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SEQUENCE STRATIGRAPHIC FRAMEWORK OF A SEA-LEVEL-DOMINATED ICEHOUSE CARBONATE RAMP: A CASE STUDY FROM THE MIDDLE BIRD SPRING FORMATION (PENNSYLVANIAN, DESMOINESIAN), ARROW CANYON, NEVADA

SCOTT M. RITTER and AARON J. LEAVITT
Brigham Young University, Department of Geology

Desmoinesian strata of Arrow Canyon were deposited on a northeast-southwest oriented carbonate shelf (Bird Spring shelf) located on the southeastern margin of the Bird Spring-Ely trough. Limestone turbidites in Death Valley and in the White-Inyo Mountains of southeastern California (Keeler Canyon Formation) suggest that the Bird Spring shelf was a west-facing, distally steepened ramp during Middle Pennsylvanian time. The ramp lacked a proximal siliciclastic source area even though highlands existed to the west (Antler Belt) and to the east (Ancestral Rockies) of Arrow Canyon.

Lacking a proximal siliciclastic source area, the stratal architecture of Bird Spring carbonates was chiefly controlled by high amplitude (100m), high frequency (icehouse) sea-level fluctuations. The Desmoinesian portion of the Bird Spring Formation is composed of 31 fourth-order parasequences that form five third-order sequences (D1-D5). Four varieties of parasequences, defined on the relative abundance of heterozoan to photozoan microfacies, vertical stacking of microfacies, and facies completeness reflect differential filling of fourth-order accommodation space during third-order sea level rise and fall. Type I and Type II cycles developed during late third-order transgression and third-order highstand when fourth-order sea level rise outpaced carbonate sediment production rates. These parasequence are dominated by deeper-water, heterozoan microfacies, the vertical stacking of which reflects significant amounts of unfilled accommodation space. By contrast, Type III (catch-up) and Type IV (keep-up) parasequences developed during late third-order highstand, third-order lowstand, and early third-order transgression when fourth-order accommodation was largely filled with grain- to mud-rich photozoan carbonate sediment.

The turnaround points on the heterozoan-photozoan relative abundance curve (proxy third-order sea-level curve) define candidate sequence boundaries and maximum flooding surfaces of the five third-order sequences. Exposure cycles are rare in the mid-ramp setting. Evidence of subaerial erosion is limited to the upper parts of parasequences 18, 21, and 24, the latter two corresponding to sequence boundaries D3 and D4, respectively. Parasequences and bundles of parasequences with high heterozoan carbonate percentages indicate the positions of candidate third-order maximum flooding surfaces. These correlate in number and stratigraphic position with third-order maximum flooding surfaces of the Paradox basin based upon fusulinid and conodont control.