

# Nitrogen fixation and photosynthetic oxygen evolution in cyanobacteria

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Table 1  
Changes in availability of Fe forms ( $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ) in seawater from the different epochs

	Archean	Proterozoic	Modern
Time frame (Myrs)	4000–2500	2500–550	550–0
$p\text{O}_2$ (atm)	0.001	0.01	0.2
pH	7	7–8	8.2
pE	–3.69	13.1 (pH 7)–12.1 (pH 8)	13.2
$\text{SO}_4^{2-}$ (mM)	2	2.1	28
$\text{HS}^-$ ( $\mu\text{M}$ )	100	0	0
$\text{Fe}^{3+}$ (M)	$10^{-15.7}$	$10^{-8}$	$10^{-8}$
$\text{Fe}^{2+}$ (M)	$10^{-8}$	$5.8 \times 10^{-18}$	$4.5 \times 10^{-20}$
Log $\text{Fe}^{2+}/\text{Fe}^{3+}$	7.6	–9.2	–11.4
Mo (nM)	1	<10	100

Fe speciation was calculated using MINEQL+ calculations using above conditions. Assumptions based on Holland (pers. comm.). Mo concentrations were estimated according to Anbar and Knoll [3].