HCS-like and combined-flow ripples in the Punta Negra Formation (Lower-Middle Devonian, Argentine Precordillera): A turbiditic deep-water or storm-dominated shelf system?

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Density current and storm-induced deposits may exhibit similarities, in particularly when the latter were lain down by a combination of oscillatory and unidirectional flows. Fortunately, the recent progress in facies analysis has enabled the discrimination between the sedimentary effects of the oscillatory and the unidirectional components of the flow. On the basis of a detailed analysis of the sedimentary facies, strata geometry, and palaeocurrent data, the present study reinterprets the Punta Negra Formation (PNF) (Lower-Middle Devonian, Argentine Precordillera), previously considered as a depositional system of deep water, as a storm-dominated prodeltaic shelf depositional system.

In the sandstone beds of the PNF, planar, low-angle and undulating laminations with weakly asymmetric hummocky and swaley bedforms, accretionary HCS-like, anisotropic HCS-like, and combined-flow ripples testify to the action of storm-induced waves combined with unidirectional flows in the generation of the deposits (Fig. 1) (Arnott, 1993; Myrow et al., 2002). The palaeocurrent data indicate offshore current directions, suggesting that the unidirectional flow was a gravity-induced current. Inverse grading at the base and overlying normally graded divisions of the sandstone beds testify waxing-waning behaviour of the depositional flows; an interbedding of sedimentary structures (undulating laminations, low-angle and parallel laminations, and combined-flow ripples) in the lower and intermediate divisions of the beds indicate fluctuations of the flow velocity (Fig. 1). This organisation of the sedimentary structures permits the association of the unidirectional component with hyperpycnal flows Zavala et al. (2006). The terrestrial origin of the hyperpycnal flows is suggested by the abundance of terrestrial plant remains, the mineralogical and textural immaturity of the sandstone composition, and the relative scarcity of bioturbation, which was likely controlled by fresh-water input and a high rate of sedimentation. Sustained by storm-wave action, hyperpycnal flows generated subaqueous channelised forms at the mouth of the river deltas, which later filled with sand (architectural element 1). At the distal end of the channelised forms, lobe-shaped sandstone beds (architectural element 2) were deposited, evolving into thin sandstone beds alternating with sandy mudstone (architectural element 3) in the more distal area (Fig. 2).

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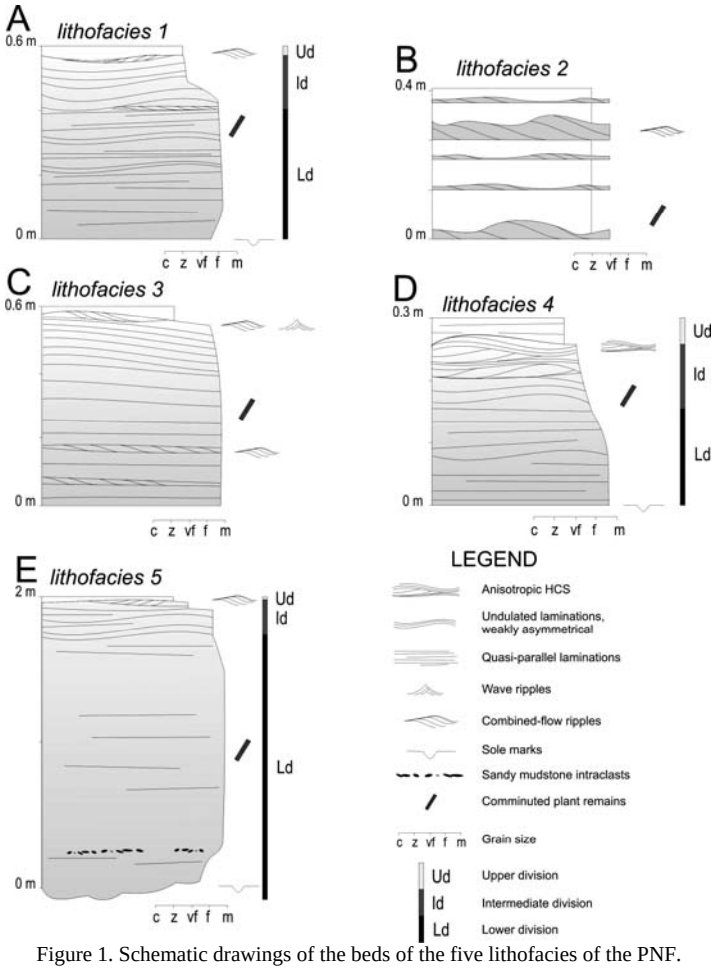

Figure 1. Schematic drawings of the beds of the five lithofacies of the PNF.

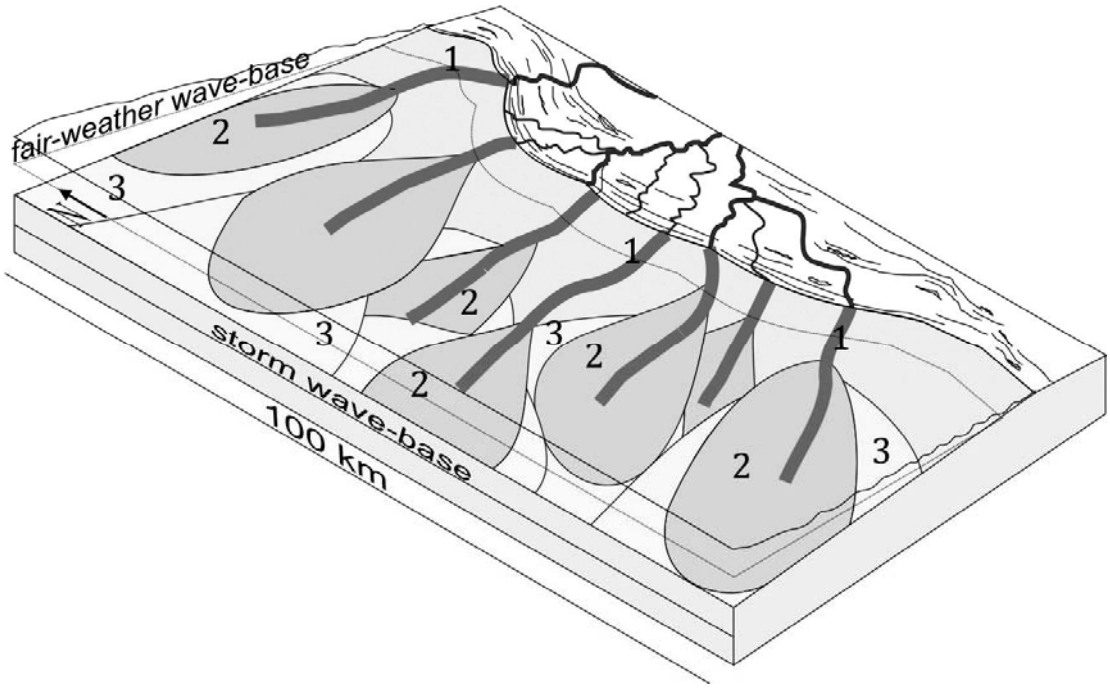

Figure 2. A simplified depositional model showing the architecture of the PNF. The numbers in the picture correspond to the architectural elements.