

## ***Quantitative mineralogy of the Green River Formation, Piceance Basin, Western Colorado***

Sheven Poole, Jeremy Boak, Kati Tanavasuu-Milkeviciene, Jufang Feng

Colorado School of Mines, USA

Bulk mineralogical analysis of 82 Green River Formation (GRF) samples was conducted by X-ray diffraction to compare the mineralogy of the Piceance basin margin to the basin depocenter. The objective is to better understand the depositional environments and processes in the evolution of distinct portions of the Eocene lake responsible for forming the richest oil shale deposits in the world. The balance of clastic (silicate minerals), chemical (carbonates and saline minerals) and organic (kerogen) deposition and secondary alteration defines cycles of rich and lean oil shale, as well as important stage boundaries in the lake history. Of the 82 samples analyzed, 54 are from two basin center cores (Shell 23-X2 and John Savage 24), representing rich and lean zones R0 through R4, and R3 to L7 respectively. The remaining 28 samples come from shallow lake margin deposits from outcrops in Douglas Pass, representing zones R0 to R8. The distribution of samples spans early, fresher water, clay mineral-rich intervals, to periods of high salinity and significant saline mineral deposition. Major mineralogic contrasts in basin center versus lake margin locations are revealed by saline minerals, clays, and zeolite contents. Purely evaporitic saline mineral beds were not sampled from the cores; however, compositions of up to 85% by weight nahcolite, and 23 wt% dawsonite are present in the basin center samples. No lake margin samples contain dawsonite, and only one sample was found to contain a trace of nahcolite. All basin margin samples contain clay minerals, mainly as illite/smectite, with up to 60 wt% present. Less than half of the basin center samples contain any clay minerals. Clay minerals in the basin center are most abundant in R0-R2, disappear in R2, and reappear in lower quantities in R5-R7. Over  $\frac{3}{4}$  of basin margin samples contain over 1 wt% analcime, with up to 40 wt% present, whereas less than 1/10 of basin center samples contain zeolites, mostly in trace amounts, with a maximum of 4 wt%. Both lake margin and basin center samples are carbonate rich, with up to 60 wt% total carbonate contents in both locations. Dolomite and ankerite predominate over calcite, indicating ready availability of  $\text{Fe}^{+2}$  and Mg. Basin center samples show only trace calcite in most cases, with exceptions in the rich and lean zones that show higher clay contents (R0-R1 and R6-R7). Depth profiles of major phases will be presented for both data sets.