Geochemical evidence for high volatile fluxes from the mantle at the end of the Archean

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The exchange of volatile species - water, CO_2, nitrogen, halogens - between the surface of the Earth and the mantle has been a key driver of environmental changes throughout Earth's history. Degassing of the mantle in the Earth's distant past remain poorly constrained. Atmospheric xenon presents a mono-isotopic excess of ^{129}Xe produced by the decay of extinct iodine-129. This excess was mainly acquired during the Earth's formation and early evolution but mantle degassing has also contributed ^{129}Xe to the atmosphere through geological time. Atmospheric xenon shows a slight depletion of ^{129}Xe relative to the modern composition[4] in Archean samples, which tends to vanish in more recent samples. To compensate for this deficit by inputs from the mantle required the degassing rate of the Earth at the end of the Archean to be two orders of magnitude higher than today. It may be shown that such an intense magmatic activity could not have occurred in a plate tectonics regime. The most likely scenario is a relatively short (≈300 My) burst of mantle activity at the end of the Neo-Archean. This lends credence to models advocating a magmatic origin for drastic environmental changes during the Neo-Archean.