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Modelling the consequences of the Siberian traps

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The temporal synchronism between large igneous provinces (LIP) emplacements and mass extinction all along the Phanerozoic reveals a possible link between the two. The release of huge amount of gases during the LIP emplacement is considered to cause major climate and environmental perturbations possibly leading to a biodiversity crisis. However no clear correlation can be drawn between LIP's properties i.e. the LIP size, the amount of gas released, etc···and the mass extinction severity.

Our primary focus was on investigating the consequences of the Siberian traps emplacement which is considered to be responsible of the end-Permian mass extinction. This biodiversity crisis lead to the disappearance of 90% of the marine species and 75% of the terrestrial species. The Siberian volcanism has produced 3 to 5 millions km3 of magma over a period not exceeding 1 Myr according to U-Pb dating. This volcanism is accompanied by the release of huge amount of gases within the atmosphere, notably CO2 and SO2.
These gases have two sources : the magmatic degassing and the thermogenic degassing generated by the intrusion of magmas in carbonate-rich or evaporite-rich sediments deposited within the Siberian basin. We propose to explicitly model volcanism by considering both short-term and long-term scale processes along the entire LIP emplacement with different scenarios to mimic the sequence of volcanic and thermogenic gas emissions. For this purpose, we employed the biogeochemical model GEOCLIM to simulate the changes of the ocean in term of temperature and pH caused by the LIP emplacement. This approach enables a detailed exploration of the impact of LIP emplacement on the climate and geochemical cycles.

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