Early Triassic super-greenhouse climate driven by vegetation collapse

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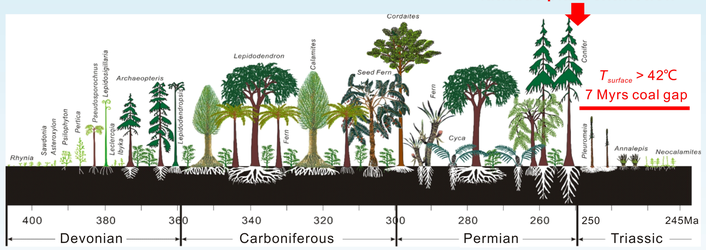
1. Why Permian-Triassic?

The latest Permian to Early Triassic (~252-247 million years ago, Ma) was a period of intense environmental and biotic stress[1]. During the Permian-Triassic Mass Extinction (PTME) at~252 Ma, around 90% of species in terrestrial and marine setting became extinct (animal)[2].



Our new result with normalizated plant database[3]:
Land plant species extinction rate in low-middle latitude 45°N–45°S is 86%; in high latitude is 66%. Plant extinction only happens in the low-middle latitude.

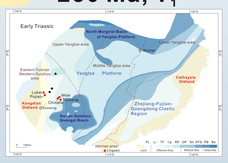
However, as the biggest deforestation event since plant landing, the evolution pattern of plant during PTME remains disputed. Permian-Triassic period provides the best window to study the plant power. It's unknown why the Early Triassic was lethally hot for 5 Myrs.

2. Where to start?

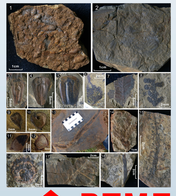
Tropical South China (with GSSP)

dots were fossil locations
(after Scotese, 2001)

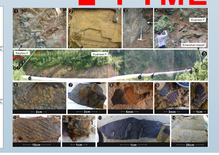
250 Ma, T_1

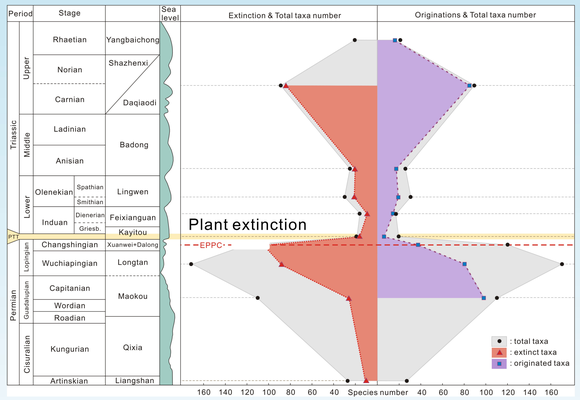


252 Ma, P_3



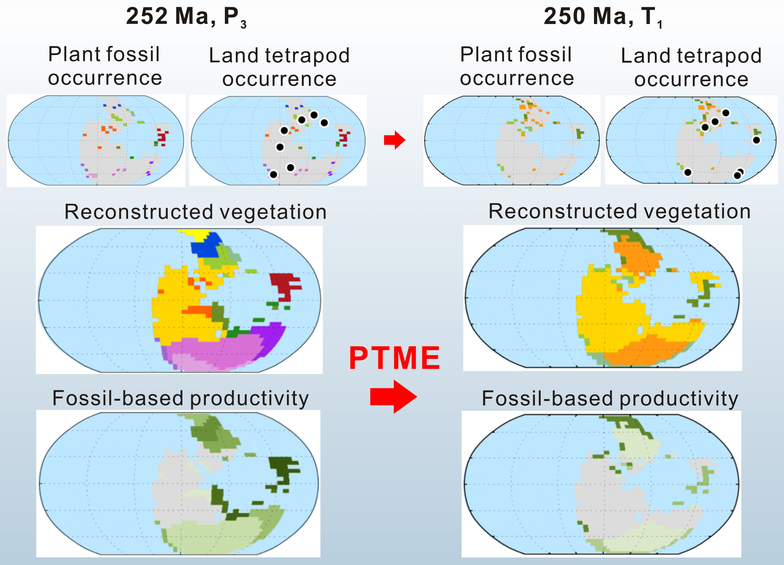
PTME

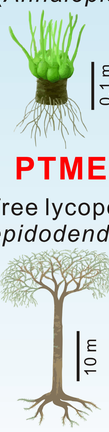




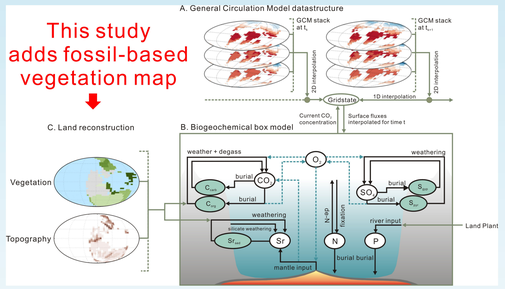
Plant extinct and originate taxa number across PTB[3]

3. Then we get the global land biome

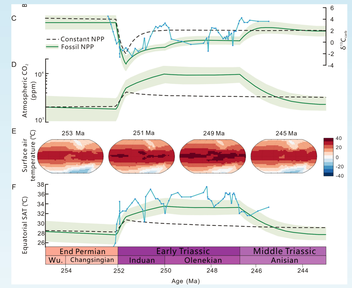




4. We hire Earth System Model *SCION* to simulate PTME



SCION schematic[4]



Model results

5. Conclusions:

(1) Low-middle latitude plant extinctions during PTME were resulted from high land surface temperature and seasonal aridity;
(2) Volcanic degassing is the main trigger of the global carbon perturbation in the End Permian, ~65% vegetation productivity decrease (21.9-47.3 Pt C/yr) is the main cause of the ~5Myrs lethally hot in the Early Triassic;
(3) Early Triassic peri-Tethys vegetation collapse, especially the Cathaysian rainforest extinction, exceed the threshold of Earth system and amplified the warming triggered by volcanics. Low-middle latitude biomes were of highest extinction risk during warming event due to its high temperature baseline, and were vital for the environment and climate stablization.

We cooperate with Huisu Studio and made a CG movie for the Permian Triassic plant event. Please scan this

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2: Dal Corso J. et al. Environmental crises at the Permian-Triassic mass extinction (2022);
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