SUPER BOUNDING SURFACE DEVELOPMENT IN A FLUVIAL-AEOLIAN INTERACTION SYSTEM: TOWARDS A MODEL FOR FLOOD-GENERATED "STOKES' SURFACES"

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Super bounding surfaces are key elements for understanding the long-term evolution of aeolian systems and represent major changes in aeolian sediment budget triggered by extra-erg factors. Multiple parallel-truncation bedding planes (aka Stokes' surfaces) have been widely described for ancient aeolian systems, associated with changes in the sediment budget and deflation to water table; although deflationis not a requisite and non-climbing, migrating ergs can also develop parallel-truncation planes. Deflationary or non-climbing conditions have been usually related to sustained dry conditions and exhaustion of the original sand supply. However, episodes of fluvial flooding may have major impact in the sedimentary budget of fluvially-sourced aeolian systems by increasing the amount of coarse-grained supply and/or rising the water table.

The Lower Cretaceous Avilé Member in central Neuquén basin is here analysed in order to describe and interpret complex super bounding surfaces developed in an extra-erg/erg-margin/erg-centre, downwind transect. The Avilé Member is dominated by the cyclic alternation of fluvial and aeolian deposits in a ~30 m-thick, overall wetting upwards succession.

Detailed work was carried out in 16 outcrop localities in which standard sedimentary logging was carried out. Gamma Ray surveys of logged sections were also performed in order to have a comparison element with subsurface information. Architectural panels of the unit were constructed and main architectural elements defined, together with key stratigraphic surfaces (flood, deflation, sand-drift surfaces). Lateral tracking of individual surfaces between localities was performed, aided by oblique aerial photographs. The study was completed with the analysis of the Avilé Member in 5 subsurface localities in which general attributes of the unit were defined by well log suites and core description.

Five different scenarios were defined from purely wet (fluvial) to purely dry (aeolian) record. In fluvial (extra-erg) settings, the record of the Avilé Member is exclusively composed of amalgamated fluvial channel units. In the outer fringe of the fluvial-aeolian interaction zone, aeolian dune units are erosionally truncated by sandy fluvial channels, covered again by dune deposits across sand-drift surfaces. In the inner portions of the erg-margin, sandy fluvial deposits are replaced by muddy and heterolithic deposits related to unconfined floods. Yet, these deposits cover dune units across planar, horizontal surfaces that suggest episodes of deflation/bypass prior to the flooding of the system. Drier scenarios are characterized, in turn, by aeolian sand sheet units intercalated between dune deposits and bounded by horizontal sharp surfaces. These indicate deflation/bypass followed by aeolian accumulation strongly influenced by the water table. Finally, the aeolian end (erg-centre) is dominated by dune units bounded by sharp planar surfaces (Stokes' surfaces) with no evidence of moisture or water in the accumulation surface.

Tracking of these surfaces over more than 60 km suggests a close relationship between flood events in the upwind sector of the system and deflation episodes in the erg centre. The identification of the processes behind the development of these surfaces are here applied in order to build a process-response approach to the development of large-scale discontinuities in fluvial/aeolian successions alternative to classical models for deflation/bypass surface development.