

Hyperpycnal Shelfal Lobes - Some Examples of the Lotena and Lajas Formations, Neuquén Basin, Argentina*

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Introduction

Very thick massive sandstone bodies constitute new exploratory targets mainly in offshore mini-basins. Although these bodies are relatively well known from subsurface studies, there are few detailed field descriptions. This contribution focuses on the description and analysis of field examples of very thick massive sandstone bodies from Middle to Upper Jurassic Lajas and Lotena formations in the Neuquén basin, Argentina. The examples provided here are composed of nearly homogeneous fine- to medium-grained sandstone beds, up to 45 meters thick, and correspond to hyperpycnal shelfal lobes. These packages overlie a sharp or slightly erosive base, and they commonly lack internal bioturbation, mud deposition layers, or other evidences of pauses in the sedimentation. The existence of very thick massive sandstones was usually related to an “in mass” deposition induced by a gravitational collapse associated with surge flows having high suspended load. However, more recent studies have proposed an origin related to the progressive aggradation from long-lived and quasi-steady turbulent flows. Massive deposits could be related to the absence of a sharp surface between the flow and the deposit.

Geologic Framework

The Neuquén basin is a back-arc basin located in the west-central Argentina. Its sedimentary infill took place during Jurassic and Cretaceous with a mainly clastic succession, up to 7000 meters thick. The Lajas Formation (Early to Middle Jurassic) represents the first prograding unit after the initial marine flooding of the basin (Los Molles Formation). It is composed of conglomerates and sandstones that accumulated in different deltaic and shallow-marine environments. The Lotena Group (Middle to Late Jurassic) sharply overlies the Lajas Formation in the study area. This group constitutes a clastic to evaporitic unit, widespread in its development in the basin during middle Callovian to late Oxfordian times. It is internally composed of conglomerates, sandstones, mudstones, and limestones that accumulated in fluvial (Dellapé et al., 1979) to deep marine (Gulisano et al., 1984) environments.

Examples

The examples analyzed here correspond mainly to Lajas Formation in the Lonopué area and Lotena Formation at the Sierra de la Vaca Muerta (Figures 1 and 2). Some characteristics of the study examples are:

- The coexistence of erosion and deposition (aggradation) at the same time, associated with a facies family related to traction plus fallout, suggests an accumulation related to long-lived flows with high suspended load (hyperpycnal flows).
- Internal erosion surfaces could not have been developed by different events since they disappear toward the laterals.
- Individual thick beds could be related to a progressive aggradation of the depositional surface from a quasi-steady and long-lived sediment gravity flow.
- The existence of massive sandstone beds with anomalous thickness could be related to the presence of a basin topography which results in a flow confinement (McCaffrey and Kneller, 2001).
- Massive strata appears to be associated with confined areas related to an early tectonic-induced basin topography.
- Field examples show that these sandstone packages compose elongate bodies, ranging 0.8 - 15 km in length and 0.5 - 3 km in width.
- Internally discontinuous erosional surfaces with aligned clay clasts are common, and they suggest a lateral anisotropy in flow velocities.
- Detailed correlation patterns also suggest that very thick sandstone bodies could have a convex-upward top.
- Reservoir properties of these bodies are deeply controlled by burial and diagenetic history. Deep burial (> 3,000 meters) often results in tight sands.

References

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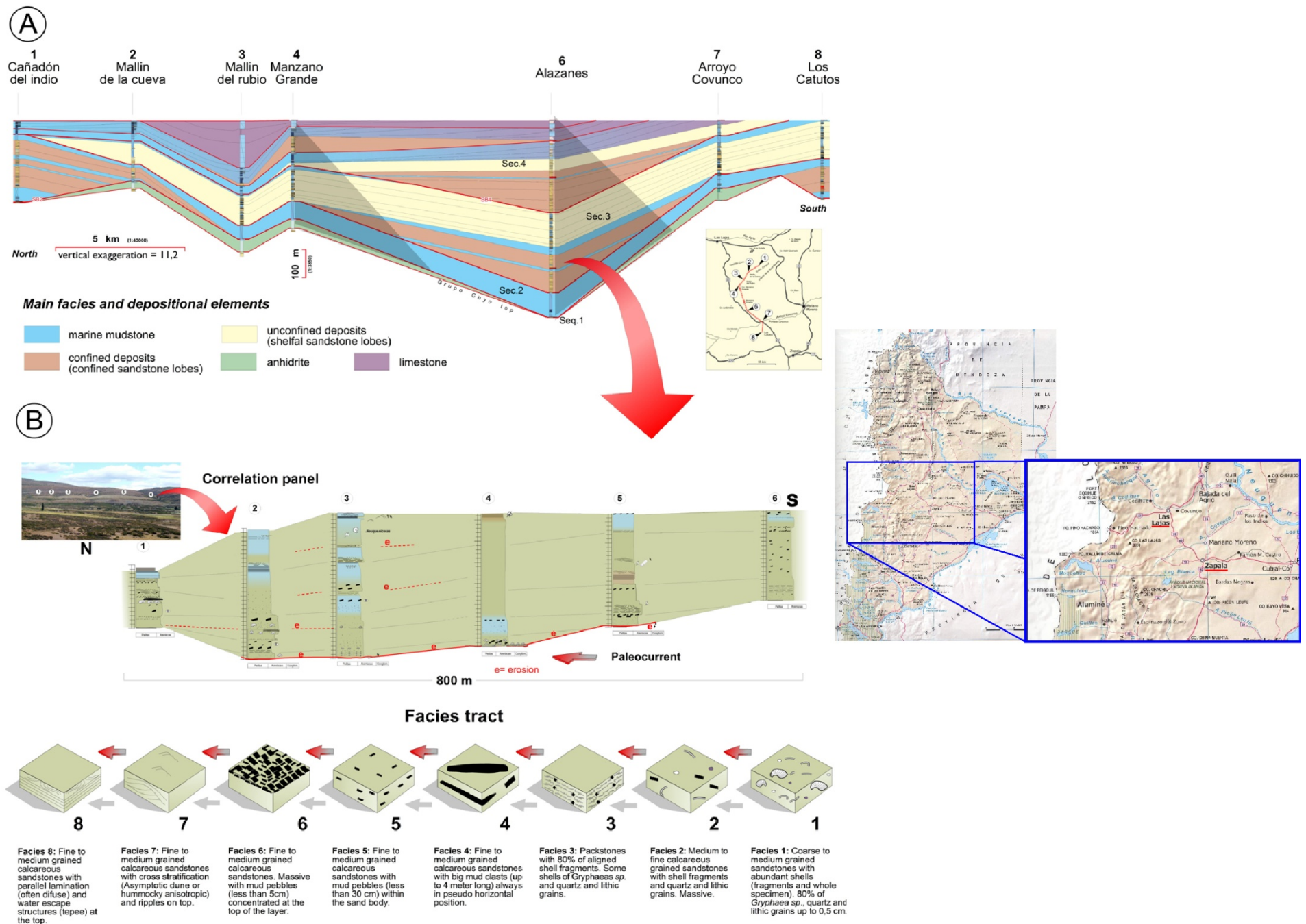


Figure 1. An example of Sierra de la Vaca Muerta sandstone lobes: Lotena Formation. A) Regional panel correlation of Lotena Formation. Note the arrangement of confined shelfal lobes, modified from Zavala and Gonzalez (2001). B) Detailed correlation panel of an individual sandstone body.



Figure 2. Some examples of thick massive sandstone bodies. A: Lotena Formation at Loncopué, Mamotreto section (thickness up to 40 m). B: Lotena Formation at Cañadón del Indio section (thickness up to 28 m). C: Lajas Formation at Loncopué, Arroyo Mulichincó section (thickness up to 56 m).