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# The distal Petit-Rhône Fan (Gulf of Lions, Western Mediterranean)

# (EUROSTRATAFORM European Programme)

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The Petit-Rhône Fan, 1.5 km thick and about 300 km long, is the main turbidite system of the Gulf of Lions. It was mainly fed by alpine inputs brought to the Mediterranean by the Rhône River. During the LGM, the western, Petit-Rhone branch of the Rhône Delta was incised on the shelf (e.g. Berné et al., 2002) and continental inputs were directly feeding the basin via the Petit-Rhône Canyon. In the Late Quaternary, instabilities of the margin resulted in the collapse of sediments from the continental slope and upper fan and deposition of two unconformable transparent mass-transport bodies on each levee of the fan. Data acquired during PROGRES cruise (2003) in the framework of EUROSTRATAFORM Programme (EU Contract n° EVK3-CT-2002-00079) imaged the distal part of this fan providing a now complete bathymetric map of the sedimentary systems of the Gulf of Lions. The area investigated during PROGRES cruise includes the distal Rhône Fan and the Neofan, that resulted from the last avulsion of the Rhône Channel and deposited on the western mass-transport body, the distal parts of the Catalan Margin including the outlet of the Valencia Valley, and the northern part of the Balearic Abyssal Plain, where a megaturbidite accumulated during the LGM (Rothwell et al., 2000).

The distal Rhône Fan shows numerous channels that meander within an area of strongly irregular topography disturbed by salt diapirs originating from the intrusion of the Messinian salt in response to Plio-Quaternary sediment loading and gliding (Gaullier, 1993). Numerous abandoned meanders (ox-bows) are visible along the

courses of the channels.

In the northern part of the area, the Rhône Main Channel (RF Channel), that is the last active channel prior to the Neochannel avulsion, is perched above the surrounding sea floor. When entering the salt domes field, the main channel seems to branch into several groups of channels. Careful examination of bifurcation points shows that these channels are no longer connected to the main channel, indicating that the channels result from avulsion in contradiction to the former assumption that the main channel was branching in its distal part (e.g. Droz and Bellaiche, 1985). At least 3 well-developed and disconnected meandering fossil groups of channels that successively avulsed to give rise to the RF Channel, are visible, and numerous others are present but difficult to link to a specific group of channels.

The last course of the RF Channel meanders towards the East-South East and sinuosity decreases towards the termination of the channel where a lobate feature can be seen on the bathymetric map, associated to a hummocky topographic pattern. Faint hummocky bulges also terminate some of the fossil channels. These terminal lobes are not visible on EM300 backscatter map, probably because they are covered by hemipelagic drape thick enough to prevent their imaging but they are visible on very high-resolution chirp data as amalgamated, transparent lenses at the most distal part of the channels.

The Neochannel and Neofan rest unconformably on the right levee of the perched Rhône Main Channel. They bear characteristics that contrast with those of the previous channels. The Neochannel is short, relatively straight, and shows thin levees and a complex termination well imaged on the bathymetric and backscatter map and chirp profiles. Main characters of the outlet of the Neochannel are the existence of several disconnected straight and erosive channels, composite lobate features representing several generations of terminal lobes, and asymmetrical scours (Kenyon et al, 1995) that control the formation of erosive channels (Droz et al., 2004).

The good imaging of the Neochannel terminal zone reflects its young age (aggradation of the Neofan's levees stopped at –15.5 ka BP, Bonnel et al., in press) and the existence of recent currents flowing from the Pyreneo-Languedocian western part of the Gulf of Lions (Droz et al., 2001) that likely prevented hemipelagic deposition to be preserved; the straightness of the channel, and thinness of lateral levees probably relates to an immature stage of evolution before abandonment.

In contrast, the characteristics of the previous channels (great length, meandering course with frequent ox-bows) attest of the maturity of these channels; the faint expression of their terminal lobes relates to their early stop of activity (the avulsion of the Neochannel that caused the abandonment of this part of the fan is estimated to have occur before -20 ka BP, Bonnel et al., in press).

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