Decoupled lithostratigraphy, orbitally-driven climate, and tectonics for a middle Pleistocene stratigraphic section in the Northern Apennines, Italy

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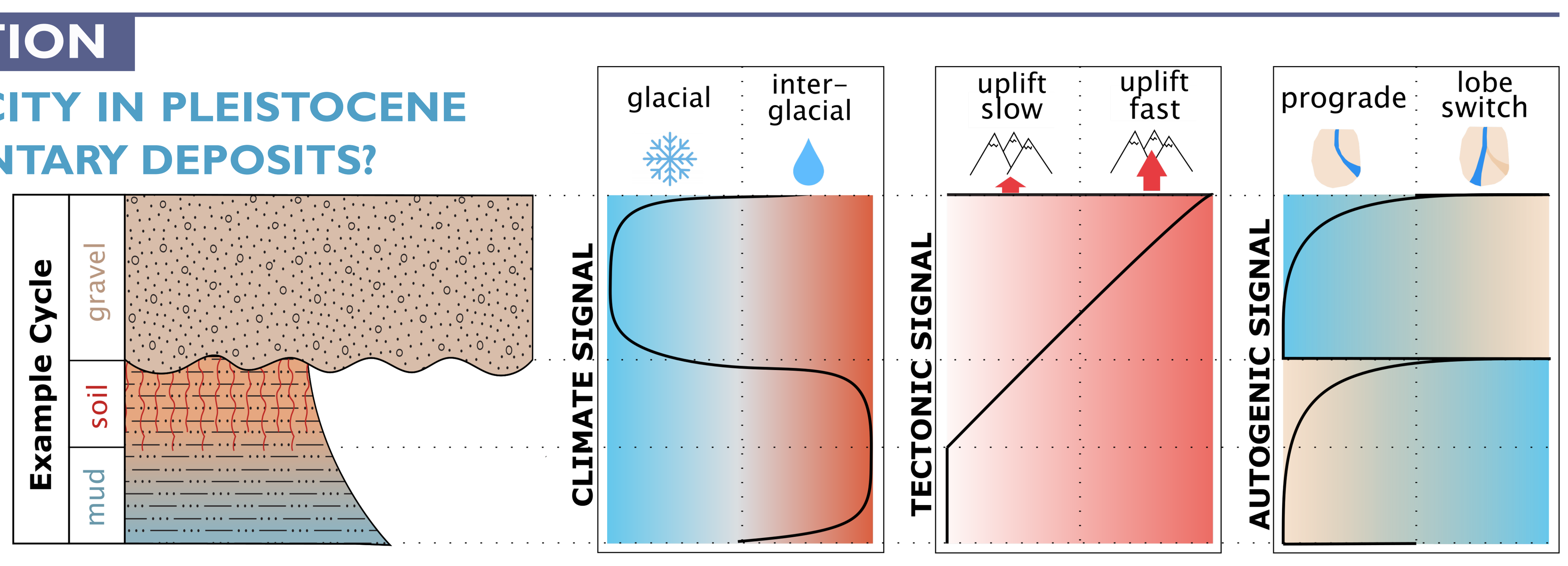
RESEARCH QUESTION

WHAT DRIVES CYCLICITY IN PLEISTOCENE TERRESTRIAL SEDIMENTARY DEPOSITS?

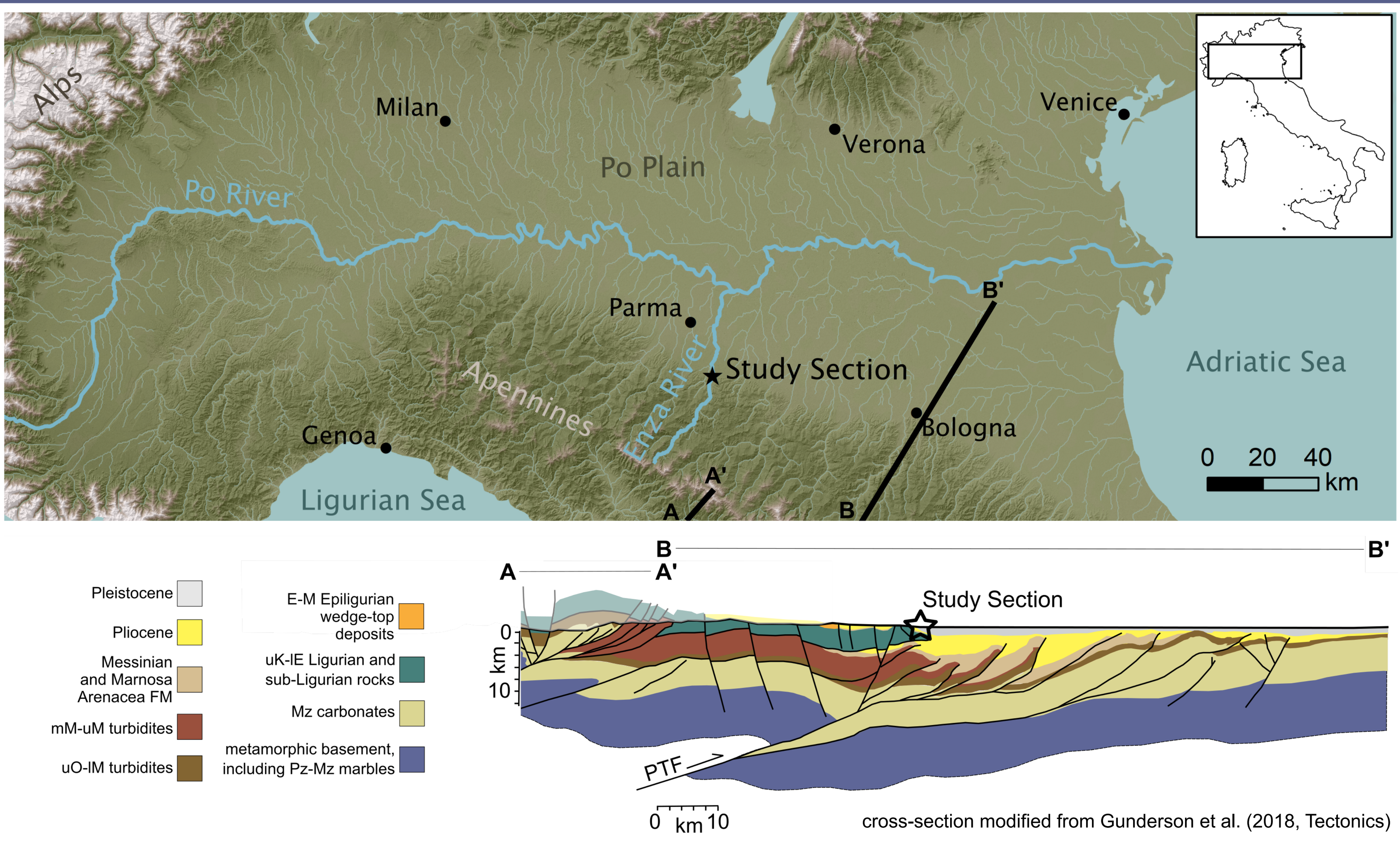
External forcing, e.g., climate or tectonics?

Autogenic processes, e.g., landsliding, bedload transport, avulsion?



- Cyclical lithologic patterns in Pleistocene sediments are traditionally attributed to exogenic interglacial-glacial cycles
- Autogenic surface processes may "shred" exogenic signals before deposition/preservation

GEOLOGIC SETTING



- 60 m Pleistocene study section is exposed along the Enza River in the Northern Apennines
- Section consists of unconsolidated sediments with repeating lithologic sequences (mud-soil-gravel; soil-loess-gravel)
- Northern Apennine tectonics are dominated by the Pede-Apennine Thrust Front (PTF), with stacked imbricate thrusts extending into the Po foreland basin

METHODS

Rock magnetic cyclostratigraphy

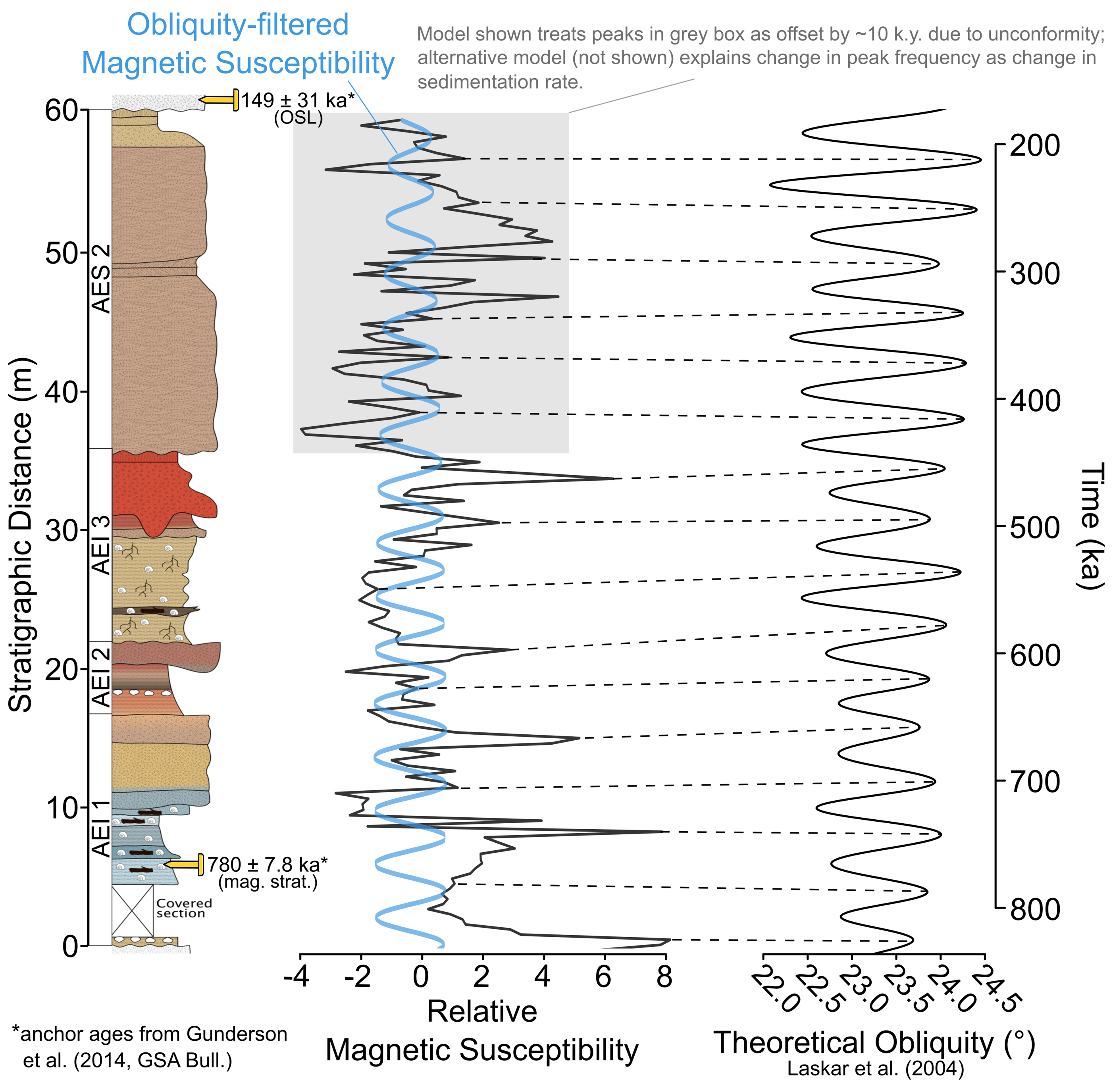
- Magnetic susceptibility (40 cm resolution) was correlated to orbital cyclicity using spectral analyses and independent OSL and magnetostratigraphic "anchor" ages to generate a high-resolution age model (± ~40 k.y.)

Cosmogenic Radionuclides

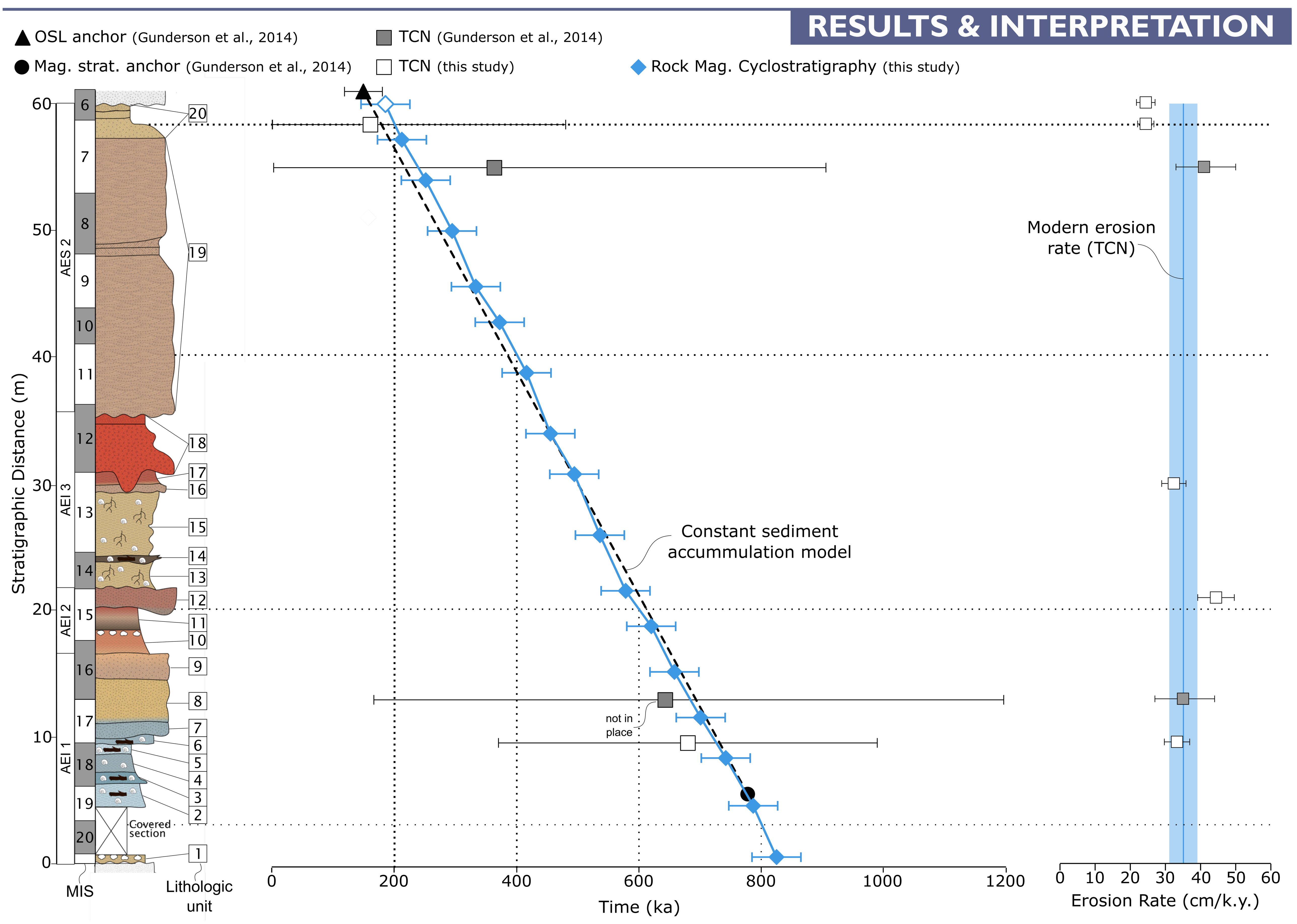
- 4 ^{26}Al-^{10}Be burial ages (2 new) were used to validate the age model
- Paleo-erosion rates were calculated from the ^{10}Be concentration of 7 samples (5 new) distributed throughout the age model

Comparison with global climate

- Age model was correlated to the global benthic $\delta^{18}O$ stack to compare sedimentary cyclicity with global glacial-interglacial cycles; each time step was assigned to a marine isotope stage (MIS)



RESULTS & INTERPRETATION

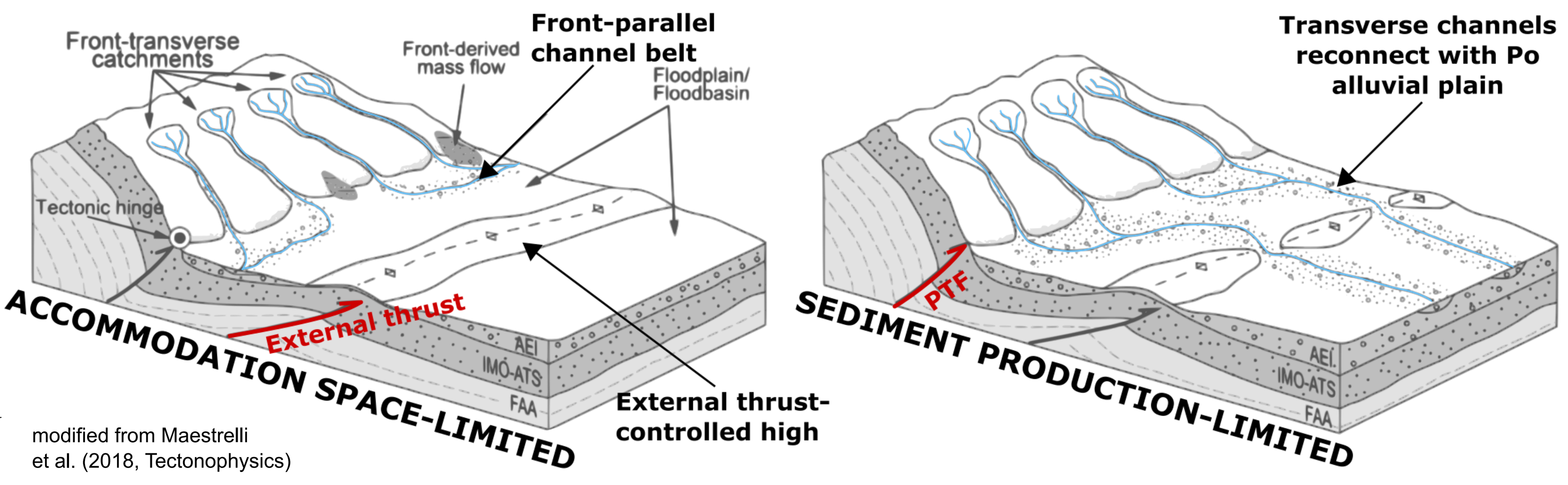


- No correlation between climate and lithology, combined with a decoupling of lithology and paleo-erosion rates, suggests **autogenic processes-driven sedimentation** from 825 ka until at least 550 ka (unit 19)
- Little variation in paleo-erosion and modern erosion rates (<20%) and relatively steady sedimentation indicate a **tectonically-controlled, accommodation space-limited system** over the same time period

IMPLICATIONS

Timing of tectonic transition

- Migration of activity from external thrusts (accommodation space-limited deposition at mountain front) to the main PTF (sediment production-limited deposition) constrained between 550 ka and 150 ka



Exogenic vs. Autogenic Signal Preservation

- Despite autogenic processes-driven lithology, Milankovitch-scale exogenic climate signal survived autogenic "shredding" and is encoded in the rock magnetic properties of the sediments in the study section
- In contrast, lithologic changes in deposits directly above the study section are due to glacial-interglacial cycling (Gunderson et al., 2014), highlighting the complex interplay of tectonics, climate, and autogenic processes in sediment generation, transport, and deposition

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