Anoxic and oxic phototrophic primary production during the Precambrian

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Large areas of the oceans were reducing during much of the Precambiran (4.5 to 0.5 Ga). The Great Oxidation Event (GOE; 2.45-2.2 Ga) most likely was associated with the establishment of a redox-cline at the base of the surface mixed layer of the ocean. In the modern ocean, the bottom of the mixed layer often lies above the base of the photic zone . Thus, an ecosystem model for the Precambrian should reflect the net primary production (NPP) of oxygenic phototrophs in the mixed layer and anoxygenic phototrophs below (NPP_{ox} and NPP_{red}, respectively). Satelite data and a vertically generalized production model (VGPM) can be used to calculate the mixed layer NPP relative to the NPP below. We use this to estimate the potential role of NPP_{red} below the mixed layer. The model implies that ~34% of the Precambrian total NPP would have been NPP_{red} if factors such as climate were comperable to today. High rates of exported NPP_{red} are consistent with the Precambrian sulfur isotope record which suggests that high rates of sulfate reduction proceeded the GOE.

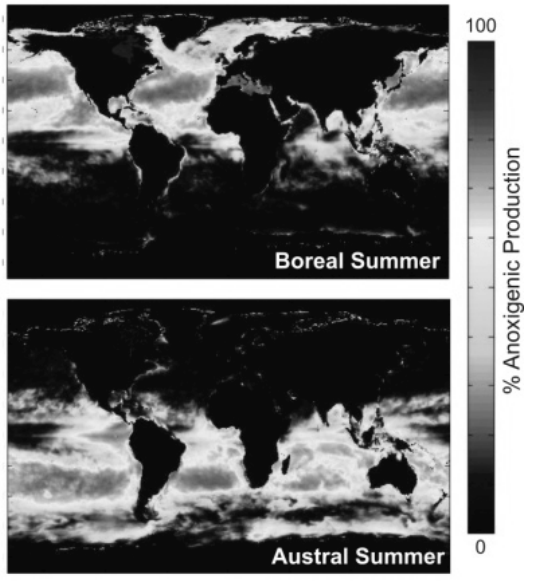

Figure 1: Results of the model of anoxigenic photosynthesis. Percent is relative to total production.

Smectite and zeolite formation from the pyroclastic deposits of the Aksitero Formation, Philippines

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The smectites and zeolites dominantly comprising the tuffaceous siltstone and sandstones of the Aksitero formation have been found to form from the interaction of hyperalkaline ground water (pH10-11). These deposits are in proximity to the main hyperalkaline spring emanation called the Manleluag Hot Springs of Mangatarem Town, Pangasinan, Philippines. Geochemical reaction modelling (i.e. Geochemist's Workbench) suggests that zeolites are formed from the reaction of the smectites with the hyperalkaline groundwater. A very good evidence for this was also found during trenching conducted on the site, basalt rocks directly underlying the Aksitero Formation show reaction pathways in the form of mixed zeolite and smectite veins. This study highlights a natural analogue site in the Philippines for the bentonite – hyperalkaline pore water interaction that is foreseen to occur in underground nuclear waste disposal.