Sedimentary products of tidal modulation in fluvio-estuarine environments

(Proposer: Prof. M. Ghinassi)

The management of fluvio-tidal sedimentary reservoirs, particularly in the context of CO_2 storage and sustainable subsurface resource management, remains a significant challenge due to the strong variability in depositional architectures and heterogeneity distribution, which depend on the relative influence of fluvial and tidal processes. This project aims to improve the understanding of fluvio-tidal sedimentary dynamics and to develop reliable criteria for distinguishing between fluvial- and tidal-dominated deposits.

The primary objective of the project is to assess whether specific sedimentological features and structures, observable also at the scale of sediment cores, can be used as diagnostic indicators of the relative contribution of tidal and fluvial processes during deposition. To achieve this, the project will focus on modern environments, where direct observations and quantitative measurements can be integrated with sedimentary products.

The PhD candidate will play a central role in designing and conducting field-based investigations, collecting quantitative data on boundary conditions during sedimentation, and linking these observations to the resulting sedimentary structures. The candidate will also apply quantitative and statistical approaches to characterize sedimentary features and develop interpretative models. Particular attention will be devoted to distinguishing between sedimentary structures generated by tidal processes and those resulting from tidal modification of riverine flows.

The research will focus on two end-member study areas: microtidal environments of the Mediterranean area, with particular focus on the Po River (Italy), where recent studies have documented tidal signatures in predominantly fluvial deposits, and macrotidal systems in South Korea, which provide a contrasting setting where tidal processes exert a dominant control on sedimentation. These sites will allow for a comparative analysis across a wide spectrum of tidal influence. Finally, the models developed from modern systems will be tested against ancient analogues through the study of well-exposed fluvio-tidal successions in the Eocene Tremp-Graus Basin (southern Pyrenees, Spain), ensuring the applicability of the results to subsurface reservoir characterization. The project will benefit from a collaboration with Prof. K. Choi (Seoul National University) and Dr. G. Davoli (ENI Spa).

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