The remarkable stability of atmospheric O_2/N_2 since the mid Pleistocene

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Measurements of O_2/N_2 ratios of trapped air in Antarctic ice are used to reconstruct atmospheric O_2/N_2 over the last million years. O_2/N_2 ratios of trapped gases in ice cores are an imperfect recorder of atmospheric O_2 as previous studies have shown that O_2 is depleted relative to N_2 due to preferential exclusion of O_2 during bubble closeoff. This introduces significant noise into the record (±5-10‰) but still permits the most precise reconstructions of atmospheric O_2 in the geologic record to date. Our records from the from the Allan Hills blue ice area (BIA) as well as previously published studies of Vostok [1] and EPICA Dome C [2] indicate remarkable stability in atmospheric O_2 over the last million years, with a likely range of < 1%. Assuming geologic sources and sinks of O_2 totaling ~10 Tmol/yr, the data imply that sources and sinks of atmospheric O_2 have been in balance to within ±2% since the Mid-Pleistocene. This result is surprising in light of observations of a four-fold increase in the rate of physical weathering and sedimentation over the Plio-Pleistocene [3] and the strong empirical relationship between organic carbon and pyrite burial (O_2 production) and sedimentation rate [4].

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