HYPERCONCENTRATED ALLUVIAL FACIES OF THE MIOCENE TERUEL BASIN (SPAIN): CONTROLS AND IMPLICATIONS FOR BASIN ANALYSIS

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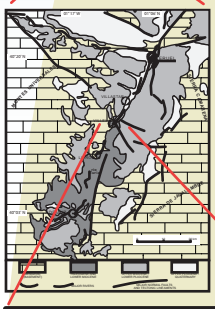
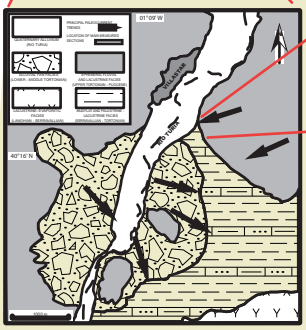
In many settings fluvial transport and deposition may develop differently from classic models. Active tectonics and flood-prone climates combine into poorly integrated catchments, bedload surplus and sporadic, ephemeral discharge. Derived drainage tends to be short, sediment-choked and represented by poorly organized deposits in the stratigraphic record. Particular sediment sources may contribute to these effects; clay-rich source lithologies for example can significantly influence flood rheology and sedimentation.





BACKGROUND AND SETTING

Alluvial fan facies typically comprise poorly organized deposits from catastrophic sediment-laden flows triggered by slope instability and exceptional meteorological events, spanning from plastic-laminar to turbulent-newtonian, depending on sediment / water ratios of parent flows. By contrast, in river systems, protracted water discharge tends to reduce sediment concentrations, allowing for highly organized facies, on scales variable from bedforms to macroforms to architectural elements. Such generalizations may not always apply in particular settings.

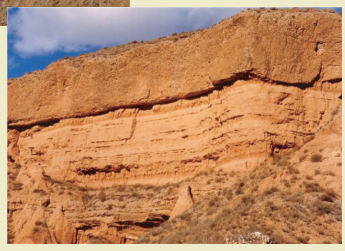
The Teruel Basin (eastern Spain) is an association of half-grabens developed from late Oligocene to Pliocene in a semi-arid climate. In the central sub-basin, muddy to carbonate facies intercalate with coarse alluvial deposits sourced by active tectonic margins.

ALLUVIAL SYSTEMS AND FACIES IN TERUEL

Alluvial fans from the western basin margin present minor volumes of debrisflow and waterflow facies, and a striking prevalence of unconfined hyperconcentrated flow conglomerates, intermediate between turbulent and laminar flows, such as distinct to fully amalgamated bedding; weak basal scouring; very poor sorting; variable clast- to matrix-support; disorganized fabrics with locally graded or imbricated domains; absence of bedforms and macroforms; and outsized boulders.
More distal, ephemeral river systems developed from the opposite, eastern margin produced extensive deposits with distinct, single to multi-storey channel fills (1, 2) and overbank deposits. Frequent lack of organization within channel fills, facies analogy with proximal fan deposits (3, 4, 5, 6) and abundant clay-rich matrix suggest that hyperconcentrated flows were significant in transferring coarse debris also along these drainage pathways.

1

ISOLATED OR LATERALLY AMALGAMATED CHANNEL FILLS, COMMONLY INTERNALLY DISORGANIZED, WITHIN AGGRADING OVERBANK MUDSTONES WITH CALCRETE LEVELS



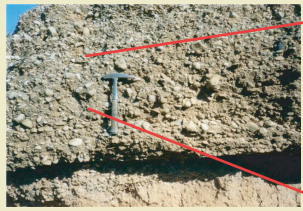
2

MASSIVE, MUDDY SANDSTONES WITH FLOATING OR ALIGNED PEBBLES AND COBBLES, LATERALLY GRADING TO CLAST- TO MATRIX SUPPORTED GRAVELS

3

MASSIVE, AMALGAMATED, BIMODAL (CLAST-SUPPORTED, MATRIX-RICH) PEBBLE TO COBBLE CONGLOMERATES

4



5

BEDDED, CLAST-SUPPORTED, PEBBLE TO COBBLE CONGLOMERATES WITH SYNDEPOSITIONAL (UNGRADED, POORLY SORTED) MATRIX AND VARIABLE FABRIC DOMAINS

6

BASIN-SCALE PRODUCTS AND CONTROLS

- Elevated sediment concentrations resulted from highly erodible, widespread Triassic claystones in the basement. Excess of suspended, clayey fines raised flow viscosity, which inhibited flow organization, sorting and development of fully tractive fabrics and structures (3, 4).
- From a basinal perspective, coarse bedload was deposited within proximal alluvial systems, whereas clay was a very important component both proximally and distally. Despite the distinctiveness between fine basinal deposits and high-energy, coarse clastic facies (pics 1,2), high volumes of clay in alluvial units may significantly lower permeability in the latter.
- Active tectonics and a semi-arid climate made the central Teruel Basin a favorable setting for these alluvial systems, with poorly integrated catchments, sporadic runoff and high sediment supply. Such fluvial facies might be more widespread in the stratigraphic record of tectonically active regions than reported in the literature.

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