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Biogeochemical investigation of Soda Lake

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ABSTRACT  Big Soda Lake, Nevada, is a terminal, volcanic crater lake whose water level is maintained exclusively by groundwater. The crater is composed of volcanic, basaltic sand and the lake is ~60 m deep (Rush, 1972). The lake is meromictic with a distinct chemocline (Kimmel et al. 1978). The chemocline currently rests at ~40 m and is reflected in both specific conductivity and salinity measurements. Below the chemocline a redox gradient develops with highly reducing conditions. The pH is consistent throughout the depth of the lake at ~9.5, proving that it is alkaline in nature. It is further stratified by both a thermocline and oxycline. The existing conditions at Big Soda Lake make it the perfect setting for studying a diverse array of microbial activities and their interactions within a varying geochemical regime. Our goal was to perform an observational survey of Soda Lake to infer the inherent biogeochemical processes.

RESULTS - PHYSICAL

The data collected by YSI displays how temperature, light, dissolved oxygen and specific conductive strong stratification.

RESULTS - CHEMICAL AND NUTRIENT

There is a rapid increase at the monimolimnion of cations, anions and nutrients. And reduced compounds ammonia, sulfides and nitrite.

RESULTS - BIOLOGICAL

Coincident with the distinct chemocline at 40 m there is a dramatic increase in reducing potential.

The upper region of the mixolimnion is dominated photoautotrophs and chemooorganoheterotrophs. The chlorophyll a, obtained by fluorometry, shows two peaks; one at 5 m and another at 20 m. BGA concentrations (relative fluorescence) peaks around 20 to 25 m. This is consistent with turbidity that shows a spike at 25 m.

The Zooplankton population is comprised of copepods and cladocerans. Cladocerans represent 81% of the population. Previous work shows that the cladoceran Moina hutchinsoni is most abundant in summer and the copepod Diaptomus sicilisis most abundant in spring (Cloern et al. 1983).

At 30 m we found evidence of purple non sulfur bacteria (likely Rhodospirillum).

SUMMARY In the stratification of Big Soda Lake there are varying biogeochemical processes. Within the numerous gradients there is a diverse array of microbial activities that likely follow the Winogradsky column model. Big Soda Lake provides an excellent opportunity to study this model in an active environmental system. Having a real environmental system to work with can raise unexpected questions such as; why does the cation and anion data show differences in some of the conservative parameters on a temporal scale? It also gives us the opportunity to investigate the system in greater detail. The oxic-anoxic interface and chemocline have fluctuating biochemical processes. Identification of the alkalophilic, halotolerant methanogenes and alkalophilic sulfate-reducing bacteria and their mechanisms would be well worth while to investigate.

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