Moisture Variation on the Bolivian Altiplano During the Last ca. 50,000 Years as Revealed by Diatom Analysis of Salar de Uyuni and Lake Titicaca

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Diatom analyses from long sediment cores of Lake Titicaca and Salar de Uyuni reveal fluctuations in lake level and lakewater chemistry driven by wet-dry cycles on the Bolivian Altiplano. Analysis from Salar de Uyuni from 55,000 cal years BP to present shows the alternation of lacustrine sediments containing abundant diatoms with salt deposits of halite and gypsum. Diatom-rich lake sediments from approximately 55,000 – 42,000 cal yr BP document a gradual transition from a moderately deep to a shallow highly alkaline lake, which ultimately dried under an arid climate. After about 36,000 cal yr BP fluctuating climate conditions resulted in a series of thin lenses of halite that alternate with lacustrine layers, characterized by a mixture of planktonic (*Cyclotella meneghiniana* and *C. stelligera*), tychoplanktonic, and benthic diatoms indicative of deposition in a lake of moderate depth. A chemically stratified and relatively deep lake after about 26,100 years ago is suggested by a transition to sulfide-rich sediments dominated by the saline planktonic taxon, *Cyclotella chochtawhatcheeana*, which persists as the dominant until about 21,000 cal yr BP. Poor core recovery precludes diatom analysis of the overlying sediments, although a continuous downhole log of natural gamma radiation from the drill hole suggests that these lacustrine sediments persist until about 15,000 cal yr BP. The gamma record suggests dry conditions and salt deposition above this, interspersed with a brief lacustrine interval about 12,500 cal yr BP.

Piston cores from the deep basin (NE98-PC1 = 152 m water depth; NE97-PC7 = 89 m) of Lake Titicaca span the last 30,000 and represent a continuous history of lacustrine deposition. Sediments from the base of the cores through 15,000 cal yr BP are dominated (>75%) by freshwater planktonic diatoms (*Cyclotella andina, Cyclotella stelligera, Fragilaria crotonensis, Aulacoseira granulata*) indicative of a deep overflowing lake. In the shallower of the two cores, benthic diatoms increase in relative abundance between 15,000 and 13,000 cal yr BP, suggestive of a small decline in lake level to below the outlet level and correlative with the onset of salt deposition in the Salar. Subsequently lake level rose briefly, followed by a large increase in benthic diatom taxa (>70%) in both cores between 11,500 and 10,000 cal yr BP, indicative of a large-amplitude decline in lake level. The resurgence of planktonic diatoms suggests that the lake rose again to overflow levels about 10,000 cal yr BP, followed by a sharp decline in level at about 8,000 years ago, as indicated by the sharp decline in freshwater planktonic diatoms and the rise in oligosaline and benthic species. The highest salinity in the lake was reached between 6000 and 5,000 cal yr BP, when the saline planktonic taxon, *Chaetoceros muelleri*, attains high abundance. The lake began to refill about 4,500 cal yr BP, as indicated by a decline in benthic taxa, and reached modern overflow levels about 2,000 cal yr BP, when planktonic diatoms again dominate the diatom flora.