



Is Earth coming out of the recent ice house age in the long-term? – constraints from probable mantle CO₂-degassing reconstructions

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Enhanced partial melting of mantle material probably started when the subduction motor started around 3.2 Ga ago as evidenced by the formation history of the continental crust. Carbon is degassing due partial melting as it is an incompatible element. Therefore, mantle carbon degassing rates would change with time proportionally to the reservoir mantle concentration evolution and the ocean crust production rate, causing a distinct CO₂-degassing rate change with time.

The evolution of the mantle degassing rate has some implications for the reconstruction of the carbon cycle and therefore climate and Earth surface processes rates, as CO₂-degassing rates are used to constrain or to balance the atmosphere-ocean-crust carbon cycle system.

It will be shown that compilations of CO₂-degassing from relevant geological sources are probably exceeding the established CO₂-sink terrestrial weathering, which is often used to constrain long-term mantle degassing rates to close the carbon cycle on geological time scales.

In addition, the scenarios for the degassing dynamics from the mantle sources suggest that the mantle is depleting its carbon content since 3 Ga. This has further implications for the long-term CO₂-sink weathering. Results will be compared with geochemical proxies for weathering and weathering intensity dynamics, and will be set in context with snow ball Earth events and long-term emplacement dynamics of mafic areas as Large Igneous Provinces.

Decreasing mantle degassing rates since about 2 Ga suggest a constraint for the evolution of the carbon cycle and recycling potential of the amount of subducted carbon. If the given scenarios hold further investigation, the contribution of mantle degassing to climate forcing (directly and via recycling) will decrease further.