ABSTRACT

Special Noon Meeting

MODELS OF CLASTIC SEDIMENTATION

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The principal sandstone-generating environments are (1) fluvial environments such as alluvial fans, braided streams, and meandering streams, (2) distributary -channel and delta-front environments of various t y pes of deltas, (3) coastal barrier islands, tidal channels, and chenier plains, (4) desert and coastal aeolian plains, and (5) deeper marine environments, where the sands are distributed by both normal and density currents.

The alluvial-fan environment is characterized by flash floods and mudflows or debris flows w h ich deposit t h e coarsest and most irregular sand bodies. Braided streams have numerous shallow channels separated b y broad sand bars; lateral channel migration results in the deposition of thin, lenticular sand bodies. Meandering streams migrate within belts twenty times their channel widths and deposit two very common types of sand bodies. Bank-caving and point-bar-accretion processes result in lateral channel migration and the formation of sand bodies (point bars) within each meander loop. Natural cutoffs and channel diversions result in the abandonment of individual meanders and long channel segments respectively. Rapidly abandoned channels are filled with some sand but predominantly with fine-grained sediments (clay plugs), whereas gradually abandoned channels are filled mainly with sands and silts.

The most common reservoirs are of deltaic origin. They are laterally equivalent to fluvial sands and prodelta and marine clays and consist of two types; delta front or fringe sands and abandoned distributary channel sands. Fringe sands are sheetlike, and their landward margins are abrupt (against organic clays of the deltaic plain). Seaward these sands grade into the finer prodelta and marine sediments. Distributary-channel sandstones are narrow, withabrupt basal contacts, and they decrease in grain size upward. They cut into or completely through the fringe sands, and are also connected w I t h the upstream fluvial sands of braided or meandering streams.

Some of the more porous and permeable sandstone reservoirs are deposited in the coastal interdeltaic re a I m of sedimentation. They consist of well-sorted beach and shoreface s a nds associated with barrier islands and tidal channels which occur between barriers. Barrier s and bodies are long and nor row, are aligned parallel to the coastline, and are characterized by an increase in grain size upward. They are flanked on the landward side by lagoonal clays and on the opposite side by marine clays. T I d al channel sand bodies have abrupt b a s a l contacts a nd range in grain size from coarse to fine upward. Laterally they merge with barrier sands and grade intothe finer sediments of tidal deltas and mudflats.

The most porous and permeable sandstone reservoirs are products of wind activity in coastal and desert regions. Wind-laid (aeolian) sands are typically very well sorted and highly cross-bedded, and they occur as extensive sheets.

Marine sandstones are those associated with normal marine processes of the continental shelf, slope, and deep and those which are of density-current origin (turbidites). An inportant type of normal marine sand is formed during marine transgressions. Although these sands are extremely thin, they are very distinctive and widespread, have sharp updip limits, and grade seaward into marine shales. Two other types of shallow marine sands (delta fringeand barrier shoreface) have previously been mentioned.

Turbidites have been interpreted to be associated with submarine canyons. These sands are transported from near-shore environments seaward through canyons and are deposited on submarine fans in deep marine basins. Other turbidites form as a result of slumping of deltaic facies at shelf edges. Turbidite sands are usually associated with thick marine shales.