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Daianne F. Hofig
Texas A&M University

Yige Zhang
Texas A&M University

Qin Leng
Bryant University, qleng@bryant.edu

Mengxiao Wu
Texas A&M University

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Sedimentation rates of the middle Miocene Clarkia Lake deposit, Northern Idaho, USA

DAIANNE F. HOFIG¹*, YI GE ZHANG¹, QIN LENG²,
MENGXIAO WU², HONG YANG²

¹ Texas A&M University, College Station, TX 77843, USA
(*correspondance: hofig@tamu.edu)

² Laboratory for Terrestrial Environments, Bryant
University, Smithfield, RI 02971, USA

A global warming phase related to the onset of the Columbia River volcanism in the USA is recorded in the middle Miocene Clarkia Lake deposit, which yields abundant fossil leaves of subtropical to warm-temperate species preserved in extraordinary conditions [1]. These leaf fossils are found in varve-like laminated successions that presumably represent seasonal phases interleaved with volcanic-ash layers [2]. Despite being studied for over four decades, this paleolake deposit remains poorly constrained in its time-scale. Defining its sedimentation rate is pivotal for reconstructing the paleoclimatic conditions during the middle Miocene. X-Ray Fluorescence (XRF) scanning of key intervals offered insights about the elemental ratio distribution in the Clarkia Lake deposit, which might hold the answer to the sedimentation rate question. Accelerating voltages of 10, 30, and 50 kV detected counts of Mg, Al, Si, P, S, Cl, Ar, K, Ca, Ti, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, As, Br, Rb, Sr, Y, Zr, Nb, Mo, and Ba. Plots of ratios using 702 element-combinations show a strong, positive correlation between the observed varve-like structures and S/Rb and Zr/Rb ratios. The former ratio is interpreted as a tracer of fluvial dilution of the presumably constant rate of reduced sulfur deposition, and the latter denotes variation in the grain-size distribution. For both ratios, low countings represent light-colored, coarse-grained, and quartz-rich layers while high countings correspond to dark-colored, fine-grained, and organic-rich layers. Volcanic ash-layers are distinguishable by enhanced signals of Si, Al, Ti, Zn, and Rb as well as low counts of Fe and Mn. Ratios of Zn and trace elements remarkably detect the extension of these layers along the profiles. Preliminary statistic treatment of this XRF data, employing spectral analysis, suggests depositional cycles at every 1.5 cm which probably reflect the annual cycle of local runoff.

[1] Smiley & Rember (1981) in *Communities of the Past*, 551–590. [2] Smiley & Rember (1985) in *Late Cenozoic History of the Pacific Northwest*, 95–112.