Contribution ID: **65** Type: **60s-Pitch + Scientific Poster**

Global Rift Analysis for Long-Term Carbon Cycle Modeling

Over geological timescales, the release of carbon at tectonic settings has strongly influenced Earth's long-term climate. Continental rifts, in particular, are thought to play a major role in CO_2 degassing by activating deep carbon reservoirs (Foley and Fischer, 2017). Previous studies even suggest a possible link between rifting and the rise of atmospheric CO_2 during the Cenozoic (Brune et al., 2017). However, substantial uncertainties remain, as the incomplete geological record makes it difficult to constrain the timing and magnitude of rift-related CO_2 release.

To quantify CO_2 degassing from rift systems over time and reduce the associated uncertainties, we combine plate tectonic reconstructions with automated geoinformation workflows, building on a global database of Phanerozoic rifting events. In addition, new measurements of rift-related CO_2 fluxes and contributions from numerical modeling will be integrated, enabling the generation of a comprehensive degassing time series. The resulting time series is evaluated against paleoclimate proxy data by incorporating it into biogeochemical carbon cycle models (Mills et al., 2021).

Brune, S., Williams, S.E., Müller, R.D., 2017. Potential links between continental rifting, CO2 degassing and climate change through time. Nature Geoscience 10, 941–946. https://doi.org/10.1038/s41561-017-0003-6

Foley, S.F., Fischer, T.P., 2017. An essential role for continental rifts and lithosphere in the deep carbon cycle. Nature Geoscience 10, 897–902. https://doi.org/10.1038/s41561-017-0002-7

Mills, B.J.W., Donnadieu, Y., Goddéris, Y., 2021. Spatial continuous integration of Phanerozoic global biogeochemistry and climate. Gondwana Research 100, 73–86. https://doi.org/10.1016/j.gr.2021.02.011

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