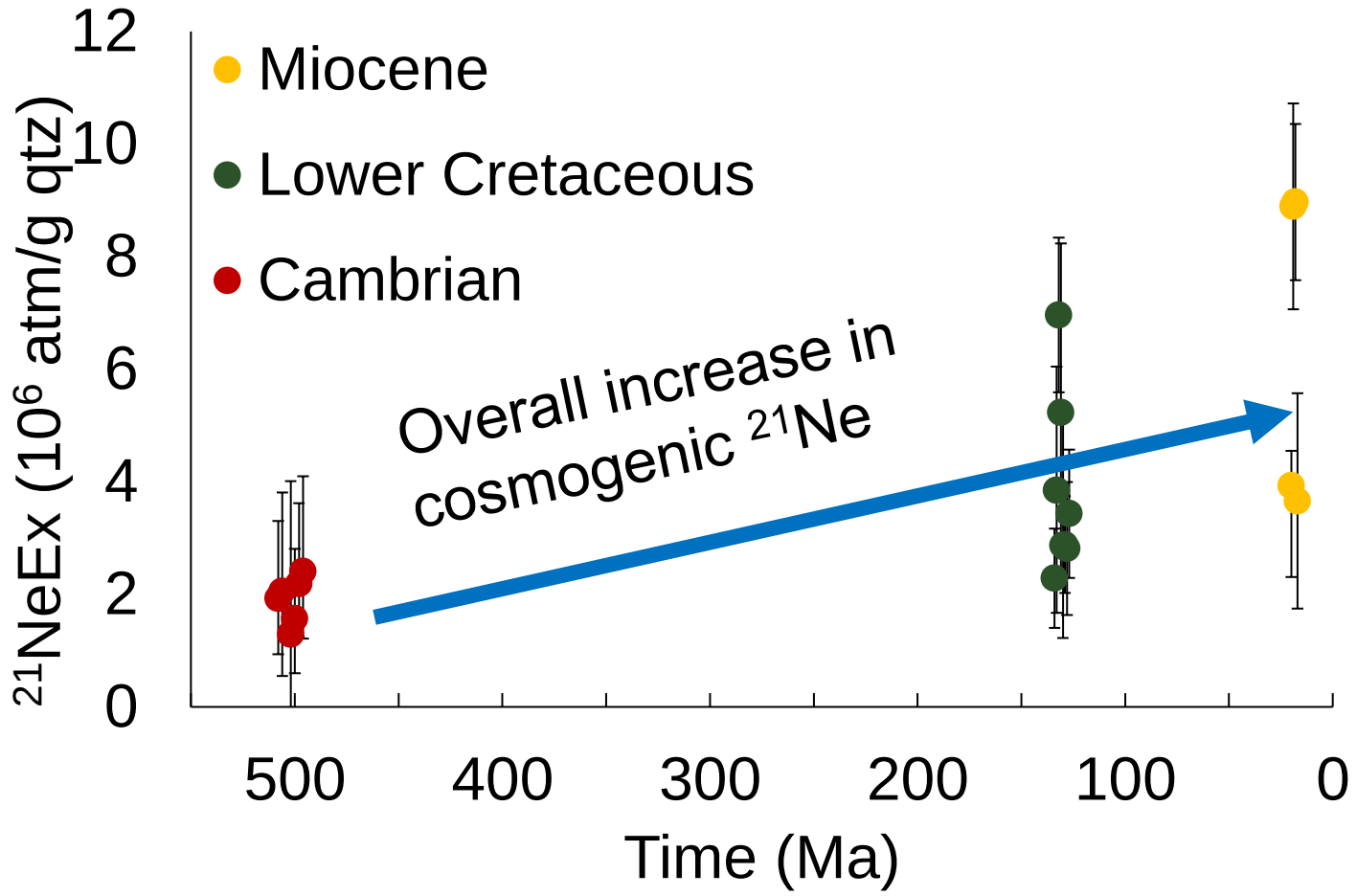
Sampling consecutive sedimentary sand units

- Sand in the Levant region was exposed, eroded, and re-deposited throughout the Phanerozoic
- This dataset allows us to follow exposure times of sediments throughout sedimentary cycles
- Using cosmogenic ^{21}Ne inheritance to follow exposure times of sediments



Consecutive sedimentary units – Levant

- ^{21}Ne corrected for diffusion based on depth and burial time
- Overall increase in cosmogenic ^{21}Ne concentrations
- ^{21}Ne concentrations translate to exposure times of 10^4-10^5 years

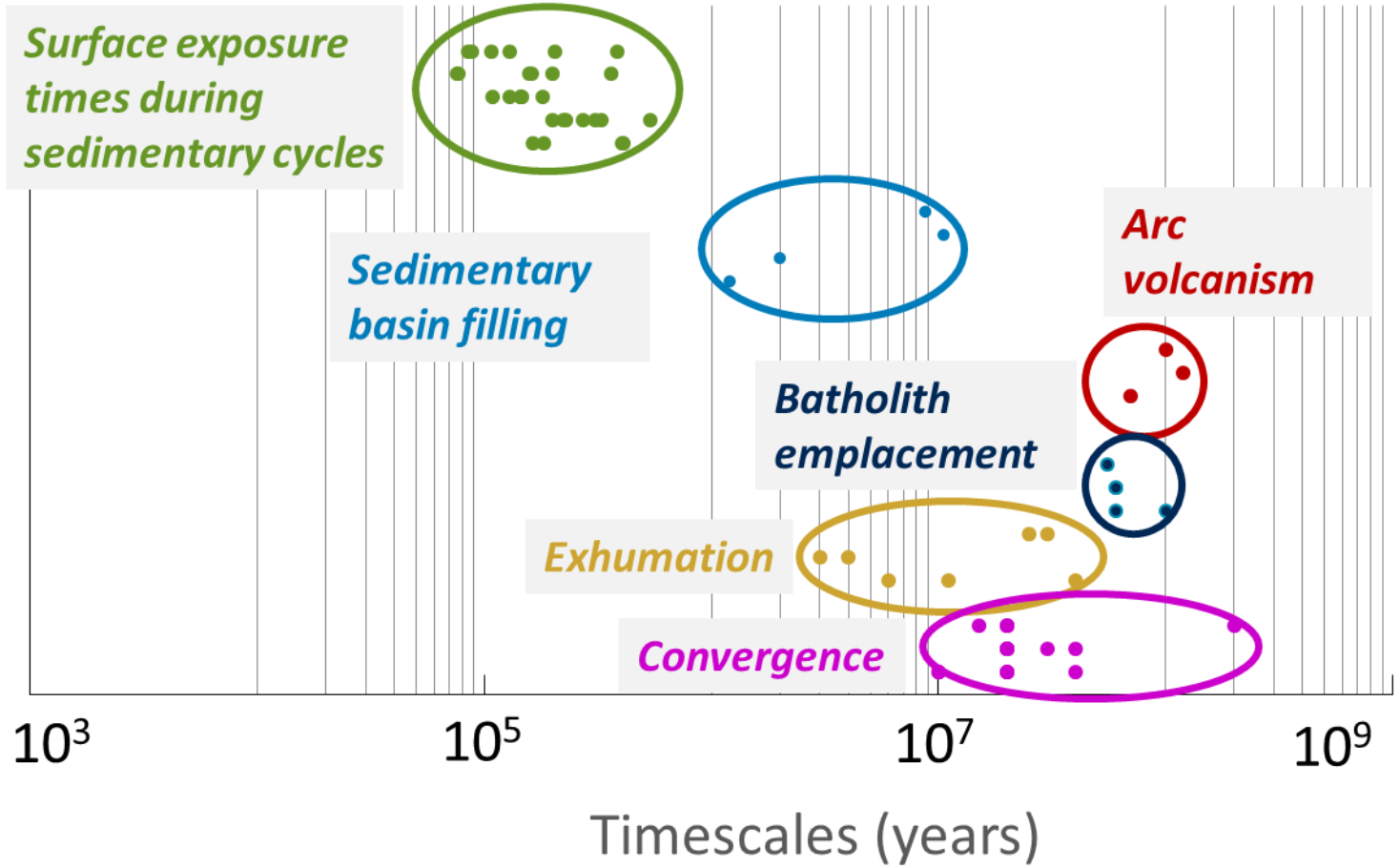


Sediments with cosmogenic inheritance

Levant **Hazeva River – 18-20 Ma** (Ben-Israel et al., 2020)	**Lower Colorado River** **Current river – 0-5 Ma** (Ben-Israel et al., in preparation)	**Tibetan Plateau** **Pleistocene Fluvial terraces** (Hetzel et al. 2002)
Provenance: Cambrian-Ordovician Arabo-Nubian sands **(<500 Ma**)	Provenance: Cambrian–Devonian to Cenozoic rocks of the Colorado Plateau (**<500 Ma**)	Provenance: Early Paleozoic metamorphic quartz veins **(~500 Ma**)
Simplified exposure history: **~60-600 kyr**	**Simplified exposure history:** **~20-500 kyr**	**Simplified exposure history:** **~40-200 kyr**

- Timescales of total exposure at the surface ~10^4-10^5 years
- Exposure times of sediments are short compared to age of sediment

Take home messages



- Exposure times of sediments at the surface are 1-2 orders of magnitude short compared to most geological processes

- Sediments spend only a brief time exposed at the surface and most of the time buried

Email me with q's or ideas
mben-israel@ucmerced.edu