Development and evolution of the saline depocenter of Eocene Lake Uinta, Piceance Basin, western Colorado

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Halite and the sodium bicarbonate mineral nahcolite were deposited during the saline phase of Eocene Lake Uinta in the Piceance Basin, western Colorado. Variations in the area of saline mineral deposition through time were interpreted from studies of core and outcrop. Saline minerals were extensively leached by groundwater, so the original extent of saline deposition was estimated from the distribution of empty vugs and collapse breccias. Vugs and breccias strongly influence groundwater movement, so determining where leaching has occurred is an important consideration for in-situ oil shale extraction methods currently being developed. Lake Uinta formed when two smaller fresh water lakes, one in the Uinta Basin of eastern Utah and the other in the Piceance Basin of western Colorado, expanded and coalesced across the Douglas Creek arch, an area of comparatively low subsidence rates. Salinity increased shortly after this expansion, but saline mineral deposition did not begin until later, after a period of prolonged infilling created broad lake-margin shelves and a comparatively small deep central lake area. These shelves probably played a critical role in brine evolution. A progression from disseminated nahcolite and nahcolite aggregates to bedded nahcolite and ultimately to bedded nahcolite and halite was deposited in this deep lake area during the early stages of saline deposition along with rich oil shale that commonly shows signs of slumping and lateral transport. The area of saline mineral and rich oil shale deposition subsequently expanded, in part due to infilling of the compact deep area, and in part because of an increase in water flow into Lake Uinta, possibly due to outflow from Lake Gosiute to the north. Finally, as Lake Uinta in the Piceance Basin was progressively filled from north to south by volcano-clastic sediment, the saline depocenter was pushed progressively southward, eventually covering much of the areas that had previously been marginal shelves. A saline depocenter formed in the eastern Uinta Basin during this progradation, and saline minerals were deposited in both basins for a time. Ultimately, the saline depocenter in the Piceance Basin was completely filled in and saline mineral deposition shifted entirely into the Uinta Basin.