High-Resolution Sequence Stratigraphy of Mixed Deposits in the Lower Cretaceous Marine Record of the Neuquén Basin, Argentina: Towards an Understanding of Mixing Processes

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Most of the Lower Cretaceous marine reservoirs of the Neuquén Basin (Argentina) occur within sedimentary successions in which siliciclastic deposits alternate with mixed siliciclastic/carbonate deposits. Alternations occur at different scales, from beds to third-order systems tracts. However, the processes involved in the temporal and/or spatial mixing of the sediments are far from understood. In order to bring some light onto these processes we document and discuss high-frequency sequences (HFS, typically < 15m thick) from outcrop and subsurface examples, in which mixed deposits occur at different stratigraphic intervals.

HFS characterized by relatively thin (< 1m) mixed deposits at the base gradually passing into coarsening-upward siliciclastic intervals are very common within the studied strata (e.g. Mulichinco Fm, Valanginian). Basal bounding surfaces are demarcated by a Glossifungites suite. Mixed deposits consist of floatstones and wackestones with abundant micrite matrix, poorly sorted gravel- to sand-size shells, and variable proportion of very fine terrigenous sand and silt. The overlying siliciclastic succession typically begins with offshore mudstones, passing to bioturbated muddy sandstones, in turn grading upward to sandstones with HCS/SCS representing shoreface conditions. Mixed deposits are interpreted to result from combination of relatively low terrigenous influx and significant carbonate production, which was mainly driven by organisms in distal marine settings. Within the HFS they represent transgressive conditions, whereas the siliciclastics form progradational units.

On the other hand, some HFS have regressive units consisting of offshore mudstones to lower-shoreface sandstones, which are capped by relatively thick (up to 4m) mixed deposits (e.g. Lower Agrio Fm, Hauterivian). These mixed deposits are laterally extensive units of sigmoidal to oblique cross-strata, in which fine-grained sandstones, skeletal sandstones and quartz-rich ooid grainstones occur. They are thought to represent upper-shoreface conditions, likely prograding spits, in which carbonate sediments combined with siliciclastic particles that were continuously supplied from source areas during the regressive conditions. Noteworthy, carbonate productivity in this case is heavily associated with non-skeletal grains (ooids) and, to a minor extent, with skeletal remains. This suggests that contrasting types of carbonate factories can occur in different parts of HFS.

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