

## Tracking down the Ediacaran isotope anomalies in a sedimentary section from Kazakhstan

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The Ediacaran-Cambrian period marks one of the most significant and vital epochs in the evolution of the Earth's ecosphere. Multicellular life, hard-shelled organisms and a bioturbating lifestyle evolved during a time of tectonic instability and fundamental biogeochemical changes in the oceans. Three major global carbonate carbon isotope excursions are assumed to be crucial for the evolution of early animal life.

Excellent preserved Ediacaran to early Cambrian strata crop out commonly in sections around the area of Zhanatas in southern Kazakhstan. However, geochemical and geochronological data from these rock sections are scarce. We determined carbonate carbon, organic carbon and nitrogen isotope data from the ~200 m thick Kyrshabakty Section including the basal late Cryogenian Aktas Tillite (Marinoan-age glacial deposit), the Ediacaran Kyrshabakty Member and the overlying lower Cambrian Chuluktau Member of Malyi Karatau Range. The section shows a high-resolution geological record of a carbonate-siliciclastic nearshore environment. Isotope data of the shallow water deposits reveal three major negative  $\delta^{13}\text{C}_{\text{carb}}$  excursions. The basal Cap Carbonate overlying the Tillite shows a negative shift down to -2.4‰ which corresponds with other sections worldwide. The middle section comprises an excursion with a nadir of -9.5‰ possibly corresponding to the Shuram-Wonoka  $\delta^{13}\text{C}_{\text{carb}}$  excursion (e.g. Oman, Australia). The uppermost strata are associated with a negative  $\delta^{15}\text{N}$  excursion of -2.5‰ co-occurring with a pronounced negative  $\delta^{13}\text{C}_{\text{carb}}$  excursion (down to -6.7‰) reflecting the global carbon isotopic trend of the Precambrian-Cambrian boundary interval (e.g. Namibia, Australia, China, Siberia). Our results suggest that the sedimentary deposits of the Kyrshabakty Member exhibit geochemical and isotopic variations of the three major profound biogeochemical fluctuations as seen in other sections worldwide. They also confirm a previously found negative  $\delta^{15}\text{N}$  excursion at the Ediacaran-Cambrian transition from South China as a large to global scale anoxic event possibly accompanied by photic zone anoxia. This anoxic event may have influenced the following Cambrian Explosion of biota significantly.

## Temperature dependence of water activity in organic aerosols

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Atmospheric aerosols are complex mixtures of organic and inorganic compounds and influence significantly the Earth's climate. Knowledge of the composition and physical state of aerosols is essential since they play significant roles in atmospheric processes such as heterogeneous and multiphase chemistry, cloud formation, scattering and absorption of visible light and infrared radiation. At low temperatures the organic aerosol fraction is expected to be present in a liquid or glassy state since the large number of organic components depresses the temperature at which crystalline solids form [1, 2]. In the upper troposphere homogeneous ice nucleation and cirrus cloud formation take place on aerosols which grow into ice crystals by dissipating supersaturated water vapour. Homogeneous ice nucleation in supercooled aqueous solutions is independent of the nature of the solute but depends on water activity ( $a_w$ ) and hence  $a_w$  of a solution is a crucial parameter for homogenous ice nucleation [3]. Activity coefficients of organic compounds in solutions may exhibit a considerable temperature dependence that has to be parameterized by models in order to achieve accurate predictions at temperatures other than room temperature.

To measure  $a_w$  over a wide composition range while focusing on low temperatures, we used different measurement techniques and instruments such as a dew point water activity meter, differential scanning calorimetry (DSC) and an electrodynamic balance (EDB). In addition we developed a setup to measure absolute vapor pressure of solutions at low temperatures. Water activity measurements were performed for aqueous organic mixtures containing the functionalities typically found in the organic aerosol fraction such as alcohol/polyol, carboxylic acids, ketones, ethers, esters, and aromatic rings. These data was used together with literature data to improve the temperature dependence of activity coefficients at low temperature in the thermodynamic group-contribution model AIOMFAC (Aerosol Inorganic-Organic Mixtures Functional groups Activity Coefficients) [4, 5].

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